Axial piston fixed motor
A2FM series 6x



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

Features

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

Contents

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Type codes

01	02	03	04	05		06	07	08		09	10	11	12	13	14	15
	A2F		**M**		**/**	**6**		**W**	**–**	**V**						

Hydraulic fluid

01	Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearing “L“ (without code)		
	HFB-, HFC-hydraulic fluid	Sizes 5 to 200 (without code)	
		Sizes 250 to 1000 (only in combination with long-life bearing “L”)	**E-**

Axial piston unit

02	Bent-axis design, fixed	**A2F**

Drive shaft bearing

		5–200	**250–500**	**710–1000**	
03	Standard bearing (without code)	●	●	–	
	Long-life bearing	–	●	●	**L**

Operating mode

04	Motor	**M**

Sizes (NG)[1)]

05	Geometric displacement (see table of values)																
		5	**10**	**12**	**16**	**23**	**28**	**32**	**107**	**125**	**160**	**180**	**200**	**250**	**355**	**500**	**710**	**1000**

Series

06		**6**

Index

07		Size 10 to 180	**1**
		Size 200	**3**
		Size 5 and 250 o 1000	**0**

Direction of rotation

08	Viewed on drive shaft, bidirectional	**W**

Seal material

09	FKM (fluoroelastomer)	**V**

Drive shaft

			5	**10**	**12**	**16**	**23**	**28**	**32**	**107**	**125**	**160**	**180**	**200**	**250–1000**	
10	Splined shaft DIN 5480		–	●	●	●	●	●	●	●	●	●	●	●	–	**A**
			–	●	●	–	●	●	–	●	–	●	–	–	●	**Z**
	Parallel keyed shaft DIN 6885		●	●	●	●	●	●	●	●	●	●	●	●	–	**B**
			–	●	●	–	●	●	–	●	–	●	–	–	●	**P**
	Conical shaft[2)]		●	–	–	–	–	–	–	–	–	–	–	–	–	**C**

Mounting flange

			5–250	**355–1000**	
11	ISO 3019-2	4-hole	●	–	**B**
		8-hole	–	●	**H**

● = Available ○ = On request – = Not available

[1)] Sizes 45, 56, 63, 80, 90 see data sheet 91071 (A2FM series 70)

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

01	02	03	04	05		06	07	08		09	10	11	12	13	14	15
	A2F		**M**		**/**	**6**		**W**	**–**	**V**						

Working ports

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

Valves

Without valve	**0**
Pressure-relief valves (without pressure boost facility)	**1**
Pressure-relief valves (with pressure boost facility)	**2**
Flushing and boost pressure valve mounted	**7**
Counterbalance valve BVD/BVE mounted[3]	**8**

Speed sensors

		5-16	23-180	200	250-1000[4]	
13	Without speed sensor (without code)	●	●	●	●	
	Prepared for HDD speed sensor	–	–	–	●	**F**
	HDD speed sensor mounted[5]	–	–	–	●	**H**
	Prepared for DSA speed sensor	–	●	●	○	**U**
	Speed sensor DSA mounted[5]	–	●	●	○	**V**

Special version (only sizes 28 to 180)

14	Standard version (without code)	
	Special version for slew drives (standard with port plate 19)	**J**

Standard / special version

15	Standard version (without code)	
	Standard version with installation variants, e. g. **T** ports against standard open or close	**–Y**
	Special version	**–S**

● = Available ○ = On request – = Not available

1) Threaded ports at the sides plugged with threaded plugs.
2) Please contact us.
3) Specify ordering code of counterbalance valve according to data sheet 95522 (BVD) respectively data sheet 95526 (BVE) separately.
4) Size 710 please contact us.
5) Specify ordering code of sensor according to data sheet 95133 (DSA) respectively data sheet 95135 (HDD) separately.

Notice

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

Technical data

Table of values

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

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

[1] These values are valid at:
- for the optimum viscosity range from v_{opt} = 36 to 16 mm^2/s
- with hydraulic fluid based on mineral oils

[2] Intermittent maximum speed: overspeed for unload and overhauling processest, t < 5 s and Δp < 150 bar

[3] Restriction of input flow with counterbalance valve

[4] Torque without radial force, with radial force see table "Permissible radial and axial forces of the drive shafts"

Note

- The values in the table are theoretical values, without consideration of efficiencies and tolerances. The values are rounded.
- Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.

Speed range

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

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

Key

V_g	Displacement per revolution [cm^3]
Δp	Differential pressure [bar]
n	Rotational speed [rpm]
η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Total efficiency ($\eta_t = \eta_v \bullet \eta_{hm}$)

Hydraulic fluids

The axial piston unit is designed for operation with mineral oil HLP according to DIN 51524.
Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR, HFDU)
- 90223: Fire-resistan, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC)
- 90225: Restricted technical data for operation with fire-resistant hydraulic fluids

Viscosity and temperature of hydraulic fluids

	Viscosity	**Shaft seal**	**Temperature[1)]**	**Comment**
Cold start	$v_{max} \leq 1600$ mm²/s	NBR[2)]	$\vartheta_{St} \geq -40$ °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm (size 5 to 200), n ≤ 0.25 • n_{nom} (size 250 to 1000), permissible temperature difference between axial piston unit and hydraulic fluid max. 25 K
		FKM	$\vartheta_{St} \geq -25$ °C	
Warm-up phase	v = 400 ... 1600 mm²/s			t ≤ 15 min, p ≤ 0.7 • p_{nom} and n ≤ 0.5 • n_{nom}
Continuous operation	v = 10 ... 400 mm²/s[3)]	NBR[2)]	$\vartheta \leq +78$ °C	measured at port **T**
		FKM	$\vartheta \leq +103$ °C	
	v_{opt} = 16 ... 36 mm²/s			range of optimum operating viscosity and efficiency
Short-term operation	v_{min} = 7 ... 10 mm²/s	NBR[2)]	$\vartheta \leq +78$ °C	t ≤ 3 min, p ≤ 0.3 • p_{nom} measured at port **T**
		FKM	$\vartheta \leq +103$ °C	

1) If the specified temperatures cannot be maintained due to extreme operating parameters, please contact us.
2) Special version, please contact us.
3) Equates e.g. with the VG 46 a temperature range of +5 °C to +85 °C (see selection diagram)

Note

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

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

Selection of hydraulic fluid

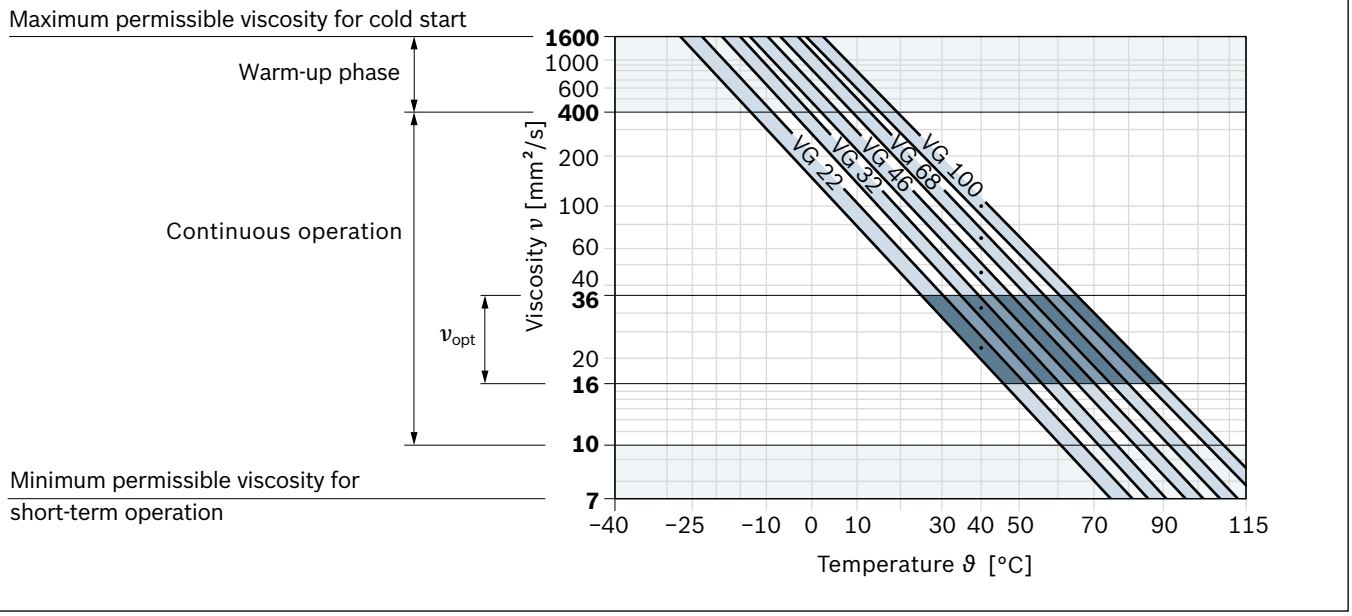
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.

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

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

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

Selection diagram



Filtration of the hydraulic fluid

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

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

At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures in short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

For example, the viscosity is 10 mm²/s at:

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

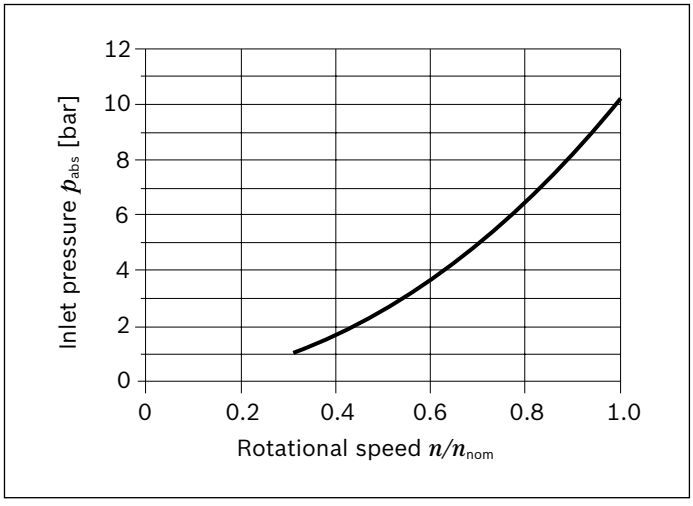
Operating pressure range

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

Note

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

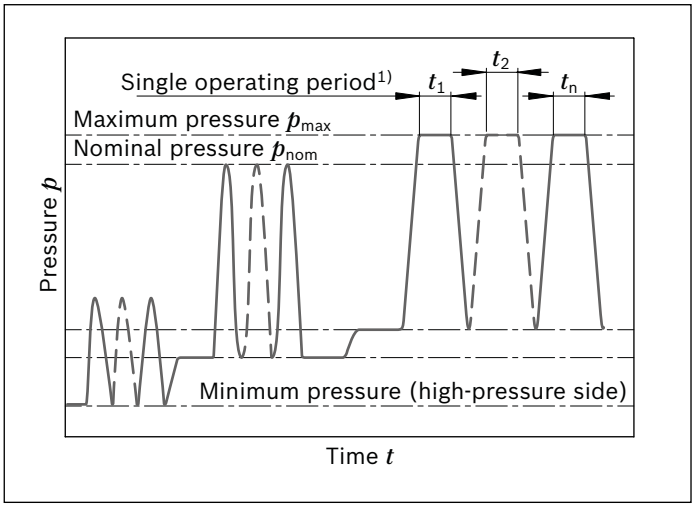
Minimum pressure at inlet (pump operating mode)



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

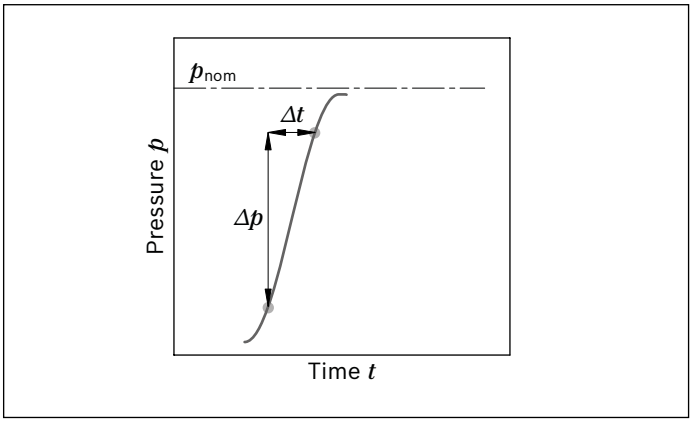
If the above mentioned conditions cannot be ensured, please contact us.

