

Axial piston fixed motor A2FM/A2FE Series 70



Features

- ▶ Fixed motor with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits
- ▶ For use in mobile and stationary applications
- ▶ Far-reaching integration of the plug-in version in mechanical gears due to recessed mounting flange located in the center of the case (extremely space-saving construction)
- ▶ Easy to install, simply plug the plug-in version into the mechanical gearbox
- ▶ The output speed depends on the flow of the pump and the displacement of the motor.
- ▶ The output torque increases with the pressure differential between the high-pressure side and the low-pressure side.
- ▶ Finely graduated sizes permit far-reaching adaptation to the drive concerned
- ▶ High power density
- ▶ Small dimensions
- ▶ High total efficiency
- ▶ Good starting efficiency
- ▶ Optional with integrated flushing valve

- ▶ A2FMN, A2FEN (sizes 28 to 107):
Nominal pressure 300 bar
Maximum pressure 350 bar
- ▶ A2FMM, A2FEM (sizes 23 to 125):
Nominal pressure 400 bar
Maximum pressure 450 bar
- ▶ A2FMH, A2FEH (sizes 45 to 125):
Nominal pressure 450 bar
Maximum pressure 500 bar

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Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
A2F				/	70	N	W	V						-

Axial piston unit

01	Bent-axis design, fixed displacement	A2F
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Operating mode

02	Motor, standard version	M
	Motor, plug-in version	E

Pressure range

		023	028	032	037	045	056	063	080	090	107	125	
03	Nominal pressure: 300 bar, maximum pressure: 350 bar	-	o	o	o	o	●	●	●	●	●	-	N
	Nominal pressure: 400 bar, maximum pressure: 450 bar	o	o	o	-	●	●	●	●	●	o	o	M
	Nominal pressure: 450 bar, maximum pressure: 500 bar	-	-	-	-	●	●	●	●	●	o	o	H

Size (NG)

04	Geometric displacement see technical data on page 7	023	028	032	037	045	056	063	080	090	107	125
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Series

05	Series 7, index 0	70
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Version of port and fastening threads

06	Metric ports according to DIN 3852 with profile sealing ring, metric fastening thread according to DIN 13	N
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Rotational direction

07	Viewed on drive shaft, bidirectional	W
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Sealing material

08	FKM (fluoroelastomer)	V
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Mounting flange

		023	028	032	037	045	056	063	080	090	107	125	
09	ISO 3019-2 (metric)	100-4 (only available for A2FM)	●	●	●	●	● ¹⁾	-	-	-	-	-	L4
		125-4 (only available for A2FM)	-	-	-	-	● ³⁾	●	●	● ¹⁾	-	-	M4
		140-4 (only available for A2FM)	-	-	-	-	-	-	● ³⁾	●	● ¹⁾	-	N4
		160-4 (only available for A2FM)	-	-	-	-	-	-	-	-	● ³⁾	●	P4
		135-2 (only available for A2FE)	●	●	●	●	● ¹⁾	-	-	-	-	-	I2
		160-2 (only available for A2FE)	-	-	-	-	● ³⁾	●	●	● ¹⁾	-	-	P2
		190-2 (only available for A2FE)	-	-	-	-	-	-	● ³⁾	●	● ¹⁾	-	Y2
		200-2 (only available for A2FE)	-	-	-	-	-	-	-	-	● ³⁾	●	S2

Drive shaft

		023	028	032	037	045	056	063	080	090	107	125	
10	Splined shaft DIN 5480	W25x1.25x18x9g	●	●	●	-	-	-	-	-	-	-	Z5
		W30x2x14x9g	●	●	●	●	●	● ²⁾	-	-	-	-	Z6
		W35x2x16x9g	-	-	-	-	-	● ³⁾	●	● ²⁾	-	-	Z8
		W40x2x18x9g	-	-	-	-	-	-	-	● ³⁾	●	●	Z9
		W45x2x18x9g	-	-	-	-	-	-	-	-	● ³⁾	●	A1
	Parallel keyed shaft DIN 6885	ø25	●	●	●	-	-	-	-	-	-	-	P5
		ø30	●	●	●	●	●	● ²⁾	-	-	-	-	P6
		ø35	-	-	-	-	-	● ³⁾	●	● ²⁾	-	-	P8
		ø40	-	-	-	-	-	-	-	● ³⁾	●	●	P9
		ø45	-	-	-	-	-	-	-	-	● ³⁾	●	B1

● = Available o = On request - = Not available

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
A2F				/	70	N	W	V						-

Working port

		023	028	032	037	045	056	063	080	090	107	125	
11	SAE working ports A and B at bottom	●	●	●	●	●	●	●	●	●	●	●	11
	SAE working ports A and B , 1x at side and 1x at bottom ¹⁾⁶⁾	—	—	—	—	●	●	●	—	—	—	—	12
	SAE working ports A and B at rear	● ³⁾	●	●	●	● ¹⁾	—	—	—	—	● ³⁾	●	01
	SAE working ports A and B at side, opposite	●	●	●	●	●	●	●	●	●	●	●	02
	Threaded ports A and B , at side, opposite	●	●	●	●	● ¹⁾	—	—	—	—	—	—	05
	Version with pressure reducing valves for mounting a counterbalance valve BVD ²⁾³⁾⁷⁾	—	—	—	—	●	●	●	●	●	—	—	07
	Version with pressure reducing valves ²⁾³⁾⁸⁾	—	—	—	—	●	●	●	●	●	—	—	09

Valves

		023	028	032	037	045	056	063	080	090	107	125	
12	Without valves	●	●	●	●	●	●	●	●	●	●	●	0
	With check valve, only for counter-clockwise or clockwise rotational direction ¹⁾	● ⁴⁾	● ⁴⁾	● ⁴⁾	● ⁴⁾	● ⁵⁾	● ⁵⁾	● ⁵⁾	● ⁵⁾	●	●	●	U
	Integrated flushing and boost pressure valve	●	●	●	●	●	●	●	●	●	—	—	C
	Flushing flow [l/min]	2.6											
	4.0	●	●	●	●	●	●	●	●	●	●	●	D
	6.0	●	●	●	●	●	●	●	●	●	●	●	E
	7.4	●	●	●	●	●	●	●	●	●	●	●	F
	8.5	●	●	●	●	●	●	●	●	●	●	●	G
	10.0	●	●	●	●	●	●	●	●	●	●	●	H
	11.4	●	●	●	●	●	●	●	●	●	—	—	I
	12.5	●	●	●	●	●	●	●	●	●	—	—	J
	15	—	—	—	—	—	—	—	—	—	● ³⁾	●	K
	18	—	—	—	—	—	—	—	—	—	● ³⁾	●	L
	21	—	—	—	—	—	—	—	—	—	● ³⁾	●	M
	27	—	—	—	—	—	—	—	—	—	● ³⁾	●	N
	31	—	—	—	—	—	—	—	—	—	● ³⁾	●	O
	37	—	—	—	—	—	—	—	—	—	● ³⁾	●	P
	Pressure relief valves (without pressure boost facility) ²⁾³⁾⁹⁾	—	—	—	—	●	●	●	●	●	—	—	R
	Pressure-relief valves (with pressure boost facility) ²⁾³⁾⁹⁾	—	—	—	—	●	●	●	●	●	—	—	S
	Counterbalance valve BVD installed ²⁾³⁾¹⁰⁾¹¹⁾	—	—	—	—	●	●	●	●	●	—	—	W