Pressure definition

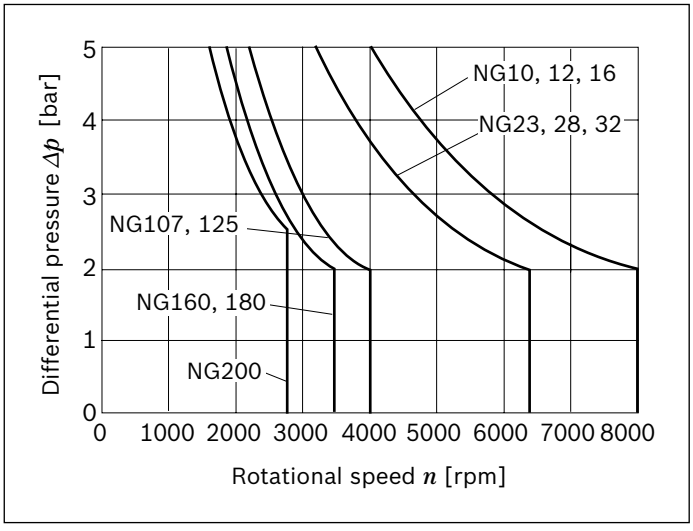


1) Total operating period = $t_1 + t_2 + ... + t_n$

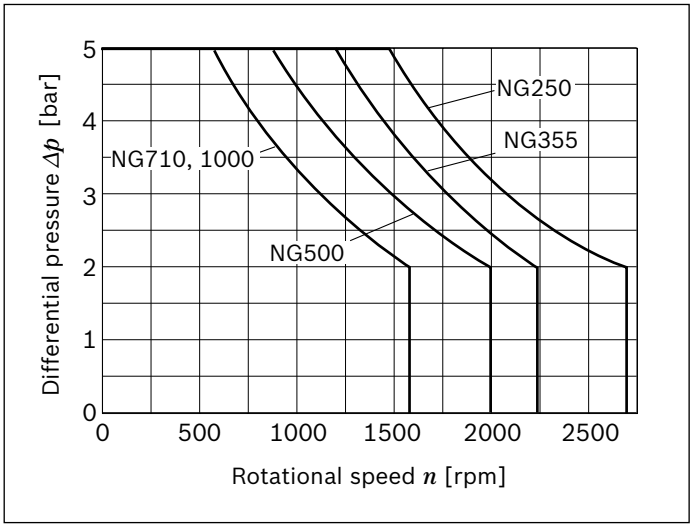
Rate of pressure change



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



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



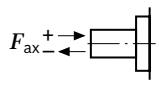
Note

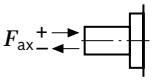
- The service life of the shaft seal is influenced by the speed of the axial piston unit and the case pressure.
- The service life decreases with an increase of the mean differential pressure between the case and the ambient pressure and with a higher frequency of pressure spikes.
- The case pressure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

Direction of flow

Direction of rotation, viewed on drive shaft	
clockwise	counter-clockwise
A to **B**	**B** to **A**

Permissible radial and axial forces of the drive shaft

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

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

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

General instructions

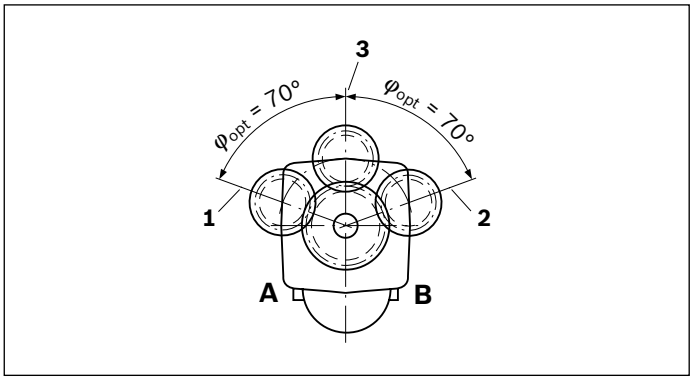
- The values given are maximum values and do not apply to continuous operation.
- The axial force in direction $-F_{ax}$ is to be avoided as the service life of the bearing is reduced.
- Special requirements apply in the case of belt drives. Please contact us.

Notes for sizes 250 ... 1000:

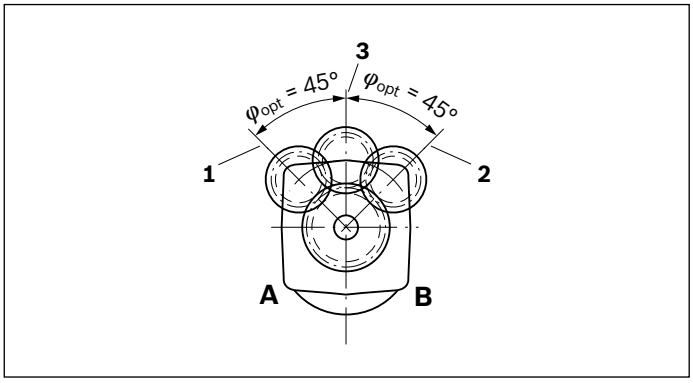
- In case of radial forces limited performance data is valid. Please contact us.
- In case of axial forces during operation of the unit please contact us.

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

Toothed gear drive, size 5 ... 180



Toothed gear drive, size 200 ... 1000



1 Direction of rotation "counter-clockwise", pressure at port **B**

2 Direction of rotation "clockwise", pressure at port **A**

3 Direction of rotation "bidirectional"

Long-life bearing

Size 250 to 1000
For long life cycle and use with HF hydraulic fluids. Identical external dimensions as design with standard bearing. Subsequent modification to long-life bearing is possible. Bearing and housing flushing via connection **U** is recommended.

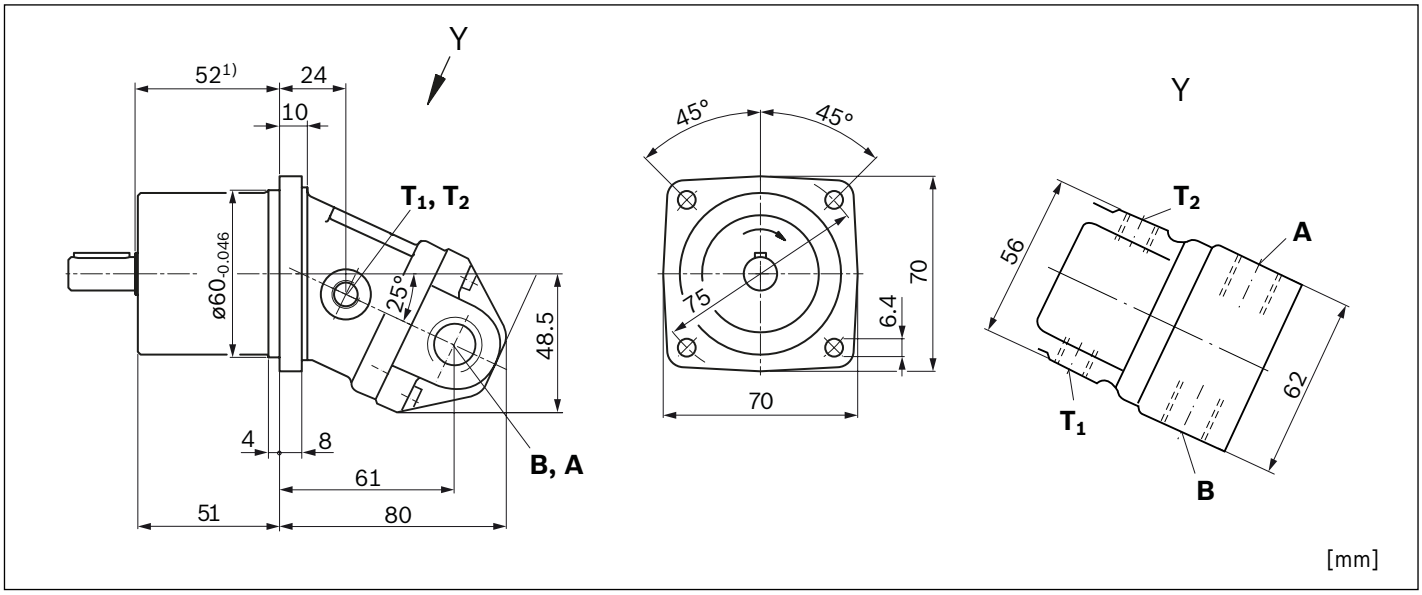
Bearing flushing

Flushing flow (recommended)

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

Dimensions

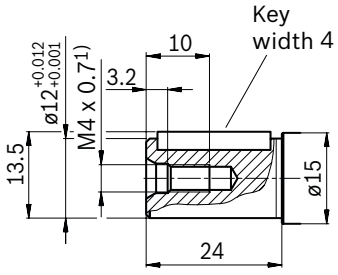
Size 5



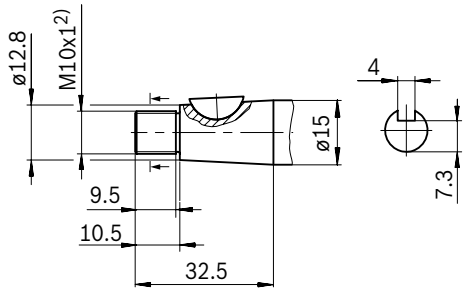
[1)] To shaft collar

Drive shafts

B Parallel keyed shaft, DIN 6885, A4x4x20



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



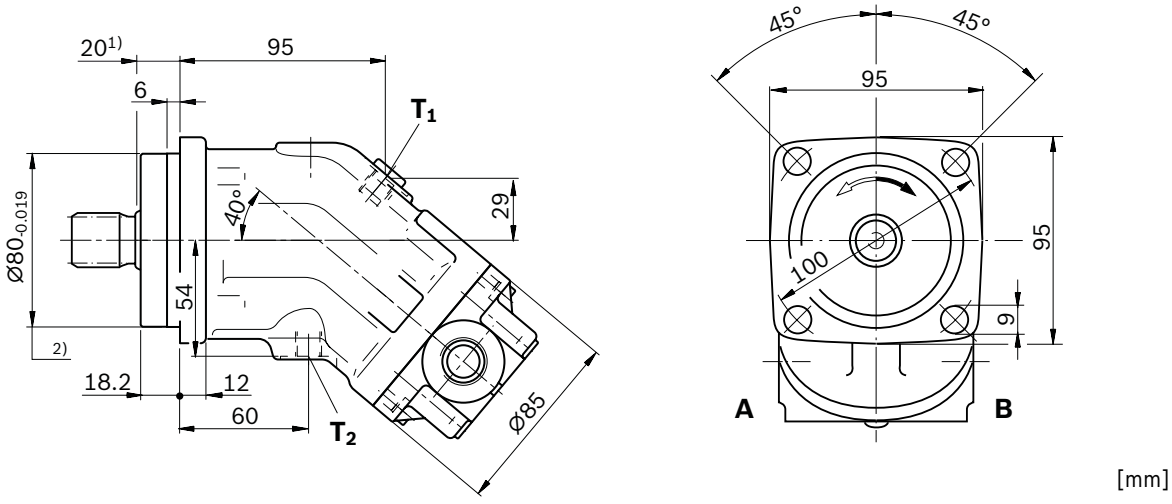
[1)] Center bore according to DIN 332 (thread according to DIN 13)
[2)] Thread according to DIN 3852, maximum tightening torque: 30 Nm

Ports

Size			5
A, B	Working port	Size	M18 × 15; 12 mm deep
		Standard [1)]	DIN 3852
		State on delivery	With protective cover (must be connected)
T_1	Drain port	Size	M10 × 1; 8 mm deep
		Standard [1)]	DIN 3852
		State on delivery [2)]	Plugged (observe installation instructions)
T_2	Drain port	Size	M10 × 1; 8 mm deep
		Standard [1)]	DIN 3852
		State on delivery [2)]	Plugged (observe installation instructions)

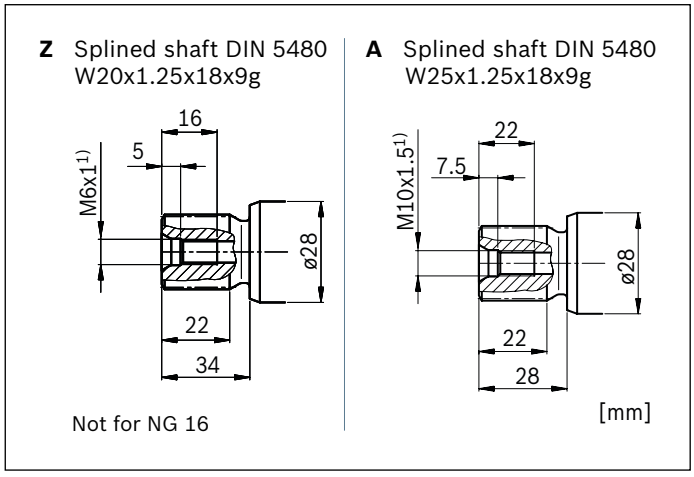
[1)] The spot face can be deeper than specified in the appropriate standard.
[2)] Unless otherwise specified. Other layouts on request.

Size 10 ... 16



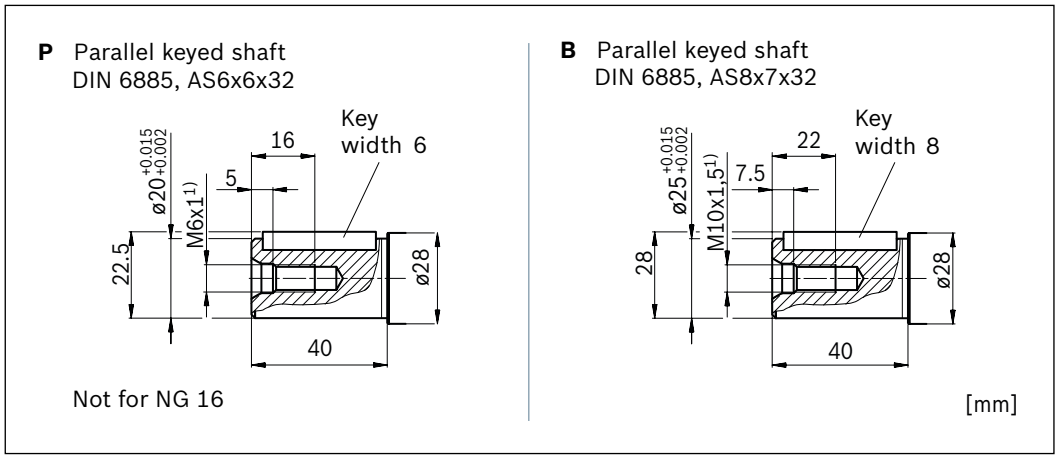
1) To shaft collar
2) Flange similar to ISO 3019-2

Drive shafts Z and A



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

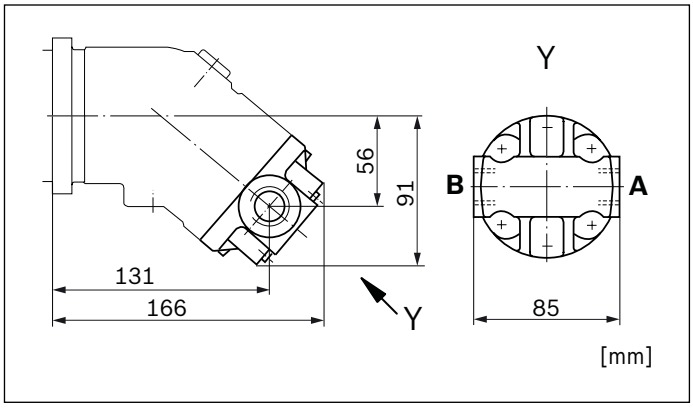
Drive shafts P and B



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

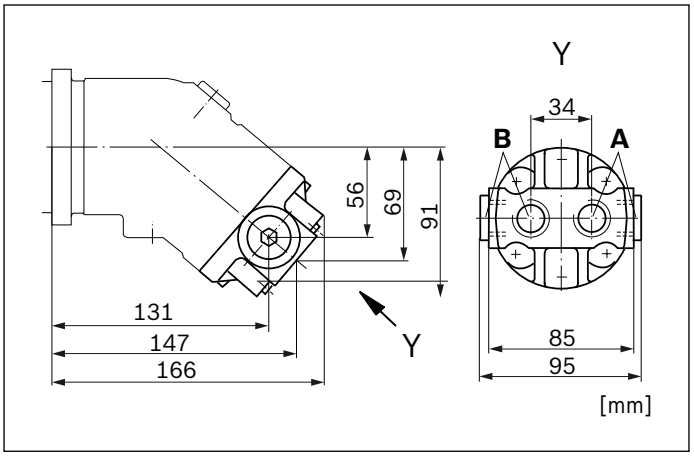
Port plate 03

Threaded ports at side, opposite



Port plate 04

Threaded ports at side and rear

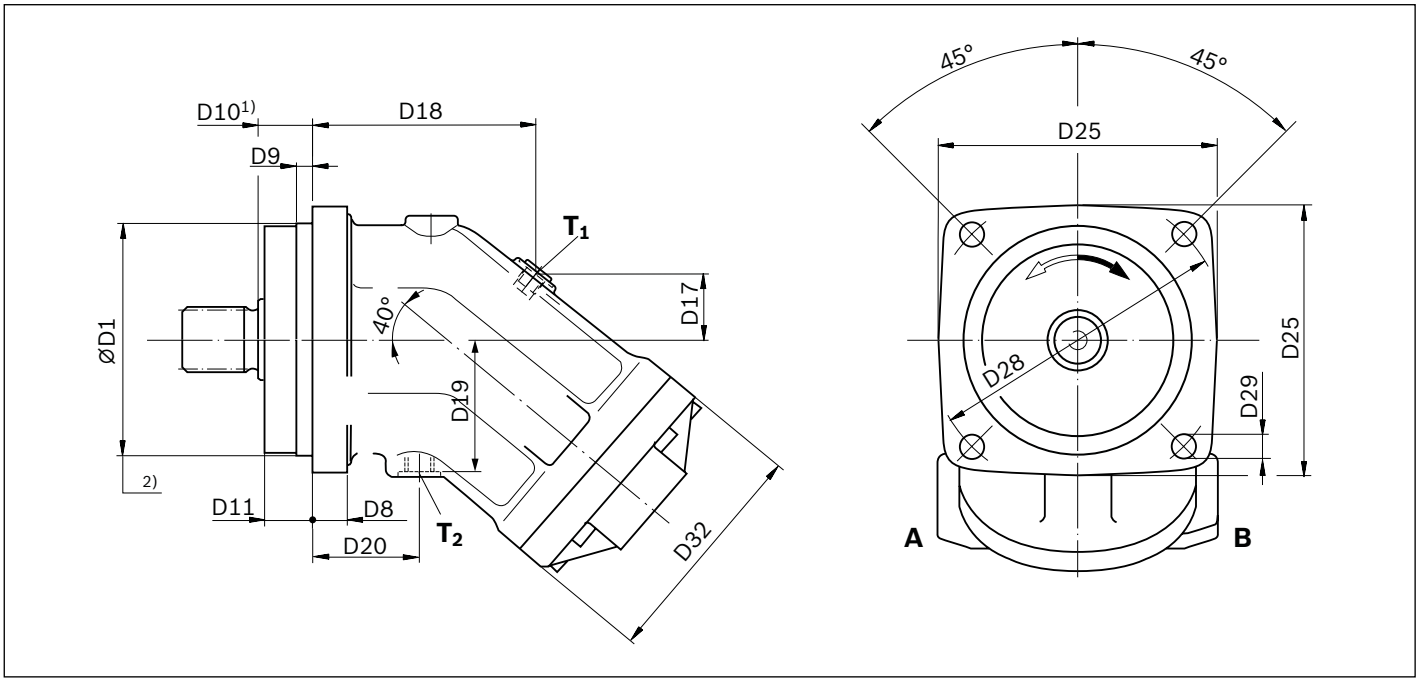


Ports

Size			10	12	16
A, B	Working port	Size	M22 × 15; 14 mm deep		
		Standard [1]	DIN 3852		
		State on delivery [2]	With protective cover (must be connected)		
T_1	Drain port	Size	M12 × 15; 12 mm deep		
		Standard [1]	DIN 3852		
		State on delivery [3]	Plugged (observe installation instructions)		
T_2	Drain port	Size	M12 × 15; 12 mm deep		
		Standard [1]	DIN 3852		
		State on delivery [3]	With protective cover (observe installation instructions)		

[1] The spot face can be deeper than specified in the appropriate standard.
[2] Unless otherwise specified: In case of connection plate 04 ports at the sides plugged. Other layouts on request.
[3] Unless otherwise specified. Other layouts on request.

Size 23 ... 180

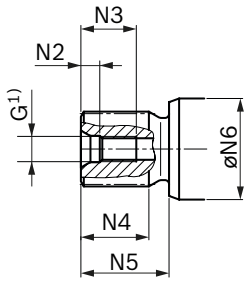


[1)] To shaft collar
[2)] Flange ISO 3019-2

Size	D1		D8	D9	D10	D11	D17	D18	D19	D20	D25	D28	D29	D32
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
23	100	0 - 0.022	18	8	25	23.2	25	106	56	42	118	125	11	106
28	100	0 - 0.022	18	8	25	23.2	25	106	56	42	118	125	11	106
32	100	0 - 0.022	18	8	25	23.2	25	106	56	42	118	125	11	106
107	160	0 - 0.025	23	10	40	36.5	40	140	85	65	190	200	17.5	150
125	160	0 - 0.025	23	10	40	36.5	40	140	85	65	190	200	17.5	150
160	180	0 - 0.025	25	10	40	37.2	47	158	96	72	210	224	17.5	180
180	180	0 - 0.025	25	10	40	37.2	47	158	96	72	210	224	17.5	180

Drive shafts Z and A

Splined shaft DIN 5480



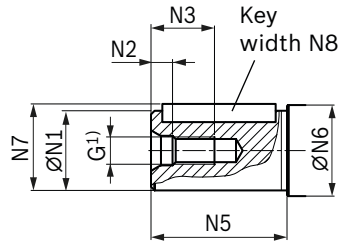
1) Center bore according to DIN 332 (thread according to DIN 13)

Splined shaft DIN 5480

NG	Code	Designation	Thread G	N2	N3	N4	N5	ØN6
				mm	mm	mm	mm	mm
23	Z	W25×1.25×18×9g	M8 × 1.25	6	19	28	43	35
	A	W30×2×14×9g	M10 × 1.5	7.5	22	27	35	35
28	Z	W25×1.25×18×9g	M8 × 1.25	6	19	28	43	35
	A	W30×2×14×9g	M10 × 1.5	7.5	22	27	35	35
32	A	W30×2×14×9g	M10 × 1.5	7.5	22	27	35	35
107	Z	W40×2×18×9g	M12 × 1.75	9.5	28	37	45	50
	A	W45×2×21×9g	M16 × 2	12	36	42	50	50
125	A	W45×2×21×9g	M16 × 2	12	36	42	50	50
160	Z	W45×2×21×9g	M16 × 2	12	36	42	50	60
	A	W50×2×24×9g	M16 × 2	12	36	44	55	60
180	A	W50×2×24×9g	M16 × 2	12	36	44	55	60

Drive shafts P and B

Parallel keyed shaft
DIN 6885



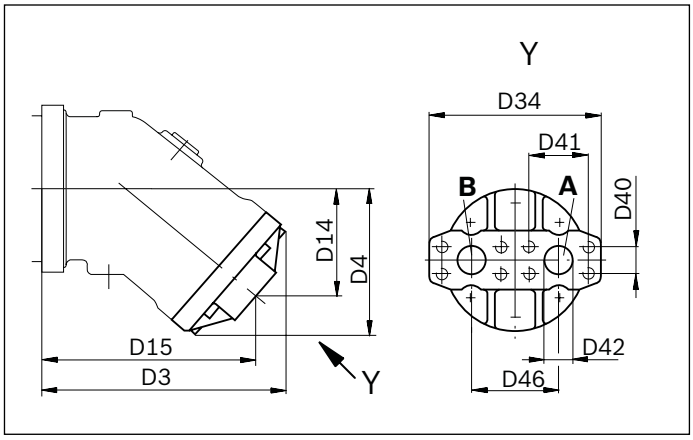
1) Center bore according to DIN 332 (thread according to DIN 13)