Speed sensor

		023	028	032	037	045	056	063	080	090	107	125	
13	Without speed sensor	●	●	●	●	●	●	●	●	●	●	●	0
	Prepared for DSA sensor	●	●	●	●	●	●	●	●	●	●	●	A
	DSA speed sensor mounted	●	●	●	●	●	●	●	●	●	●	●	B
	Prepared for DSM sensor (not available for A2FE)	●	●	●	●	●	●	●	●	●	●	●	N
	Speed sensor DSM mounted (not available for A2FE)	●	●	●	●	●	●	●	●	●	●	●	M

● = Available ○ = On request — = Not available

1) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

2) Not available for A2FMH, A2FEH (pressure range 450 to 500 bar)

3) Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

4) Only in combination with working ports 11

5) Only in combination with working ports 11 or 12

6) Only in combination with check valve (valve design U)

7) Only in combination with mounted counterbalance valve (valve design W)

8) Only in combination with pressure relief valve (valve designs R or S)

9) Only in combination with working ports 09

10) Only in combination with working ports 07

11) Type code for counterbalance valve to be quoted separately in accordance with data sheet 95522 (BVD) and 95526 (BVE)

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
A2F				/	70	N	W	V						-

Special version

14	Standard version	0
	Long-life bearing ¹²⁾	L
	Special version for slew drives	J

Standard/special version

15	Standard version	0
	Standard version with installation variants, e.g. T ports contrary to standard, open or closed	Y
	Special version	S

● = Available ○ = On request - = Not available

Notices

- ▶ Note the project planning notes on page 48.
- ▶ Please note that not all type code combinations are available although the individual functions are marked as being available.

¹²⁾ Type code version "L" not available in combination with A2FMH/A2FEH since in the case of pressure range "H" the long-life bearing is already included in the standard version (type code designation "0").

Hydraulic fluids

The fixed motor A2FM/A2FE is designed for operation with HLP mineral oil according to DIN 51524. Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection 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

Information on the selection of hydraulic fluid

Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} ; see selection diagram).

Notice

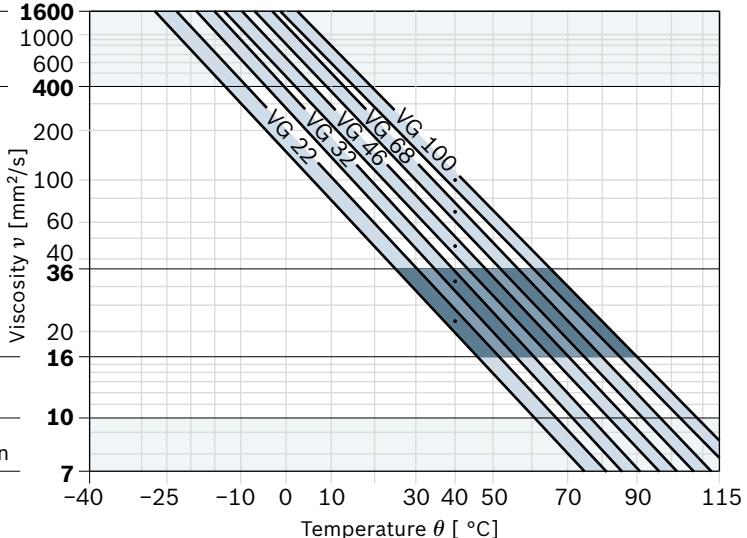
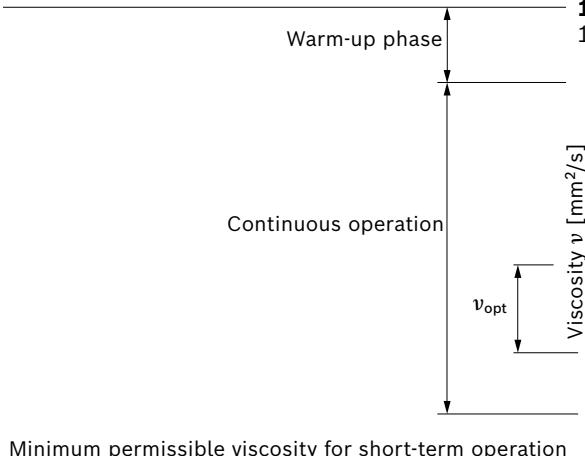
For operation with HF hydraulic fluids, please contact us.

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ³⁾	Comment
Cold start	$\nu_{\text{max}} \leq 1600 \text{ mm}^2/\text{s}$	NBR ²⁾	$\theta_{\text{St}} \geq -40^\circ\text{C}$	$t \leq 3\text{min}$, without load ($p \leq 50\text{bar}$), $n \leq 1000 \text{ rpm}$
		FKM	$\theta_{\text{St}} \geq -25^\circ\text{C}$	Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	$\nu = 1600 \dots 400 \text{ mm}^2/\text{s}$			$t \leq 15\text{min}$, $p \leq 0.7 \times p_{\text{nom}}$ and $n \leq 0.5 \times n_{\text{nom}}$
Continuous operation	$\nu = 400 \dots 10 \text{ mm}^2/\text{s}^1)$	NBR ²⁾	$\theta \leq +78^\circ\text{C}$	measured at port T
		FKM	$\theta \leq +103^\circ\text{C}$	
	$\nu_{\text{opt}} = 36 \dots 16 \text{ mm}^2/\text{s}$			optimal operating viscosity and efficiency range
Short-term operation	$\nu_{\text{min}} = 10 \dots 7 \text{ mm}^2/\text{s}$	NBR ²⁾	$\theta \leq +78^\circ\text{C}$	$t \leq 3\text{min}$, $p \leq 0.3 \times p_{\text{nom}}$, measured at port T
		FKM	$\theta \leq +103^\circ\text{C}$	

▼ Selection diagram

Maximum permissible viscosity on cold start



¹⁾ This corresponds, for example on the VG 46, to a temperature range of +4 °C to +85 °C (see selection diagram)

²⁾ Special version, please contact us

³⁾ If the temperature at extreme operating parameters cannot be adhered to, please contact us.

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 during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.

For example, the viscosity 10 mm²/s at:

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

Flow direction

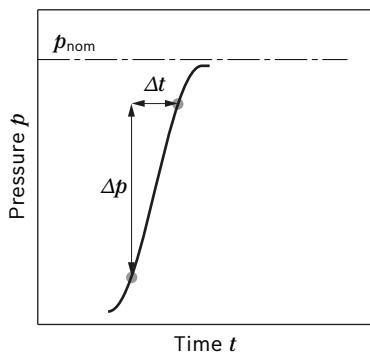
Rotational direction viewed on drive shaft

clockwise	counter-clockwise
A to B	B to A

Working pressure range

Pressure at working port A or B		Definition
p_{nom}	A2FMN, A2FEN	300 bar
	A2FMM, A2FEM	400 bar
	A2FMH, A2FEH	450 bar
p_{max}	A2FMN, A2FEN	350 bar
	A2FMM, A2FEM	450 bar
	A2FMH, A2FEH	500 bar
Maximum single operating period	10 s	
Total operating period	300 h	
Minimum pressure – pump operating mode (inlet)	see the diagram	To prevent damage to the axial piston motor in pump operating mode (change of the high-pressure side at constant rotational direction, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{su}	700 bar	The summation pressure is the sum of the pressures at the ports for the Working lines (A and B).
Rate of pressure change $R_{\text{A max}}$		Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
with integrated pressure relief valve	9000 bar/s	
without pressure relief valve	16000 bar/s	
Case pressure at port T		
Continuous differential pressure $\Delta p_{\text{L/T cont}}$	2 bar	Maximum averaged differential pressure at the shaft seal (case to ambient pressure)
Pressure peaks $p_{\text{L/T peak}}$	10 bar	$t < 0.1$ s

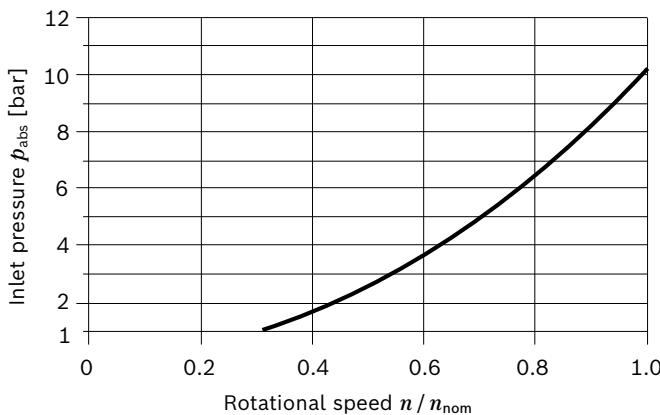
▼ **Rate of pressure change $R_{A \max}$**



Notice

- ▶ Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- ▶ In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.
- ▶ The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
- ▶ The case pressure must be greater than the ambient pressure.