Parallel keyed shaft DIN 6885

NG	Code	Designation	Thread G	ØN1		N2	N3	N5	ØN6	N7	N8
				mm	mm	mm	mm	mm	mm	mm	mm
23	P	Ø25, AS8×7×40	M8 × 1.25	25	+ 0.015 + 0.002	6	19	50	35	28	8
	B	Ø30, AS8×7×40	M10 × 1.5	30	+ 0.015 + 0.002	7.5	22	50	35	33	8
28	P	Ø25, AS8×7×40	M8 × 1.25	25	+ 0.015 + 0.002	6	19	50	35	28	8
	B	Ø30, AS8×7×40	M10 × 1.5	30	+ 0.015 + 0.002	7.5	22	50	35	33	8
32	B	Ø30, AS8×7×40	M10 × 1.5	30	+ 0.015 + 0.002	7.5	22	50	35	33	8
107	P	Ø40, AS12×8×63	M12 × 1.75	40	+ 0.018 + 0.002	9.5	28	80	50	43	12
	B	Ø45, AS14×9×63	M16 × 2	45	+ 0.018 + 0.002	12	36	80	50	48.5	14
125	B	Ø45, AS14×9×63	M16 × 2	45	+ 0.018 + 0.002	12	36	80	50	48.5	14
160	P	Ø45, AS14×9×70	M16 × 2	45	+ 0.018 + 0.002	12	36	90	60	48.5	14
	B	Ø50, AS14×9×70	M16 × 2	50	+ 0.018 + 0.002	12	36	90	60	53.5	14
180	B	Ø50, AS14×9×70	M16 × 2	50	+ 0.018 + 0.002	12	36	90	60	53.5	14

Port plate 01

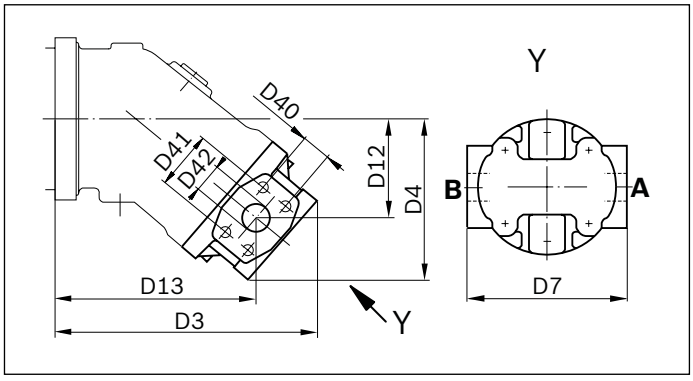
SAE working ports at rear



Size	D3	D4	D14	D15	D34	D40	D41	D42	D46
	mm	mm	mm	mm	mm	mm	mm	mm	mm
23 ... 32	173	106	78	153	115	18.2	40.5	13	59
107 ... 125	252	159	120	225.5	194	31.8	66.7	32	99
160 ... 180	294	188	134	252	194	31.8	66.7	32	99

Port plate 02

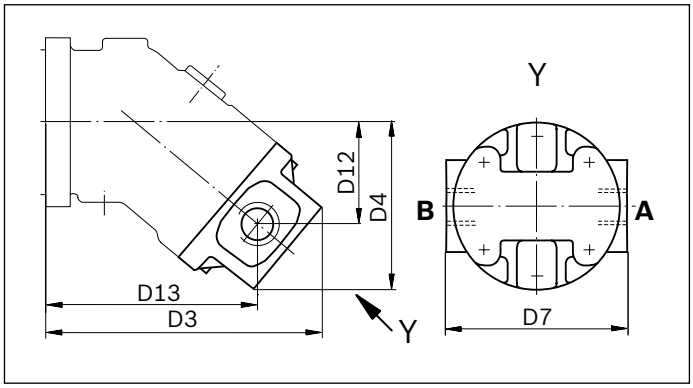
SAE working ports at side, opposite



Size	D3	D4	D7	D12	D13	D40	D41	D42
	mm	mm	mm	mm	mm	mm	mm	mm
23 ... 32	190	117	120	70	144	18.2	40.5	13
107	285	181	178	110	213	27.8	57.2	25
125	285	181	178	110	213	31.8	66.7	32
160 ... 180	294	188	202	121	237	31.8	66.7	32

Port plate 03

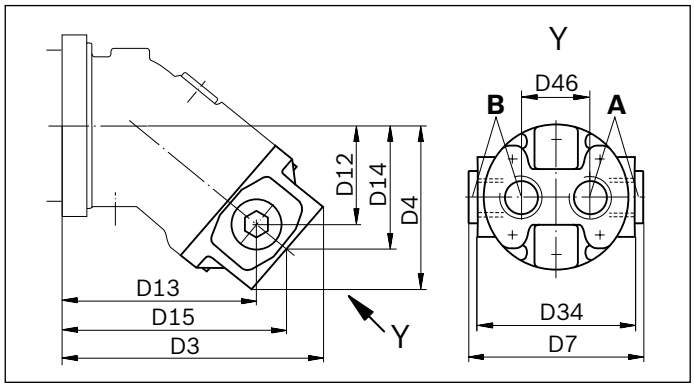
Threaded ports at side, opposite



Size	D3	D4	D7	D12	D13
	mm	mm	mm	mm	mm
23 ... 32	190	117	120	70	144

Port plate 04

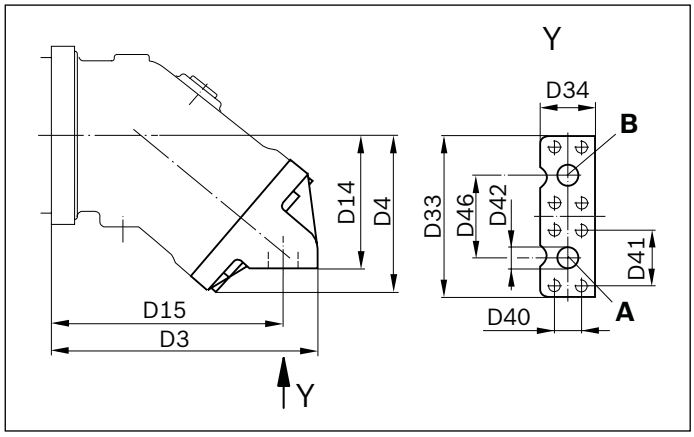
Threaded ports at side and rear



Size	D3	D4	D7	D12	D13	D14	D15	D34	D46
	mm	mm	mm	mm	mm	mm	mm	mm	mm
23 ... 32	190	117	130	70	144	88	166	120	58

Port plate 10

SAE working ports at bottom



Size	D3	D4	D14	D15	D33	D34	D40	D41	D42	D46
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
28 ... 32	178	106	91	158	115	40	18.2	40.5	13	59
107 ... 125	261	157	136	226	194	70	31.8	66.7	32	99
160 ... 180	290	185	149	252	194	70	31.8	66.7	32	99

Note

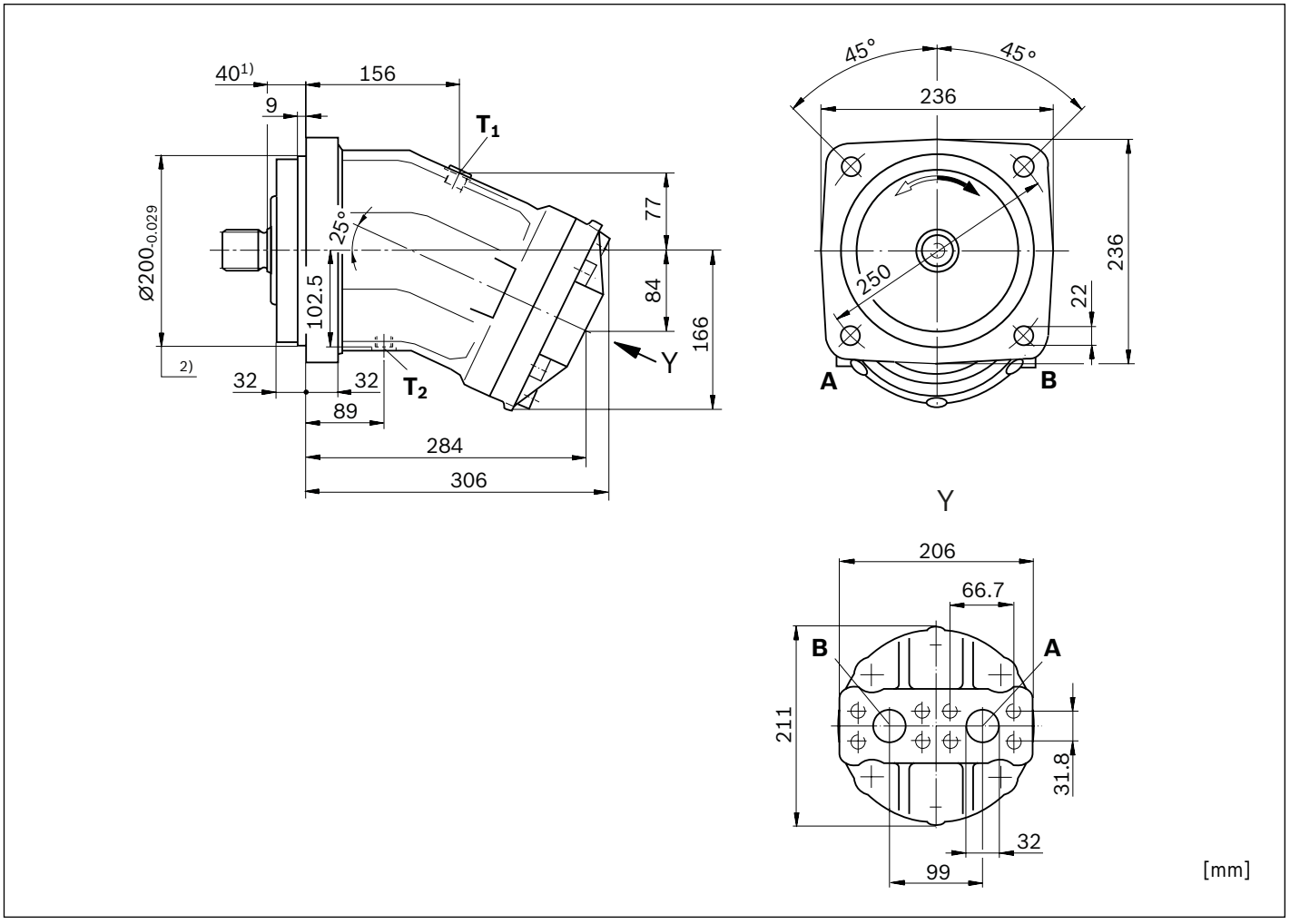
- The dimensional drawings of the port plates with valves can be found in the chapter "Extended functions and versions".

Ports

Size			23	28	32	107	125	160	180
A, B (plate 01, 02, 10)	Working port	Size	1/2 in			1 1/4 in [1]	1 1/4 in		
		Standard	Dimensions according to SAE J518						
		Fastening thread [2]	M8 × 125; 15 mm deep			M14 × 2; 19 mm deep [1]	M14 × 2; 19 mm deep		
		State on delivery	With protective cover (must be connected)						
A, B (plate 03, 04)	Working port	Size	M27 × 2; 16 mm deep						
		Standard [3]	DIN 3852						
		State on delivery [4]	With protective cover (must be connected)						
T_1	Drain port	Size	M16 × 15; 12 mm deep			M18 × 15; 12 mm deep		M22 × 15; 14 mm deep	
		Standard [3]	DIN 3852						
		State on delivery [5]	Plugged (observe installation instructions)						
T_2	Drain port	Size	M16 × 15; 12 mm deep			M18 × 15; 12 mm deep		M22 × 15; 14 mm deep	
		Standard [3]	DIN 3852						
		State on delivery [5]	With protective cover (observe installation instructions)						

[1] In case of port plate 02: Size of working port A, B: 1 in with fastening threads M12 × 1.75, 17 mm deep
[2] Thread according to DIN 13
[3] The spot face can be deeper than specified in the appropriate standard.
[4] Unless otherwise specified: In case of connection plate 04 ports at the sides plugged. Other layouts on request.
[5] Unless otherwise specified. Other layouts on request.

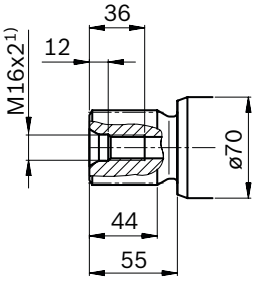
Size 200



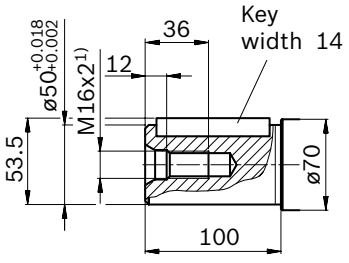
[1)] To shaft collar
[2)] Flange ISO 3019-2

Drive shafts

A Splined shaft DIN 5480
W50x2x24x9g



B Parallel keyed shaft
DIN 6885, AS14x9x80



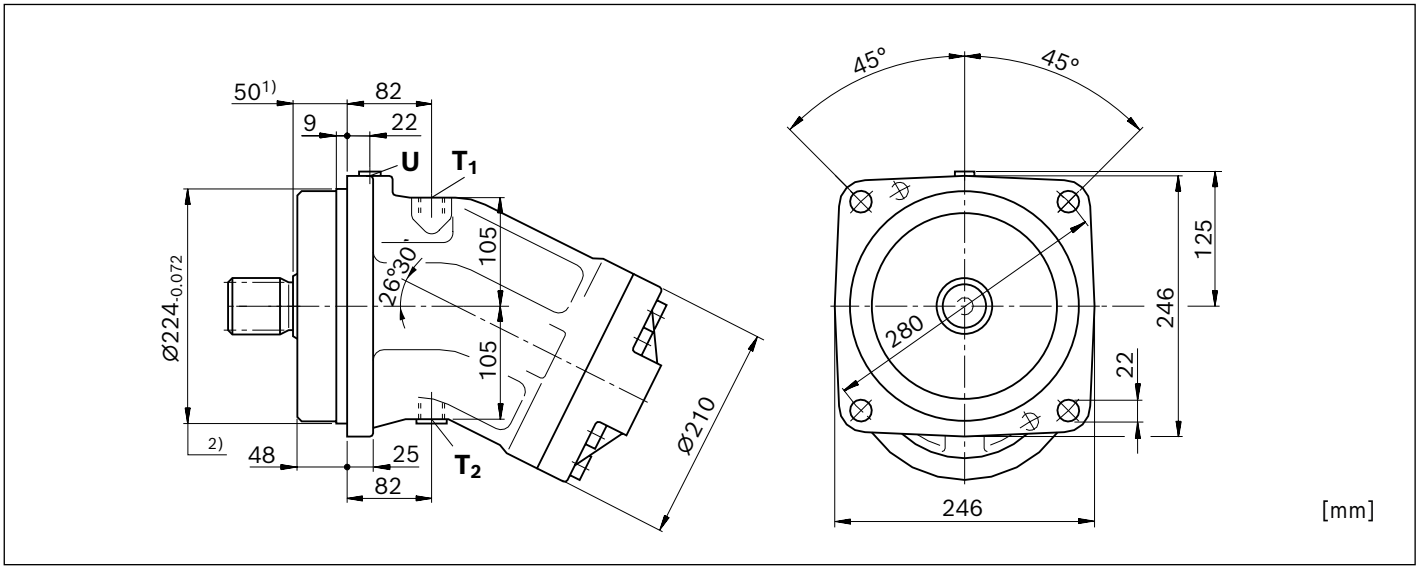
[1)] Center bore according to DIN 332 (thread according to DIN 13)

Ports

Size			200
A, B	Working port	Size	1 1/4 in
		Standard	Dimensions according to SAE J518
		Fastening thread [1]	M14 × 2; 19 mm deep
		State on delivery	With protective cover (must be connected)
T_1	Drain port	Size	M22 × 15; 14 mm deep
		Standard [2]	DIN 3852
		State on delivery [3]	Plugged (observe installation instructions)
T_2	Drain port	Size	M22 × 15; 14 mm deep
		Standard [2]	DIN 3852
		State on delivery [3]	With protective cover (observe installation instructions)

[1] Thread according to DIN 13
[2] The spot face can be deeper than specified in the appropriate standard.
[3] Unless otherwise specified. Other layouts on request.

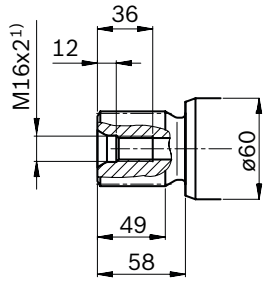
Size 250



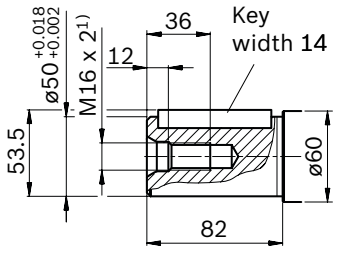
[1] To shaft collar
[2] Flange ISO 3019-2

Drive shafts

Z Splined shaft DIN 5480
W50x2x24x9g



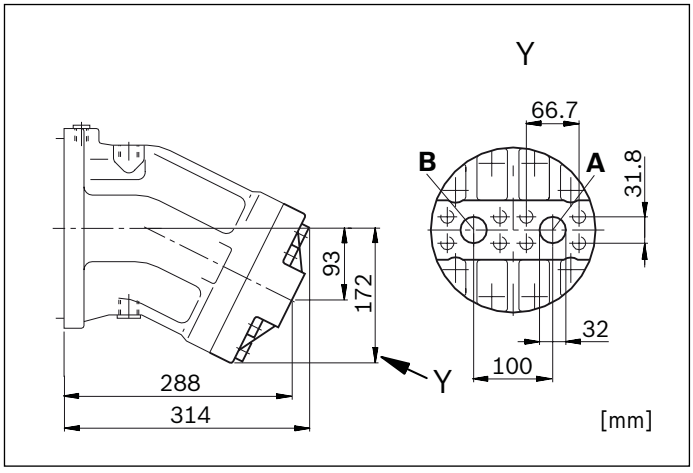
P Parallel keyed shaft
DIN 6885, AS14x9x80



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

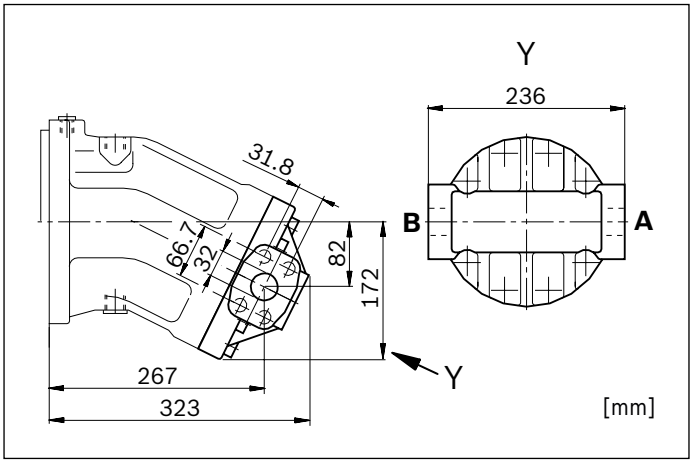
Port plate 01

SAE working ports at rear



Port plate 02

SAE working ports at side, opposite

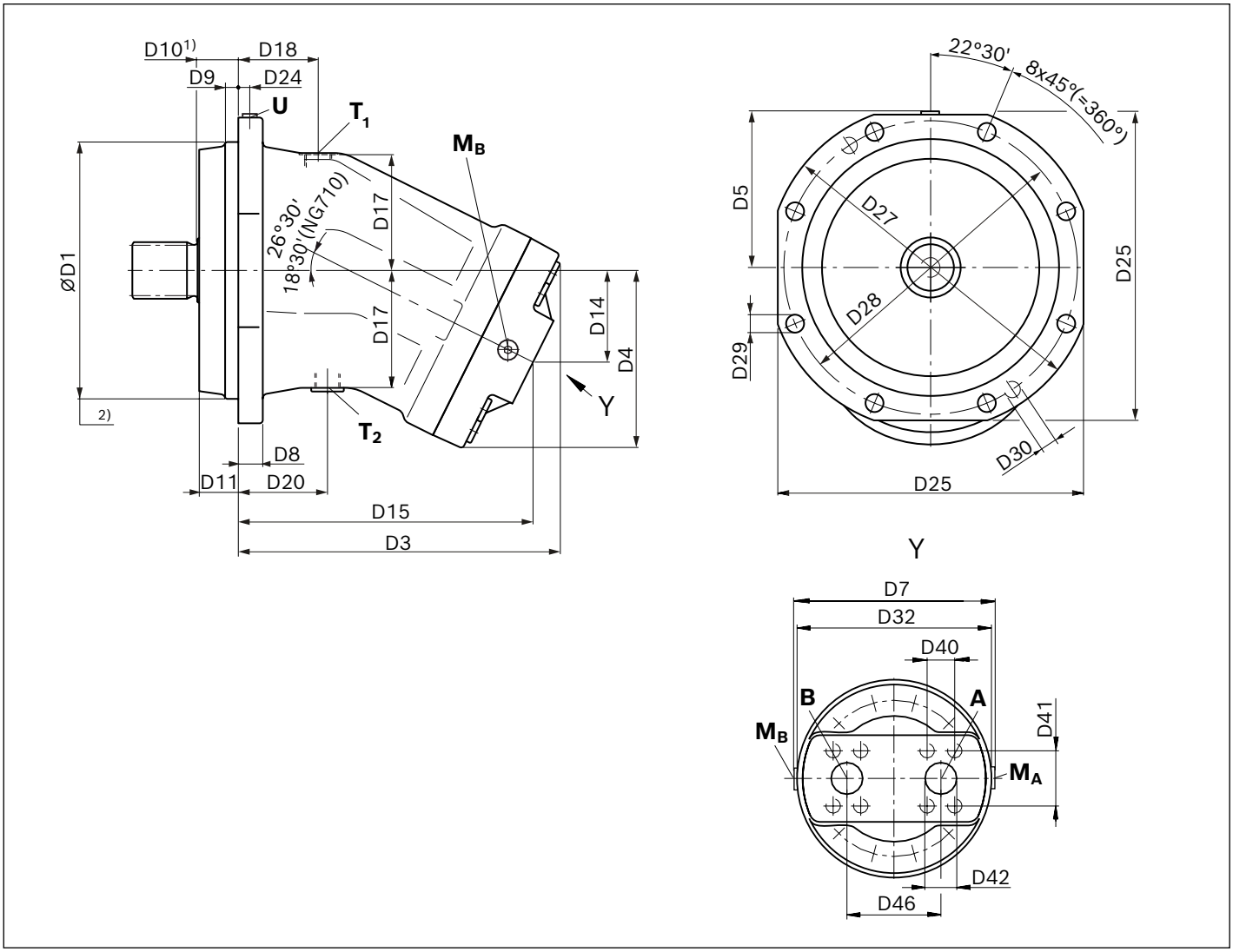


Ports

Size			250
A, B	Working port	Size	1 1/4 in
		Standard	Dimensions according to SAE J518
		Fastening thread 1)	M14 × 2; 19 mm deep
		State on delivery	With protective cover (must be connected)
T_1	Drain port	Size	M22 × 15; 14 mm deep
		Standard 2)	DIN 3852
		State on delivery 3)	With protective cover (observe installation instructions)
T_2	Drain port	Size	M22 × 15; 14 mm deep
		Standard 2)	DIN 3852
		State on delivery 3)	Plugged (observe installation instructions)
U	Bearing flushing	Size	M14 × 15; 12 mm deep
		Standard 2)	DIN 3852
		State on delivery	Plugged

1) Thread according to DIN 13
2) The spot face can be deeper than specified in the appropriate standard.
3) Unless otherwise specified. Other layouts on request.