▼ **Minimum pressure – pump operating mode (inlet)**



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

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

Technical data

A2FMN, A2FEN

Size	NG	28	32	37	45	56	63	80	90	107
Displacement geometric, per revolution	V_g cm ³	28.1	32.0	36.8	44.2	56.6	63.0	81.7	90.5	108.8
Maximum rotational speed ¹⁾	n_{nom} rpm	4725	4725	4200	4200	3750	3750	3375	3375	3000
	$n_{\text{max}}^{2)}$ rpm	5175	5175	4650	4650	4125	4125	3700	3700	3300
Inlet flow	$q_{\text{v max}}$ l/min	133	151	155	186	212	236	276	305	326
Torque ³⁾ at $\Delta p = 300$ bar	T Nm	134	153	176	211	270	301	390	432	519
Rotary stiffness	c_{min} kNm/rad	2.20	2.46	4.29	4.84	6.97	8.11	8.47	9.85	10.96
Moment of inertia of the rotary group	J_{TW} kgm ²	0.0010	0.0011	0.0012	0.0012	0.0034	0.0035	0.0037	0.0058	0.0061
Case volume	V l	0.3	0.3	0.3	0.3	0.6	0.6	0.6	0.65	0.65
Weight approx.	m kg	10.7	10.7	10.7	10.7	17	17	17	23	23

A2FMM, A2FEM

Size	NG	23	28	32	45	56	63	80	90	107	125
Displacement geometric, per revolution	V_g cm ³	22.9	28.1	32.0	44.9	56.6	63.0	79.8	90.5	106.7	125.0
Maximum rotational speed ¹⁾	n_{nom} rpm	6300	6300	6300	5000	5000	5000	4500	4500	4000	4000
	$n_{\text{max}}^{2)}$ rpm	6900	6900	6900	5500	5500	5500	5000	5000	4400	4400
Inlet flow	$q_{\text{v max}}$ l/min	144	177	202	225	283	315	359	407	427	500
Torque ³⁾ at $\Delta p = 400$ bar	T Nm	146	179	204	286	360	401	508	576	679	796
Rotary stiffness	c_{min} kNm/rad	1.76	2.20	2.46	4.65	6.97	8.11	9.10	9.85	12.49	13.65
Moment of inertia of the rotary group	J_{TW} kgm ²	0.0010	0.0010	0.0011	0.0033	0.0034	0.0035	0.0056	0.0058	0.0088	0.0091
Case volume	V l	0.3	0.3	0.3	0.6	0.6	0.6	0.65	0.65	1.1	1.1
Weight approx.	m kg	10.7	10.7	10.7	17	17	17	23	23	32.8	32.8

A2FMH, A2FEH

Size	NG	45	56	63	80	90	107	125
Displacement geometric, per revolution	V_g cm ³	44.9	56.6	63.0	79.8	90.5	106.7	125.0
Maximum rotational speed ¹⁾	n_{nom} rpm	5000	5000	5000	4500	4500	4000	4000
	$n_{\text{max}}^{2)}$ rpm	5500	5500	5500	5000	5000	4400	4400
Inlet flow	$q_{\text{v max}}$ l/min	225	283	315	359	407	427	500
Torque ³⁾ at $\Delta p = 450$ bar	T Nm	322	405	451	572	648	764	895
Rotary stiffness	c_{min} kNm/rad	4.65	6.97	8.11	9.10	9.85	12.49	13.65
Moment of inertia of the rotary group	J_{TW} kgm ²	0.0033	0.0034	0.0035	0.0056	0.0058	0.0088	0.0091
Case volume	V l	0.6	0.6	0.6	0.65	0.65	1.1	1.1
Weight approx.	m kg	17	17	17	23	23	32.8	32.8

Speed range

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

¹⁾ The valid values (observing the maximum permissible inlet flow):

- for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 mm²/s
- with hydraulic fluid based on mineral oils

²⁾ Intermittent maximum speed: Overspeed for unload and overhauling processes, $t < 5$ s and $\Delta p < 150$ bar

³⁾ Torque without radial force, with radial force see page 9

Permissible radial and axial loading on the drive shafts
A2FMN, A2FEN

Size	NG	Z5/P5	Z6/P6	Z5/P5	Z6/P6	Z6/P6	Z6/P6	Z6/P6	Z8/P8	Z8/P8	Z9/P9	Z9/P9
		28	28	32	32	37	45	56	63	80	90	107
Drive shaft	with splined shaft	ø	mm	25	30	25	30	30	30	35	35	40
	with keyed shaft	ø	mm	25	30	25	30	30	30	35	35	40
Maximum radial force ¹⁾ at distance a (from shaft collar)		F _q max	kN	4.3	3.6	4.9	4.1	4.7	5.6	7.2	6.9	8.9
				a	mm	16	16	16	16	18	18	20
Maximum torque at F _q max		T _q max	Nm	134	134	153	153	176	211	270	301	390
Maximum differential pressure at F _q max		Δp _q max	bar	300	300	300	300	300	300	300	300	300
Maximum axial force at standstill or pressure-free operation		+ F _{ax} max	N	0	0	0	0	0	0	0	0	0
				- F _{ax} max	N	500	500	500	500	800	800	800
Permissible axial force per bar working pressure		+ F _{ax} perm/ bar	N/bar	5.2	5.2	5.2	5.2	5.2	8.7	8.7	8.7	10.6

A2FMM, A2FEM

Size	NG	Z5/ P5	Z6/ P6	Z5/ P5	Z6/ P6	Z5/ P5	Z6/ P6	Z6/ P6	Z8/ P8	Z8/ P8	Z8/ P8	Z9/ P9	Z9/ P9	Z9/ P9	A1/ B1	A1/ B1	
		23	23	28	28	32	32	45	56	63	80	80	90	107	107	125	
Drive shaft	with splined shaft	ø	mm	25	30	25	30	25	30	30	35	35	40	40	40	45	45
	with keyed shaft	ø	mm	25	30	25	30	25	30	30	35	35	40	40	40	45	45
Maximum radial force ¹⁾ at distance a (from shaft collar)		F _q max	kN	4.7	3.9	5.7	4.8	6.5	5.4	7.6	9.6	8.2	9.2	11.6	10.2	11.5	13.6
				a	mm	16	16	16	16	16	18	18	18	20	20	20	20
Maximum torque at F _q max		T _q max	Nm	146	146	179	179	204	204	286	360	360	401	508	508	576	679
Maximum differential pressure at F _q max		Δp _q max	bar	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Maximum axial force at standstill or pressure-free operation		+ F _{ax} max	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				- F _{ax} max	N	500	500	500	500	500	800	800	800	1000	1000	1000	1250
Permissible axial force per bar working pressure		+ F _{ax} perm/ bar	N/bar	5.2	5.2	5.2	5.2	5.2	8.7	8.7	8.7	10.6	10.6	10.6	12.9	12.9	12.9

A2FMH, A2FEH

Size	NG	Z6/P6	Z8/P8	Z8/P8	Z9/P9	Z9/P9	Z9/P9	A1/B1	A1/B1
		45	56	63	80	90	107	107	125
Drive shaft	with splined shaft	ø	mm	30	35	35	40	40	45
	with keyed shaft	ø	mm	30	35	35	40	40	45
Maximum radial force ¹⁾ at distance a (from shaft collar)		F _q max	kN	8.6	9.3	10.3	11.4	13.0	15.3
				a	mm	18	18	18	20
Maximum torque at F _q max		T _q max	Nm	322	405	451	572	648	764
Maximum differential pressure at F _q max		Δp _q max	bar	450	450	450	450	450	450
Maximum axial force at standstill or pressure-free operation		+ F _{ax} max	N	0	0	0	0	0	0
				- F _{ax} max	N	800	800	800	1000
Permissible axial force per bar working pressure		+ F _{ax} perm/ bar	N/bar	8.7	8.7	8.7	10.6	10.6	12.9

¹⁾ With intermittent operation

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	$T = \frac{V_g \times \Delta p \times \eta_{mh}}{20 \times \pi}$	[Nm]
Power	$P = \frac{2 \pi \times T \times n}{60000} = \frac{q_v \times \Delta p \times \eta_t}{600}$	[kW]

Key

V_g	= Displacement per revolution [cm ³]
Δp	= Differential pressure [bar]
n	= Rotational speed [rpm]
η_v	= Volumetric efficiency
η_{mh}	= Mechanical-hydraulic efficiency
η_t	= Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

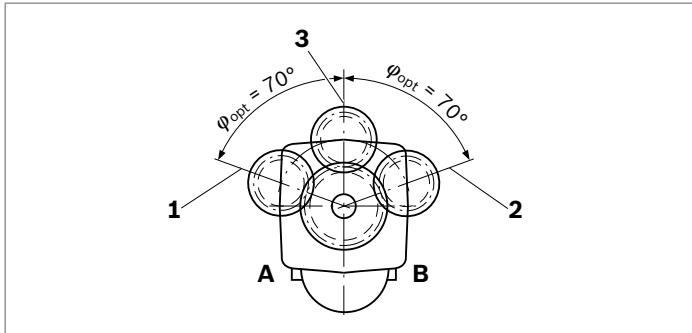
Notices

- ▶ Theoretical values, without efficiency and tolerances; values rounded
- ▶ Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, 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.
- ▶ The values given are maximum values and do not apply to continuous operation.
- ▶ The permissible 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.

Effect of radial force F_q on bearing service life

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 the rotational direction. Examples:

▼ **Toothed gear drive**



1 "Counter-clockwise" rotational direction, pressure at port **B**

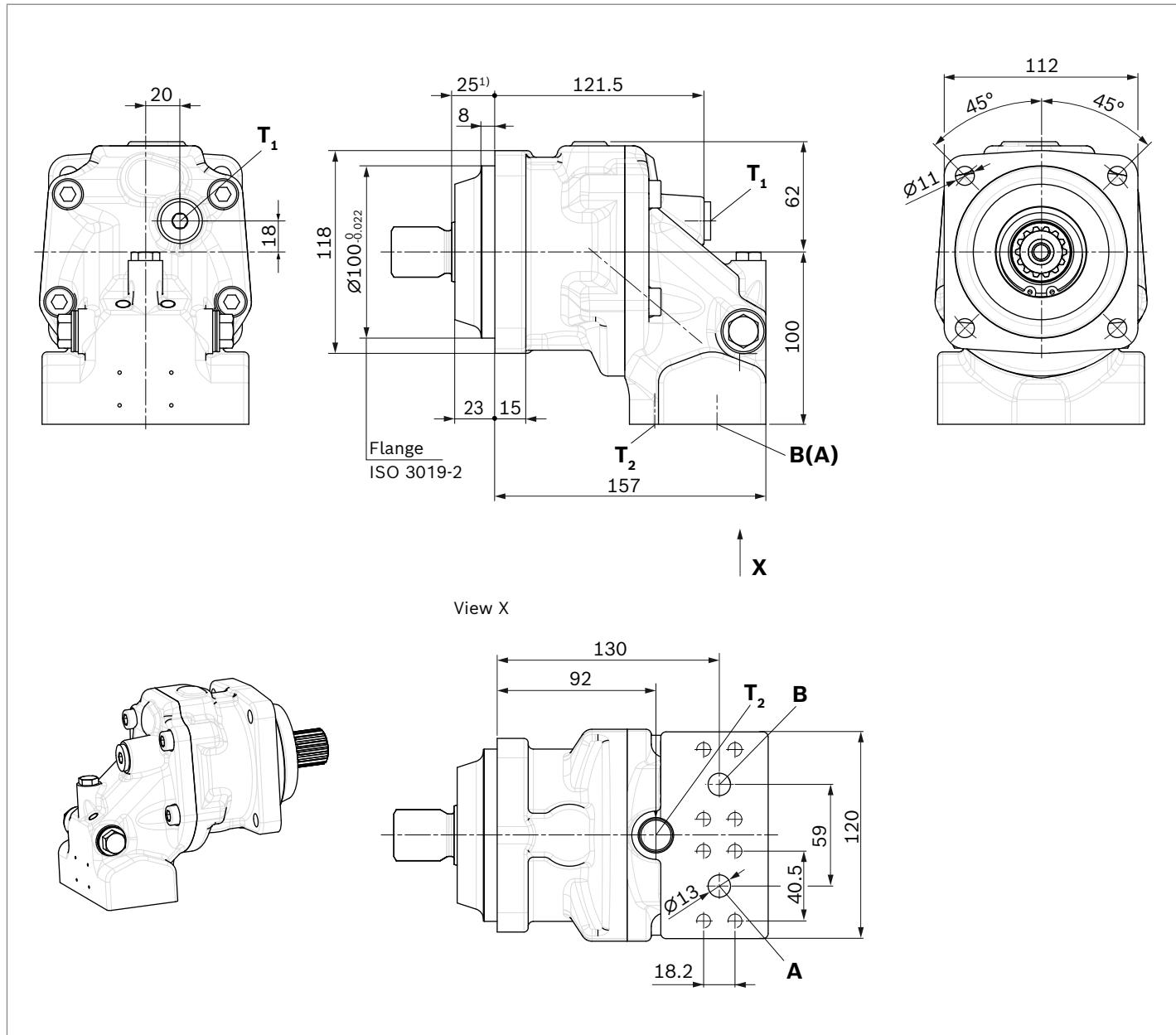
2 "Clockwise" rotational direction, pressure at port **A**

3 "Alternating" rotational direction

Dimensions A2FM, SAE working ports A and B at bottom (11)

A2FMN sizes 28, 32, 37 and 45

A2FMM sizes 23, 28 and 32



Ports		Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B	Working port	SAE J518	1/2 in	450	O
	Fastening thread A/B	DIN 13	M8 × 1.25; 16 deep		
T₁	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

- 3) Depending on the application, momentary pressure peaks can occur.