Size 355 ... 1000

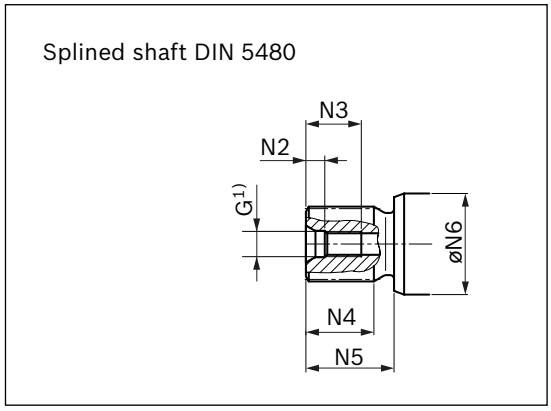


[1)] To shaft collar
[2)] Flange ISO 3019-2

Size	D1		D3	D4	D5	D7	D8	D9	D10	D11	D14	D15	D17	D18	D20	D24	D25
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
355	280	0 - 0.081	350	198	171	250	28	14	50	48	102	320	128	83	83	23.5	335
500	315	0 - 0.081	396	220	191	276	30	14	50	48	112.5	362	142	98	111	27.5	375
710	400	0 - 0.089	507	249	236	344	35	14	50	47	102	485	183	131	156	41.5	465
1000	400	0 - 0.089	511	277	236	344	35	14	50	47	143	468	183	131	156	41.5	465

Size	D27	D28	D29	D30	D32	D40	D41	D42	D46
	mm	mm	mm		mm	mm	mm	mm	mm
355	360	320	18	M18	245	36.6	79.4	40	120
500	400	360	22	M20	270	36.6	79.4	40	130
710	500	450	22	M24	340	44.5	96.8	50	170
1000	500	450	22	M24	340	44.5	96.8	50	170

Drive shaft Z

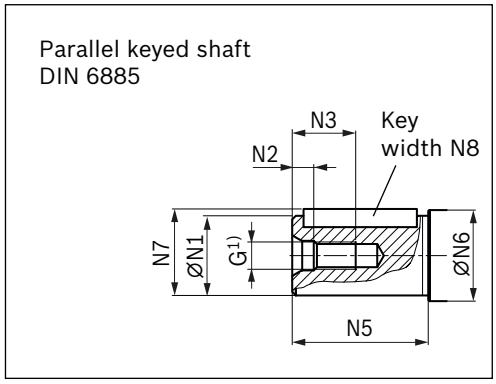


Splined shaft DIN 5480

NG	Code	Designation	Thread G	N2	N3	N4	N5	øN6
				mm	mm	mm	mm	mm
355	Z	W60×2×28×9g	M20 × 2.5	15	42	71	82	70
500	Z	W70×3×22×9g	M20 × 2.5	15	42	67	80	80
710	Z	W90×3×28×9g	M24 × 3	18	50	91	105	100
1000	Z	W90×3×28×9g	M24 × 3	18	50	91	105	100

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

Drive shaft P



Parallel keyed shaft DIN 6885

NG	Code	Designation	Thread G	øN1	N2	N3	N5	øN6	N7	N8
				mm	mm	mm	mm	mm	mm	mm
355	P	Ø60, AS18×11×100	M20 × 2.5	60 + 0.03 + 0.011	15	42	105	70	64	18
500	P	Ø70, AS20×12×100	M20 × 2.5	70 + 0.03 + 0.011	15	42	105	80	74.5	20
710	P	Ø90, AS25×14×125	M24 × 3	90 + 0.035 + 0.013	18	50	130	100	95	25
1000	P	Ø90, AS25×14×125	M24 × 3	90 + 0.035 + 0.013	18	50	130	100	95	25

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

Ports

Size			355	500	710	1000
A, B	Working port	Size	1 1/2 in		2 in	
		Standard	Dimensions according to SAE J518			
		Fastening thread 1)	M16 × 2; 21 mm deep		M20 × 25; 30 mm deep	
		State on delivery	With protective cover (must be connected)			
T_1	Drain port	Size	M33 × 2; 18 mm deep		M42 × 2; 20 mm deep	
		Standard 2)	DIN 3852			
		State on delivery 3)	With protective cover (observe installation instructions)			
T_2	Drain port	Size	M33 × 2; 18 mm deep		M42 × 2; 20 mm deep	
		Standard 2)	DIN 3852			
		State on delivery 3)	Plugged (observe installation instructions)			
U	Bearing flushing	Size	M14 × 15; 12 mm deep	M18 × 15; 12 mm deep		
		Standard 2)	DIN 3852			
		State on delivery	Plugged			
M_A, M_B	Measuring port pressure A, B	Size	M14 × 15; 12 mm deep			
		Standard 2)	DIN 3852			
		State on delivery	Plugged			

1) Thread according to DIN 13
2) The spot face can be deeper than specified in the appropriate standard.
3) Unless otherwise specified. Other layouts on request.

Extended functions and versions

Flushing and boost pressure valve

The flushing and boost pressure valve is used in closed circuits for the removal of heat and to ensure a minimum boost pressure level.
Hydraulic fluid is directed from the respective low pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. The removed hydraulic fluid must be replaced by cooled hydraulic fluid from the boost pump.
With port plate 027, the valve is mounted directly on the fixed motor (sizes 107 to 180, 250); with port plate 017 (sizes 355 and 500) on a plate.

Cracking pressure of pressure retaining valve
(observe when setting the primary valve)
Sizes 107 to 500, fixed setting: 16 bar

Switching pressure of flushing piston Δp
Sizes 107 to 500: 8±1 bar

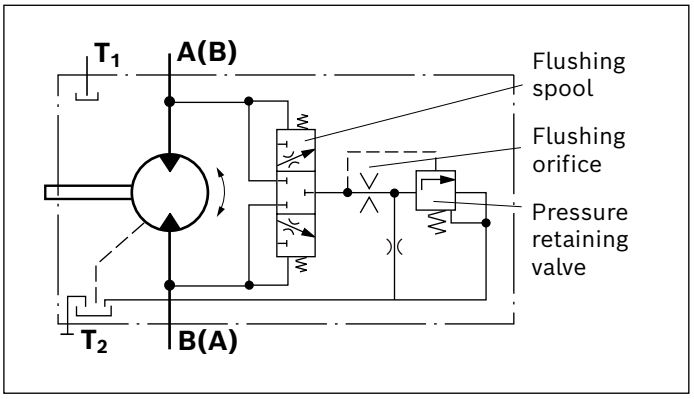
Flushing flow q_v
Orifices can be used to adjust the flushing flows as required. The following information is based on:
$\Delta p_{ND} = p_{ND} - p_G = 25$ bar und $v = 10$ mm²/s
(p_{ND} = low pressure, p_G = case pressure)

Flushing and boost-pressure valve attached (port plates 027 and 017)

Size	Flushing flow q_v	Orifice-Ø	Material number of orifice
	l/min	mm	
107, 125	8	1.8	R909419696
160, 180	10	2	R909419697
250			
355	16	2.5	R910803019
500			

With sizes 107 to 180, orifices can be supplied for flushing flows from 8 to 10 l/min. For flushing flows deviating from the values in the table, please state the required flushing flow when ordering. For nominal sizes 250 to 1000, please always specify the flushing flow. For sizes 107 to 180 the flushing flow without orifice is approx. 12 to 14 l/min at low pressure $\Delta p_{ND} = 25$ bar, for sizes 250 to 1000 please contact us.

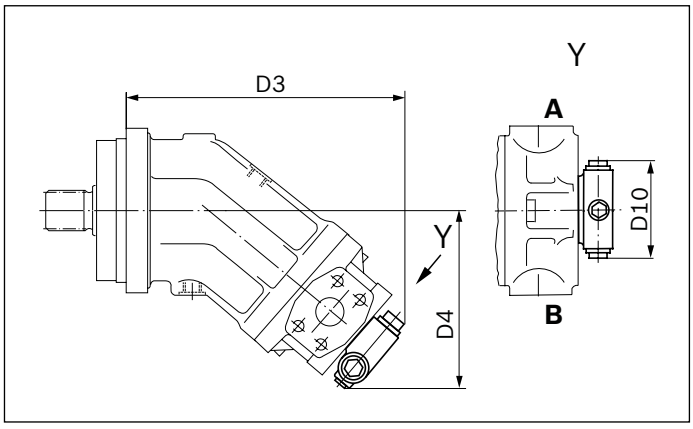
Circuit diagram



Dimensions

Port plate 027

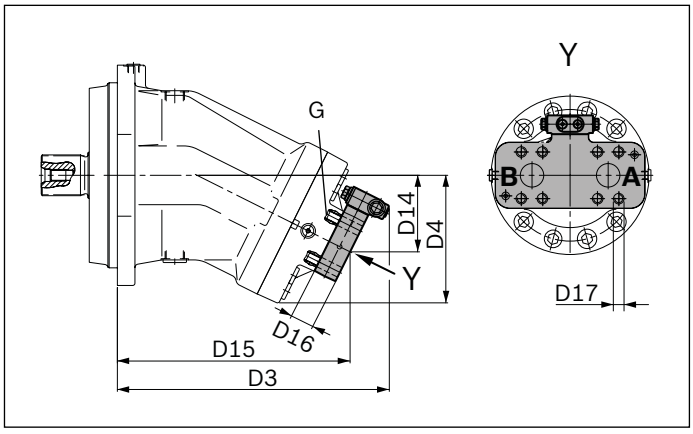
SAE working ports at side, opposite



Size	D3	D4	D10
	mm	mm	mm
107, 125	294	192	102
160, 180	315	201	102
250	344	172	102

Port plate 017

SAE working ports at rear



Size	D3	D4	D14	D15	D16	D17	G [1]
	mm	mm	mm	mm	mm	mm	
355	421	198	120	356	40	18	M16 × 2; 21 mm deep
500	464	220	130	397	40	18	M16 × 2; 21 mm deep

[1] Thread according to DIN 13

Pressure relief valve

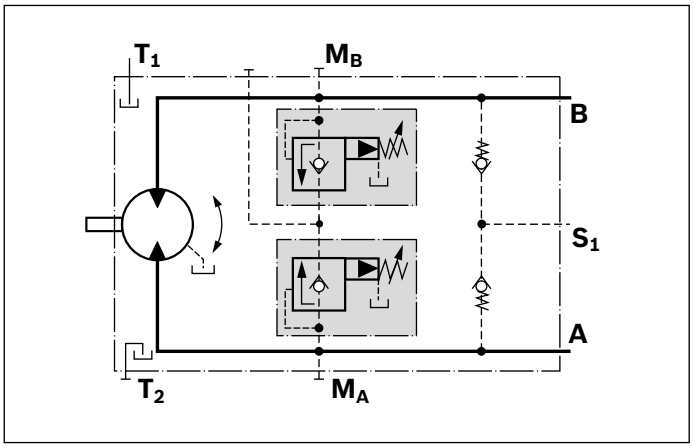
The MHDB pressure relief valves protect the hydraulic motor from overload. As soon as the set cracking pressure is reached, the hydraulic fluid flows from the high-pressure side to the low-pressure side.
The pressure relief valves are only available in conjunction with connection plates 181, 191 or 192. (Connection plate 181: see section “BVD and BVE counterbalance valve”

Setting range of cracking pressure: 50 up to 420 bar

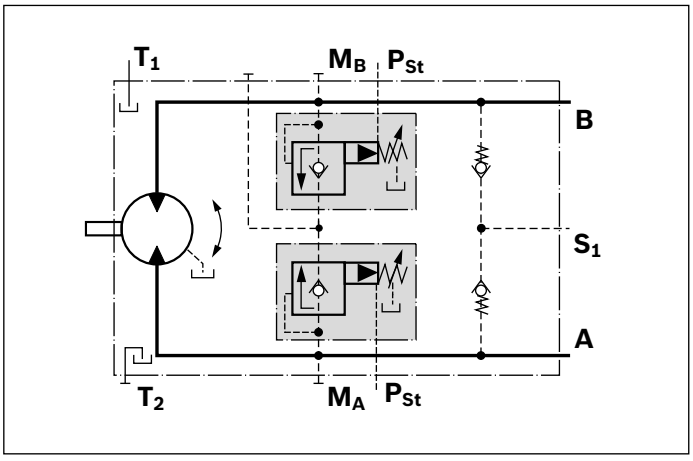
For versions “with pressure sequencing stage” (code 192), a higher pressure setting can be implemented by connecting an external pilot pressure of 25 up to 30 bar at port p_{St}.
When ordering, state in plain text:

- Cracking pressure of pressure relief valve
- Cracking pressure with pilot pressure applied to p_{St} (only with version 192)

Version without pressure boost facility (code 191)



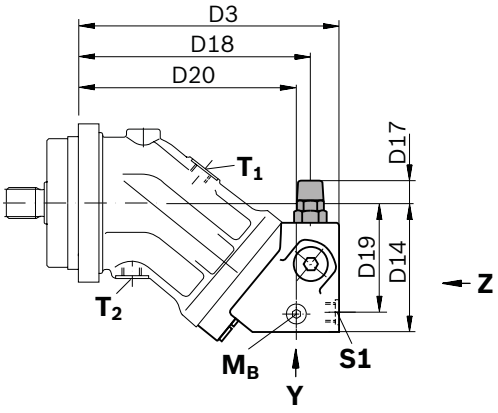
Version with pressure boost facility (code 192)



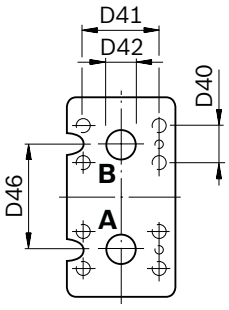
Permissible input flow or pressure in case of port plate with pressure-relief valves

Size		Code	p_{nom}	p_{max}	q_V
Motor	**MHDB**		**bar**	**bar**	**l/min**
28 ... 32	16	191, 192	350	420	100
107 ... 180	32				400

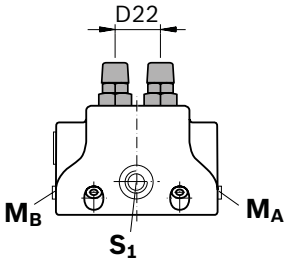
Dimensions



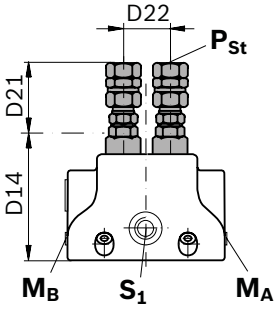
Detailed view **Y**



Detailed view **Z**:
Version without pressure boost facility (code 191)



Detailed view **Z**:
Version with pressure boost facility (code 192)



Size		D3	D14	D17	D18	D19	D20	D21	D22	D40	D41	D42	D46
Motor	**MHDB**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
28, 32	16	209	102	25	186	87	174	68	36	23.8	50.8	19	66
107, 125	32	298	149.5	10	266	130	251	52	53	31.8	66.7	32	84
160, 180		332	170	5	301	149	285	47	53	31.8	66.7	32	84

Ports

Size			28, 32	107, 125	160, 180
A, B	Working port	Size	3/4 in	1 1/4 in	
		Standard	Dimensions according to SAE J518		
		Fastening thread [1]	M10 × 15; 17 mm deep	M14 × 2; 19 mm deep	
		State on delivery	With protective cover (must be connected)		
S_1	Boost port	Size	M22 × 15; 14 mm deep	M26 × 15; 16 mm deep	
		Standard	DIN 3852		
		State on delivery	With protective cover (must be connected)		
P_{St}	Pilot pressure port	Size	G 1/4 [2]		
		Standard	DIN ISO 228		
		State on delivery	With protective cover (must be connected)		
M_A, M_B	Measuring port pressure A, B	Size	M20 × 15; 14 mm deep	M26 × 15; 16 mm deep	M30 × 15; 16 mm deep
		Standard [3]	DIN 3852		
		State on delivery	Plugged		

[1] Thread according to DIN 13
[2] Only with port plate 192
[3] The spot face can be deeper than specified in the appropriate standard.

Counterbalance valve BVD and BVE

Function

Travel drive/winch counterbalance valves are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if the motor speed is greater than it should be for the given input flow while braking, travelling downhill, or lowering a load.

If the inlet pressure drops, the counterbalance spool throttles the return flow and brakes the motor until the inlet pressure returns to approx. 20 bar.

Note

- BVD available for sizes 28 to 180 and BVE available for sizes 107 to 180.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set. Ordering example: A2FM(E)107/61W–VAB**188** + BVD20F27S/41B–V03K16D0400S12
- The counterbalance valve does not replace the mechanical service brake and park brake.
- Observe the detailed notes on the BVD counterbalance valve in data sheet 95522 and BVE counterbalance valve in data sheet 95526!
- For the design of the brake release valve, we must know for the mechanical park brake:
  - the pressure at the start of opening
  - the volume of the counterbalance spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - the required closing time for a warm device (oil viscosity approx. 16 mm^2/s)

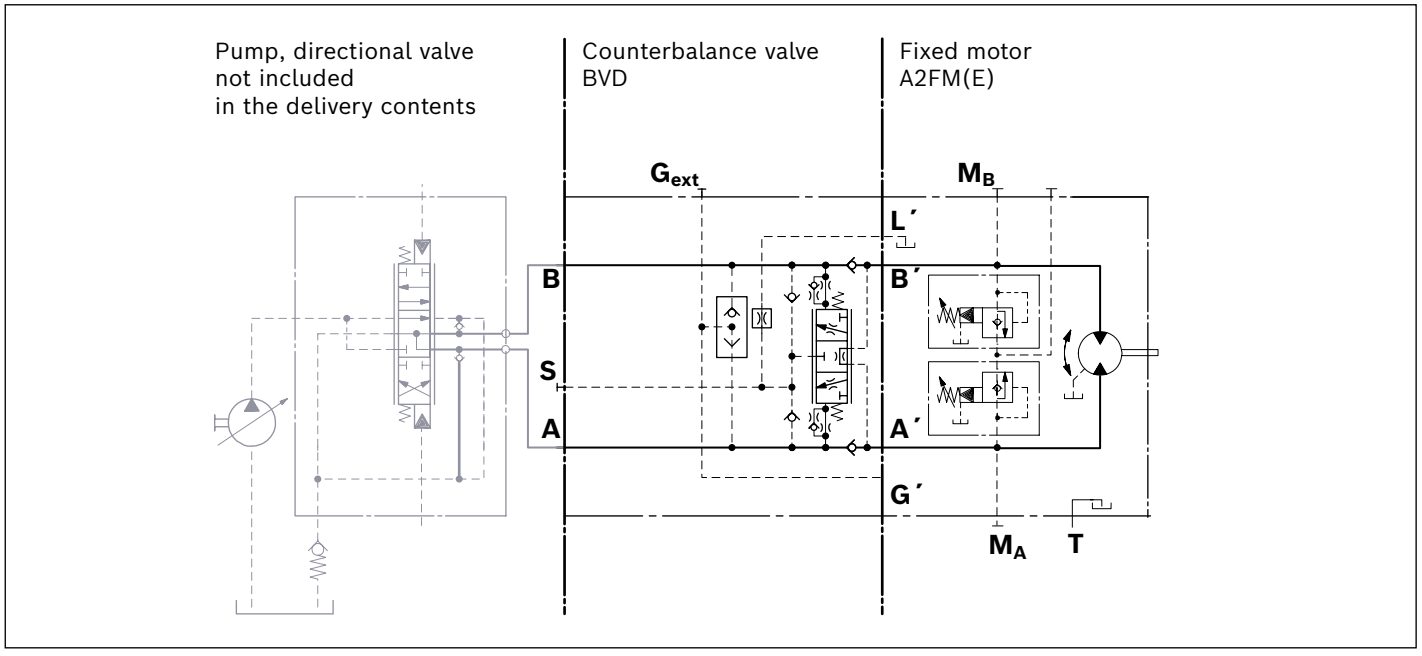
Travel drive counterbalance valve BVD...F

Application option:

- Travel drive on wheeled excavators

Example schematic for travel drive on wheeled excavators

A2FM(E)107/61W-VAB188 + BVD20F27S/41B–V03K16D0400S12



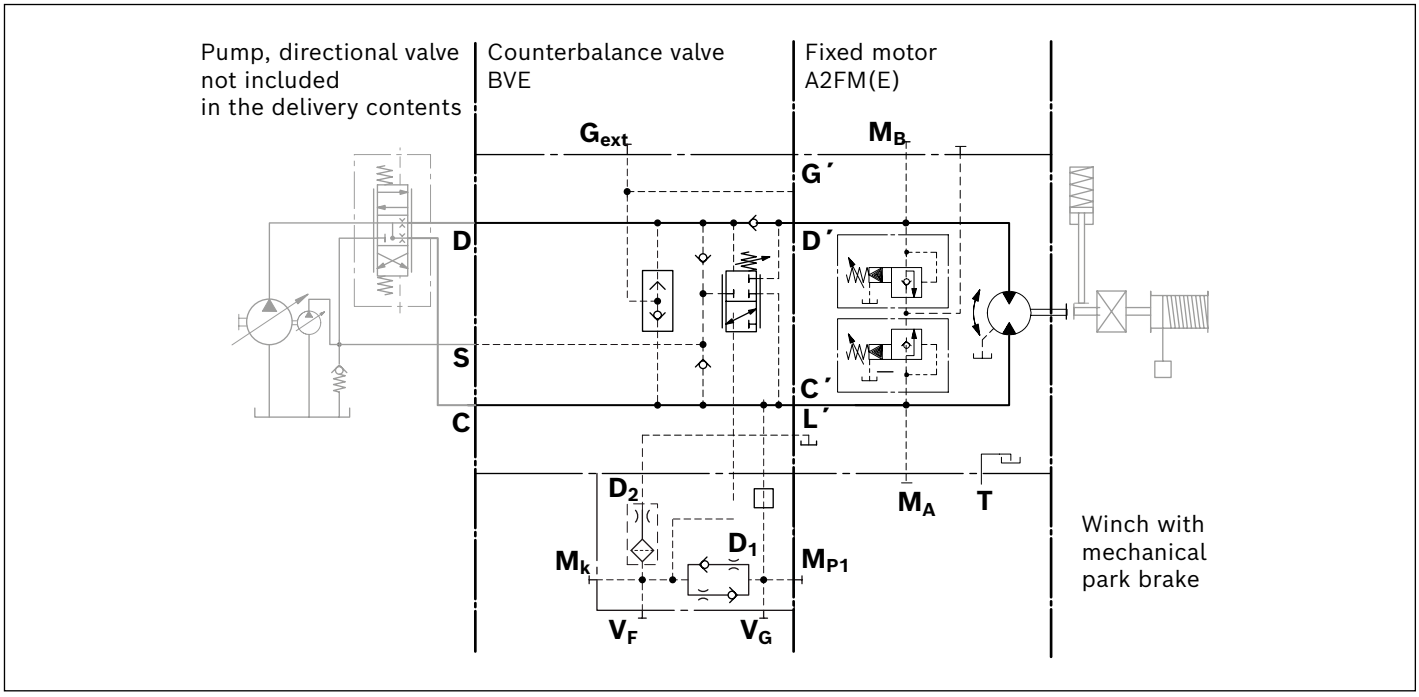
Winch counterbalance valve BVD...W and BVE

Application options:

- Winch drive in cranes (BVD and BVE)
- Track drive in excavator crawlers (BVD)

Example circuit diagram for winch drive in cranes

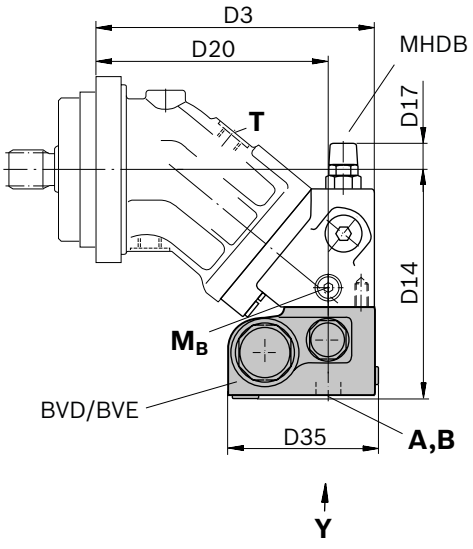
A2FM(E)107/61W-VAB188 + BVE25W385/51ND-V100K00D4599T30S00-0