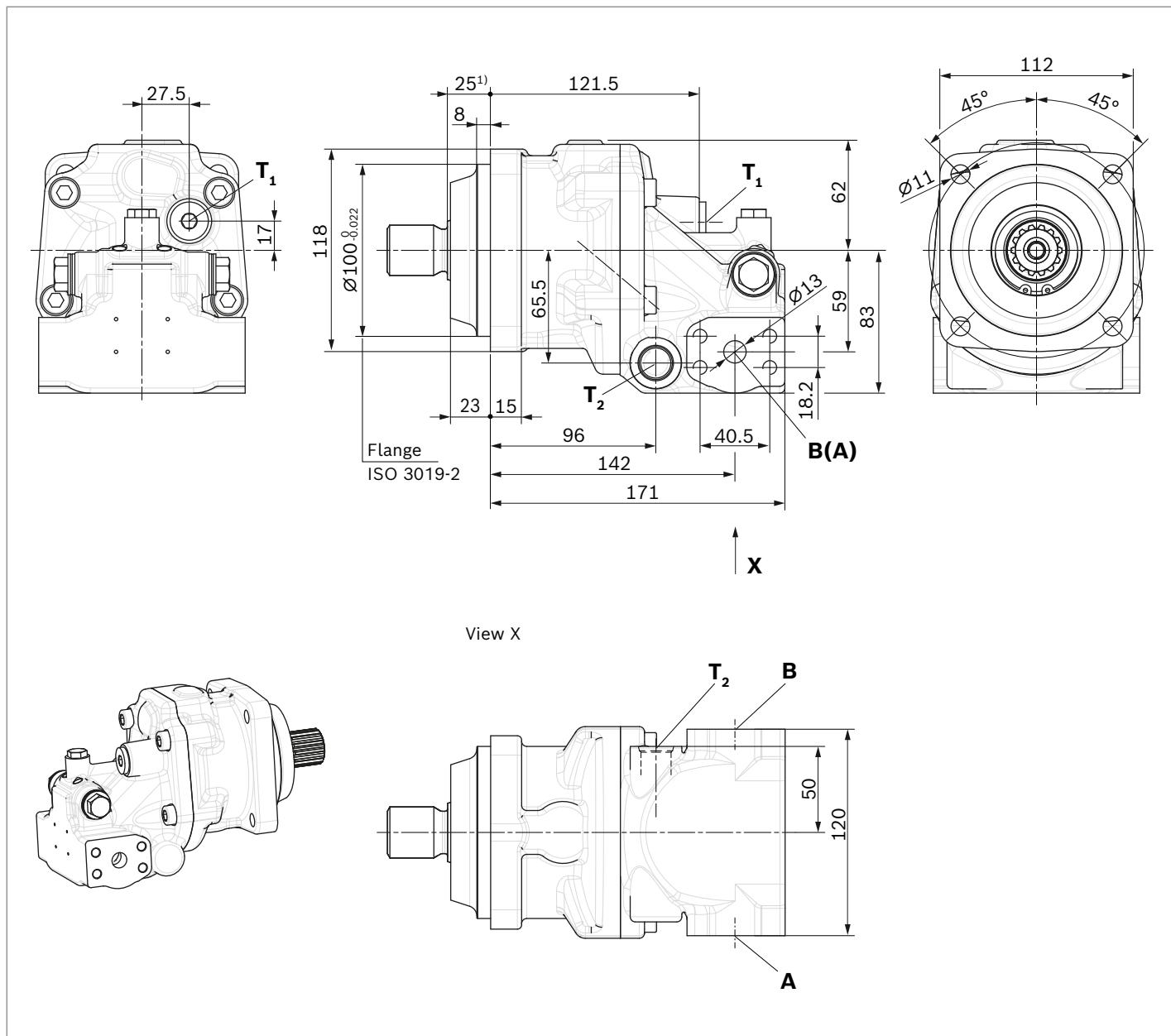
Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports A and B at side, opposite (02)**A2FMN sizes 28, 32, 37 and 45****A2FMM sizes 23, 28 and 32**

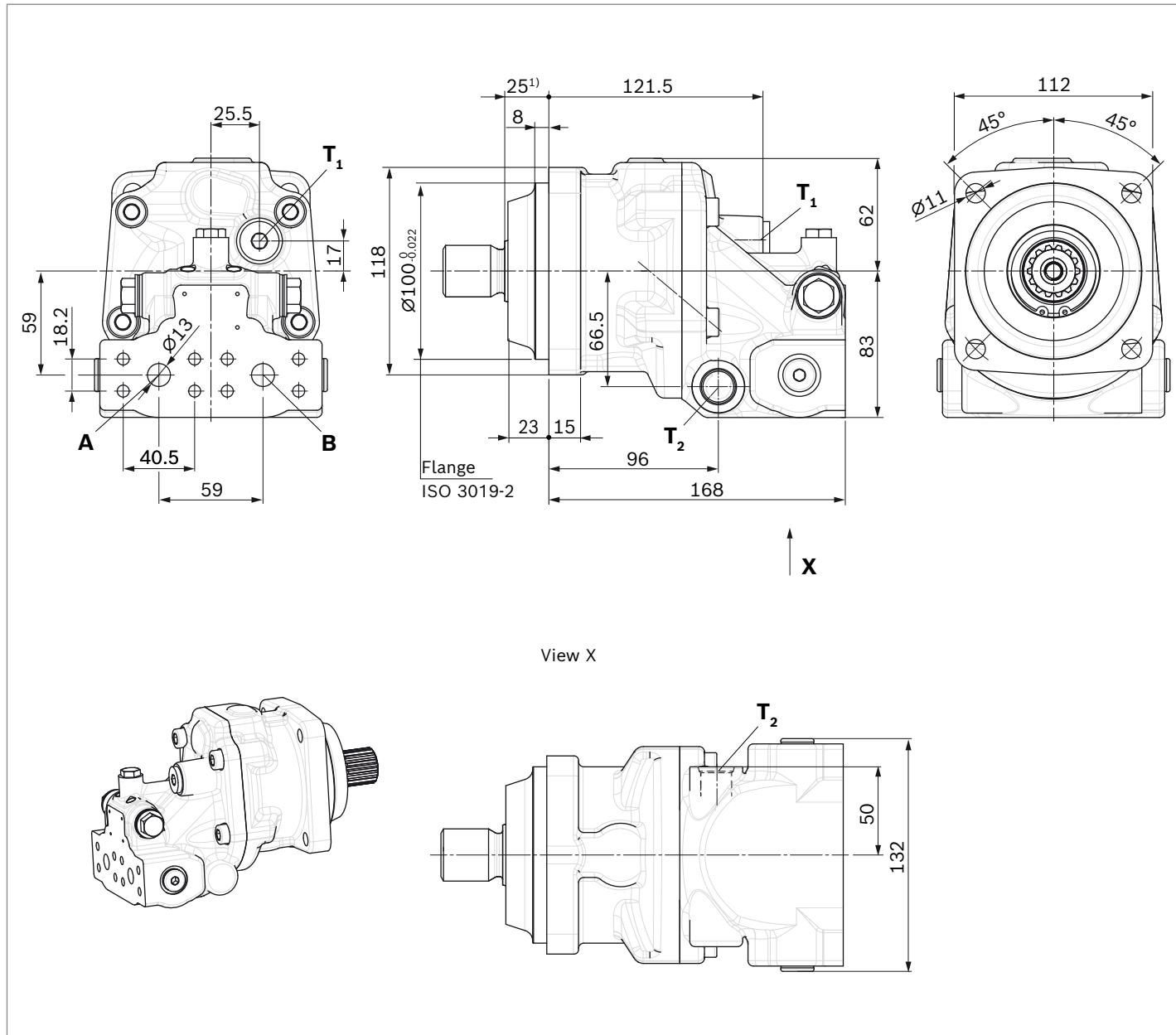
Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port	SAE J518	1/2 in	450	O
Fastening thread A/B	DIN 13	M8 x 1.25; 16 deep		
T₁ Drain port	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports A and B at rear (01)**A2FMN sizes 28, 32, 37 and 45****A2FMM sizes 23, 28 and 32**

Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	1/2 in M8 × 1.25; 16 deep	450 O
T ₁	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3 X ⁴⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3 O ⁴⁾

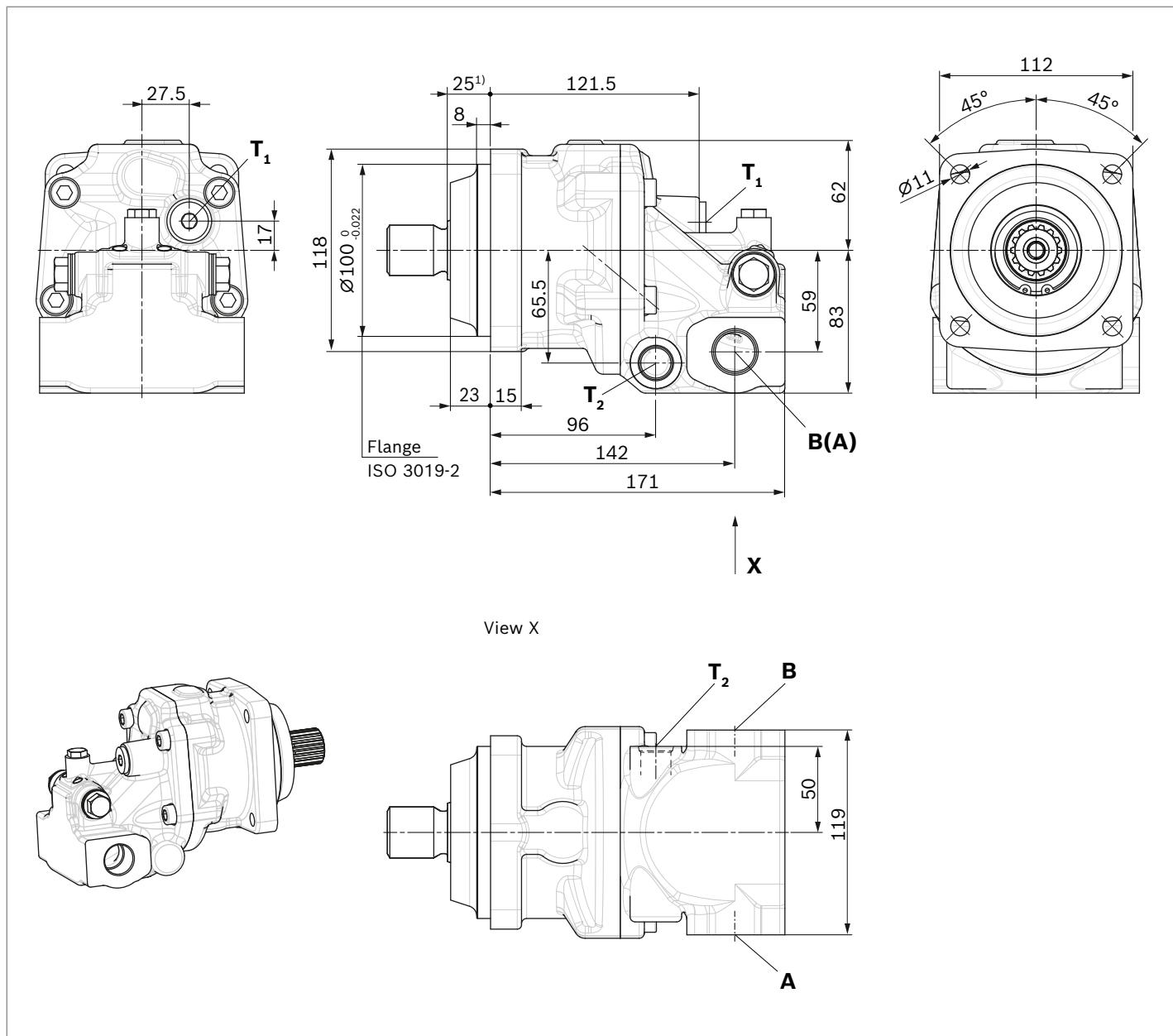
¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring instruments and fittings.⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

Dimensions A2FM, threaded ports A and B at side, opposite (05)

A2FMN sizes 28, 32, 37 and 45

A2FMM sizes 23, 28 and 32



Ports		Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B	Working port	DIN 3852 ⁵⁾	M27 × 2; 16 deep	450	O
T₁	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

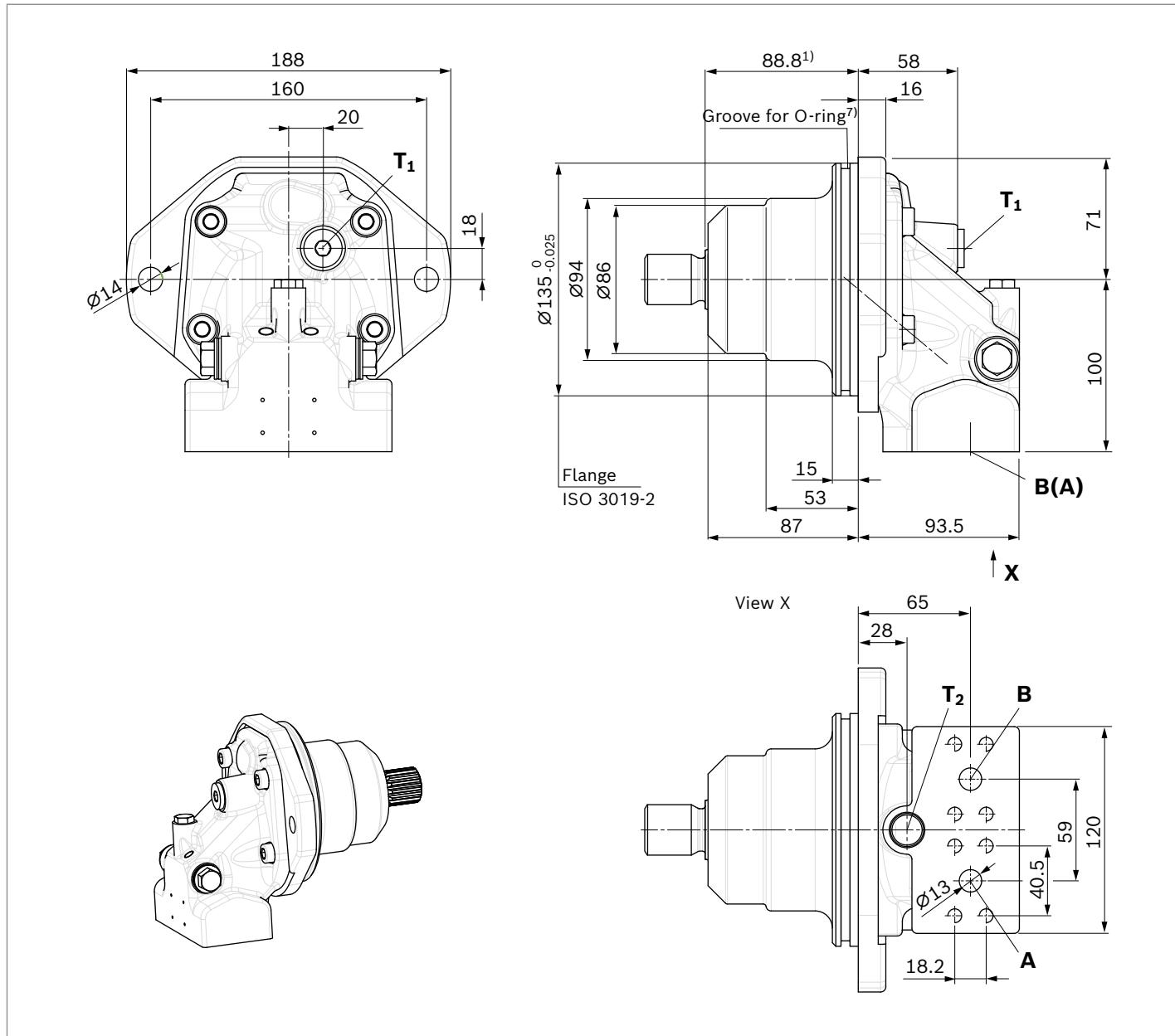
Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

Dimensions A2FE, SAE working ports A and B at bottom (11)**A2FEN sizes 28, 32, 37 and 45****A2FEM sizes 23, 28 and 32**

Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port	SAE J518	1/2 in	450	O
Fastening thread A/B	DIN 13	M8 × 1.25; 16 deep		
T₁ Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

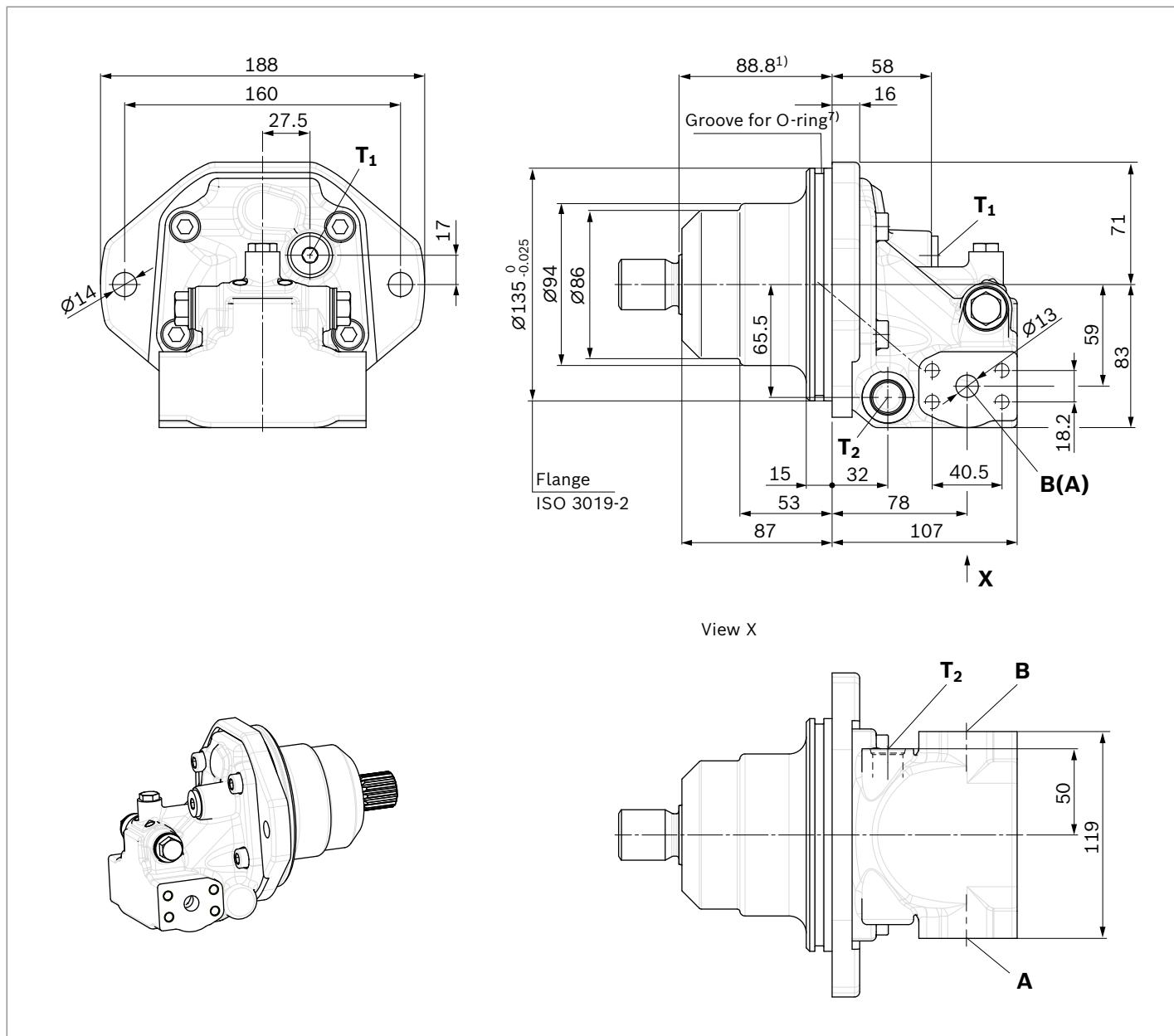
X = Plugged (in normal operation)

⁷⁾ O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports A and B at side, opposite (02)

A2FEN sizes 28, 32, 37 and 45

A2FEM sizes 23, 28 and 32



Ports		Standard	Size ²⁾	p_{\max} [bar ³⁾	State ⁶⁾
A, B	Working port	SAE J518	1/2 in	450	O
	Fastening thread A/B	DIN 13	M8 × 1.25; 16 deep		
T₁	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

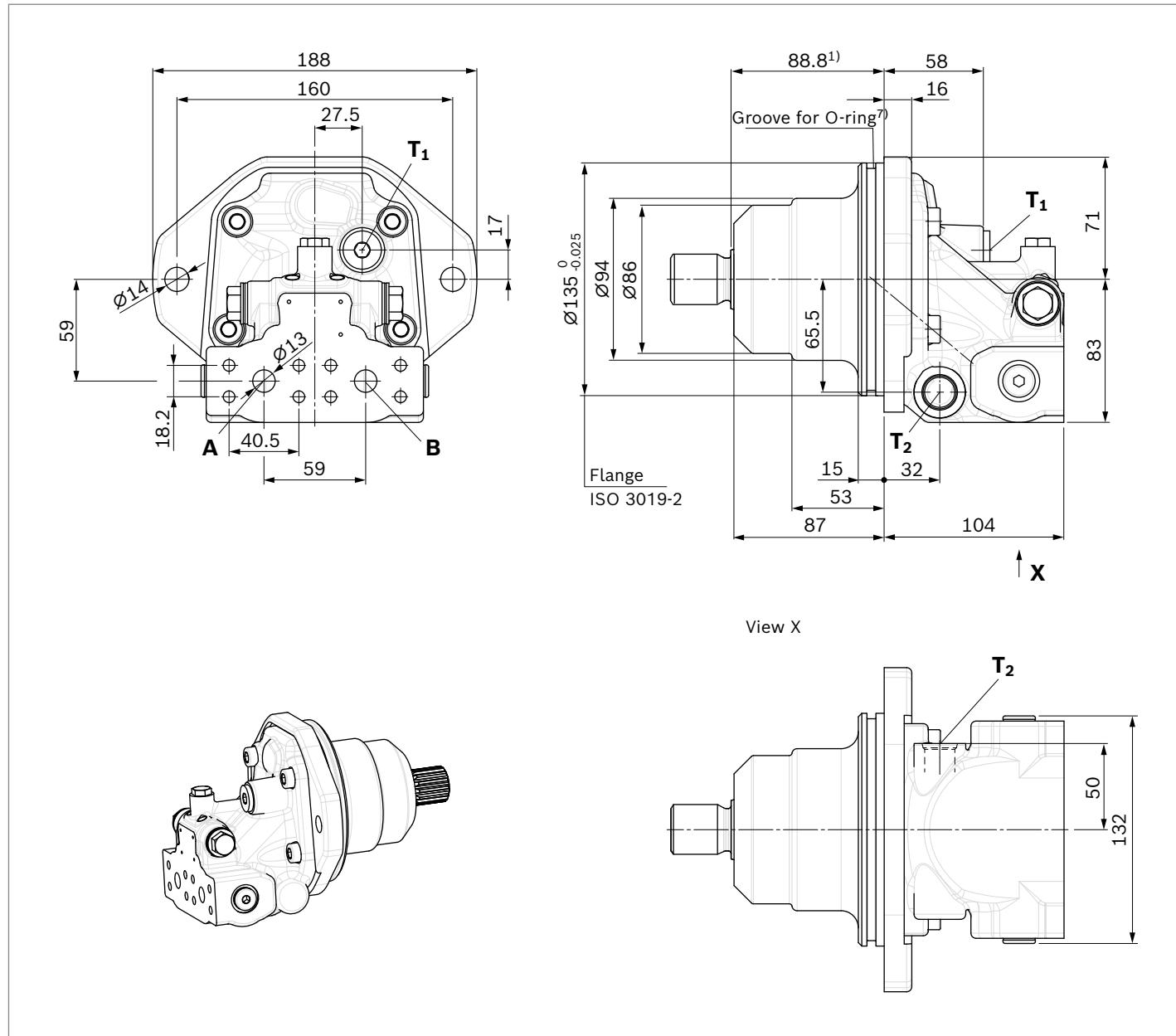
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