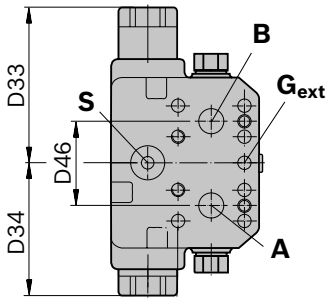
Permissible input flow or pressure in case of port plate with counterbalance valves

Size			Code	p_{nom}	p_{max}	q_V
Motor	**BVD/ BVE**	**MHDB**		**bar**	**bar**	**l/min**
28 ... 32	20	16	181, 188	350	420	100
107 ... 125		22	171, 178			220
107 ... 180	25	32	181, 188			320

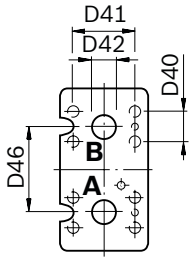
Dimensions



Detailed view **Y:**
with BVD/BVE (code 178, 188)



Detailed view **Y**:
without BVD/BVE (code 171, 181)



Size		Code	D3	D14	D17	D20	D33	D34	D35 [1]	D40	D41	D42	D46
Motor	**Counterbalance valve**		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
28, 32	BVD20..16	188	209	175	25	174	139	98	142	23.8	50.8	19	66
107, 125	BVD20..28	178	298	238	10	251	139	98	142	27.8	57.2	25	84
	BVD25..38	188	298	239	10	251	175	120.5	158	31.8	66.7	32	84
	BVE25..38	188	298	240	10	251	214	137	167	31.8	66.7	32	84
160, 180	BVD25..38	188	332	260	5	285	175	120.5	158	31.8	66.7	32	84
	BVE25..38	188	332	260	5	285	214	137	167	31.8	66.7	32	84

[1] For version with brake release valve (BV...L): Dimension D35 +5 mm

Ports

Size			28, 32	107, 125		160, 180
A, B	Working port	Size	3/4 in	1 in [1]	1 1/4 in [2]	1 1/4 in
		Standard	Dimensions according to SAE J518			
		Fastening thread [3]	M10 × 15; 17 mm deep	M12 × 175; 16 mm deep	M14 × 2; 19 mm deep	
		State on delivery	With protective cover (must be connected)			
S	Boost port	Size	M22 × 15; 14 mm deep		M27 × 2; 16 mm deep	
		Standard [4]	DIN 3852			
		State on delivery	Plugged			
B_r	Brake release port (only BV...L)	Size	M12 × 1.5			
		Standard [4]	DIN 3852			
		State on delivery	With protective cover (must be connected)			
G_{ext}	Brake release port (only BV...S)	Size	M12 × 1.5			
		Standard [4]	DIN 3852			
		State on delivery	Plugged			
M_A, M_B	Measuring port pressure A, B	Size	M12 × 15; 12 mm deep			
		Standard [4]	ISO 6149			
		State on delivery	Plugged			

[1] With BVD20
[2] With BVD25 / BVE25
[3] Thread according to DIN 13
[4] The spot face can be deeper than specified in the appropriate standard.

Speed sensors

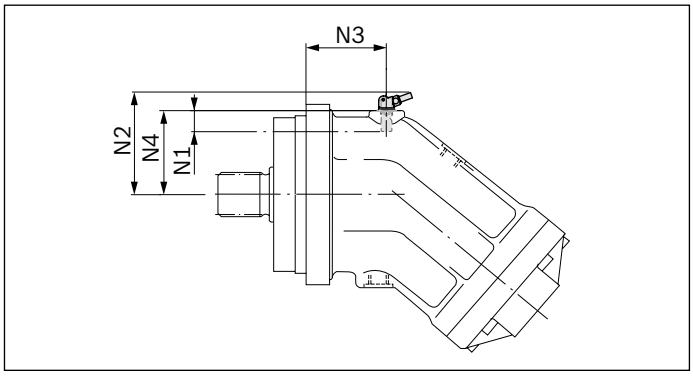
The versions A2FM...U and A2FM...F ("prepared for speed sensor", i.e. without sensor) are equipped with a toothed ring on the rotary group.
On deliveries "prepared for speed sensor", the port is plugged with a pressure-resistant cover.
With the DSA or HDD speed sensor mounted a signal proportional to motor speed can be generated. The sensors measures the speed and direction of rotation.
Ordering code, technical data, dimensions and details on the connector, plus safety information about the sensor can be found in the relevant data sheet.

DSA: data sheet 95133
HDD: data sheet 95135

The sensor is mounted at the specially provided port as follows:
DSA: with one mounting bolt
HDD: with two mounting bolts

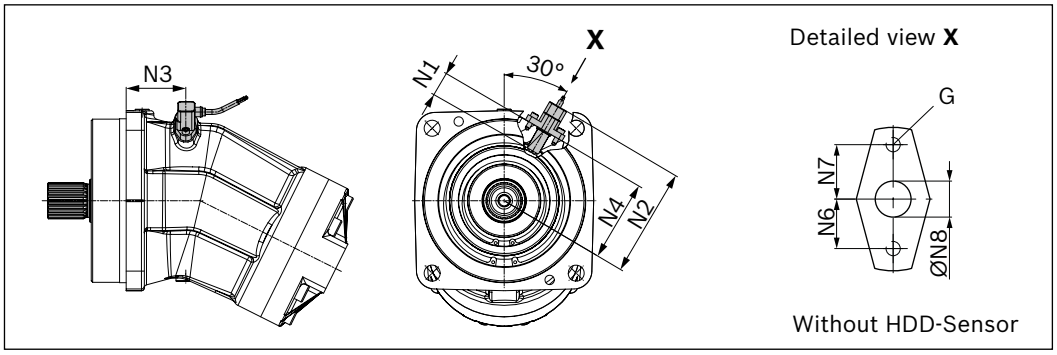
We recommend ordering the A2FM fixed motor complete with sensor mounted.

DSA speed sensor mounted (code V)
Size 23 ... 200



Motor Size	Number of teeth	N1 mm	N2 mm	N3 mm	N4 mm
23 ... 32	38	18.4 + 0.1 - 0.1	74.5	54.7	57.9
107, 125	59	18.4 + 0.1 - 0.1	96.5	76.8	79.9
160, 180	67	18.4 + 0.1 - 0.1	104	86.8	87.4
200	80	18.4 + 0.1 - 0.1	117.5	97.5	100.9

HDD speed sensor mounted (code H)
Size 250 ... 500



Motor Size	Number of teeth	N1 mm	N2 mm	N3 mm	N4 mm	N6 mm	N7 mm	ØN8 mm	G [1]
250	78	32 + 0.1 - 0.1	149	82	110.5	20	22	18.2	M6 × 1; 7.5 mm deep
355	90	32 + 0.1 - 0.1	161	93	122.5				
500	99	32 + 0.1 - 0.1	171	113	132.5				
710, 1000	126	32 + 0.1 - 0.1	199	172	160.5				

[1] Thread according to DIN 13

Project planning information

Installation information

General information

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

Installation position

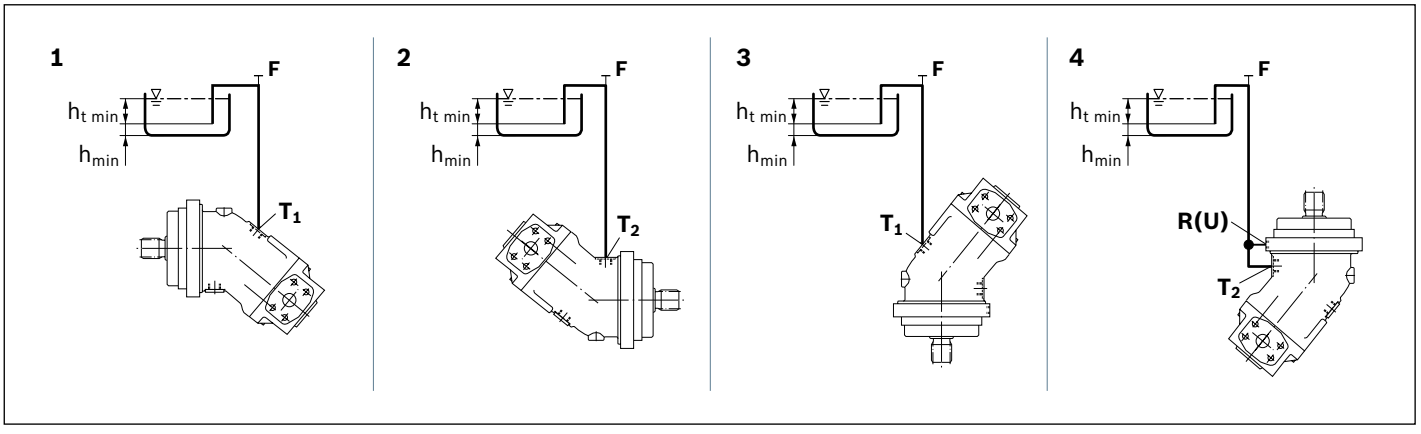
See the following examples **1** to **8**.
Further installation positions are possible upon request.
Recommended installation position: **1** and **2**.

Note

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

Below-tank installation (standard)

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

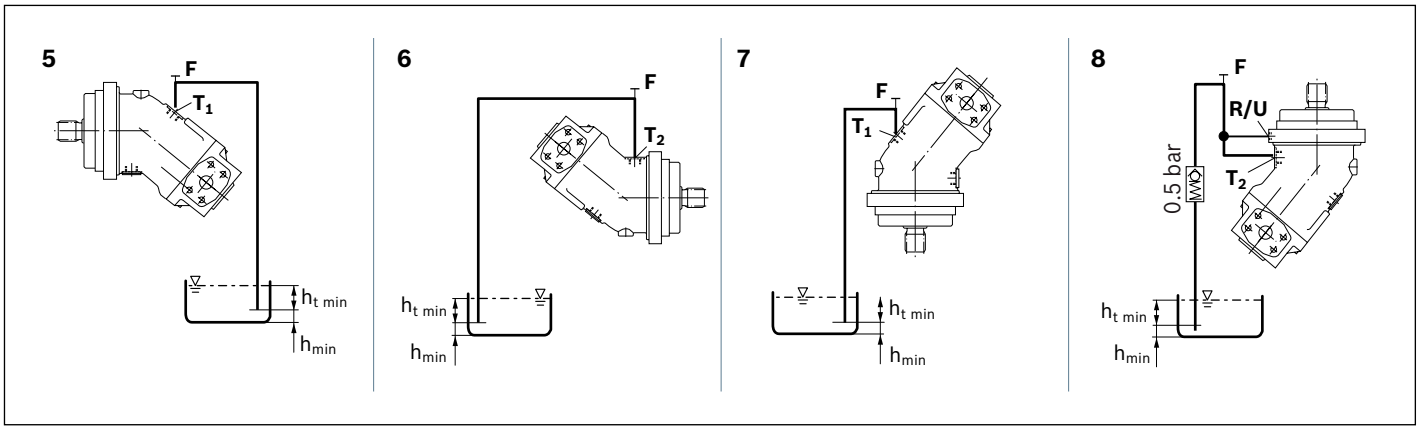


Installation position	Air bleeding	Filling
1	**F**	**T_1**
2	**F**	**T_2**
3	**F**	**T_1**
4	**R (U)**	**T_2**

Above-reservoir installation

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

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



Installation position	Air bleeding	Filling
5	**F**	**T_1 (F)**
6	**F**	**T_2 (F)**
7	**F**	**T_1 (F)**
8	**R (U)**	**T_2 (F)**

Key

F	Filling / Air bleeding
R	Air bleed port
U	Bearing flushing / air bleed port
T_1, T_2	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)

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

General project planning notes

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

Safety Instructions

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

Accessories

Product	Refer to document
Counterbalance valve BVD 20-25	RE 95522
Counterbalance valve BVE 25	RE 95526
Speed sensor DSA	RE 95133
Speed sensor HDD	RE 95135