7) O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports A and B at rear (01)**A2FEN sizes 28, 32, 37 and 45****A2FEM sizes 23, 28 and 32**

Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port	SAE J518	1/2 in	450	O
Fastening thread A/B	DIN 13	M8 × 1.25; 16 deep		
T₁ Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M16 × 1.5; 12 deep	3	O ⁴⁾

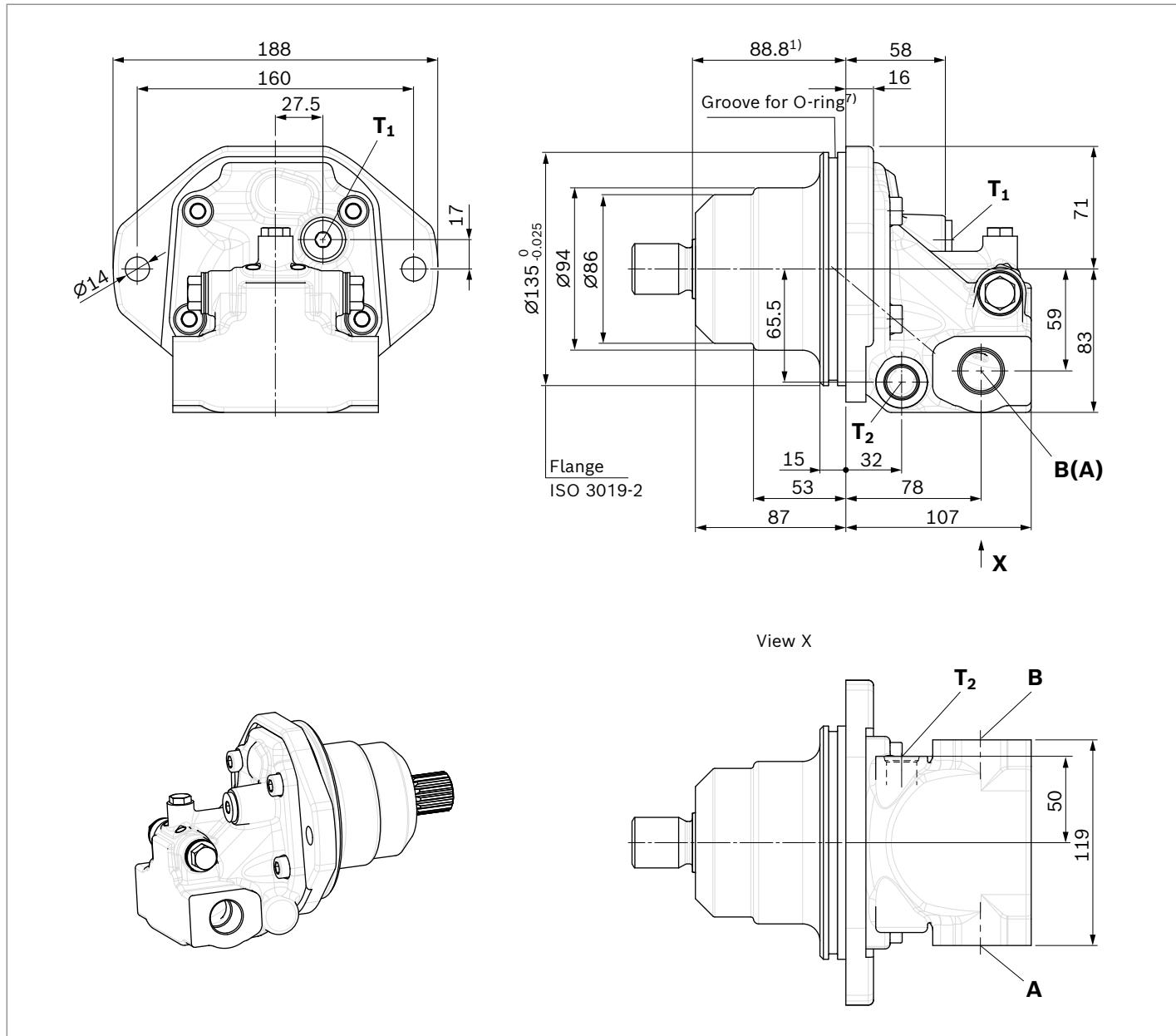
¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

⁷⁾ O-ring is not included in the scope of delivery.

Dimensions A2FE, threaded ports A and B at side, opposite (05)**A2FEN sizes 28, 32, 37 and 45****A2FEM sizes 23, 28 and 32**

Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port	DIN 3852 ⁵⁾	M27 x 2; 16 deep	450	O
T₁ Drain port	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M16 x 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

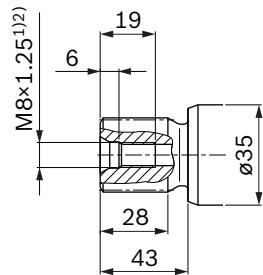
⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

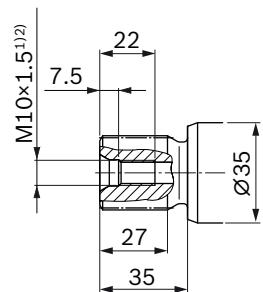
⁷⁾ O-ring is not included in the scope of delivery.

▼ **Splined shaft DIN 5480,
Sizes 23³⁾, 28 and 32**

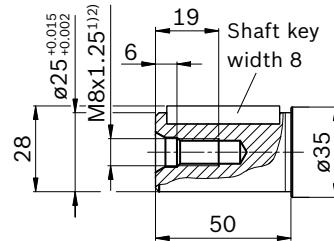
Z5 – W25×1.25×18×9 g

▼ **Splined shaft DIN 5480,
Sizes 23³⁾, 28, 32, 37 and 45⁴⁾**

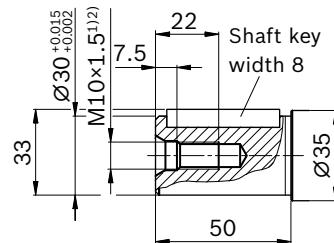
Z6 – W30×2×14×9 g

▼ **Parallel keyed shaft DIN 6885,
Sizes 23³⁾, 28 and 32**

P5 – AS8×7×40

▼ **Parallel keyed shaft DIN 6885,
Sizes 23³⁾, 28, 32, 37 and 45⁴⁾**

P6 – AS8×7×40



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

2) For maximum tightening torques, see instruction manual.

3) Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

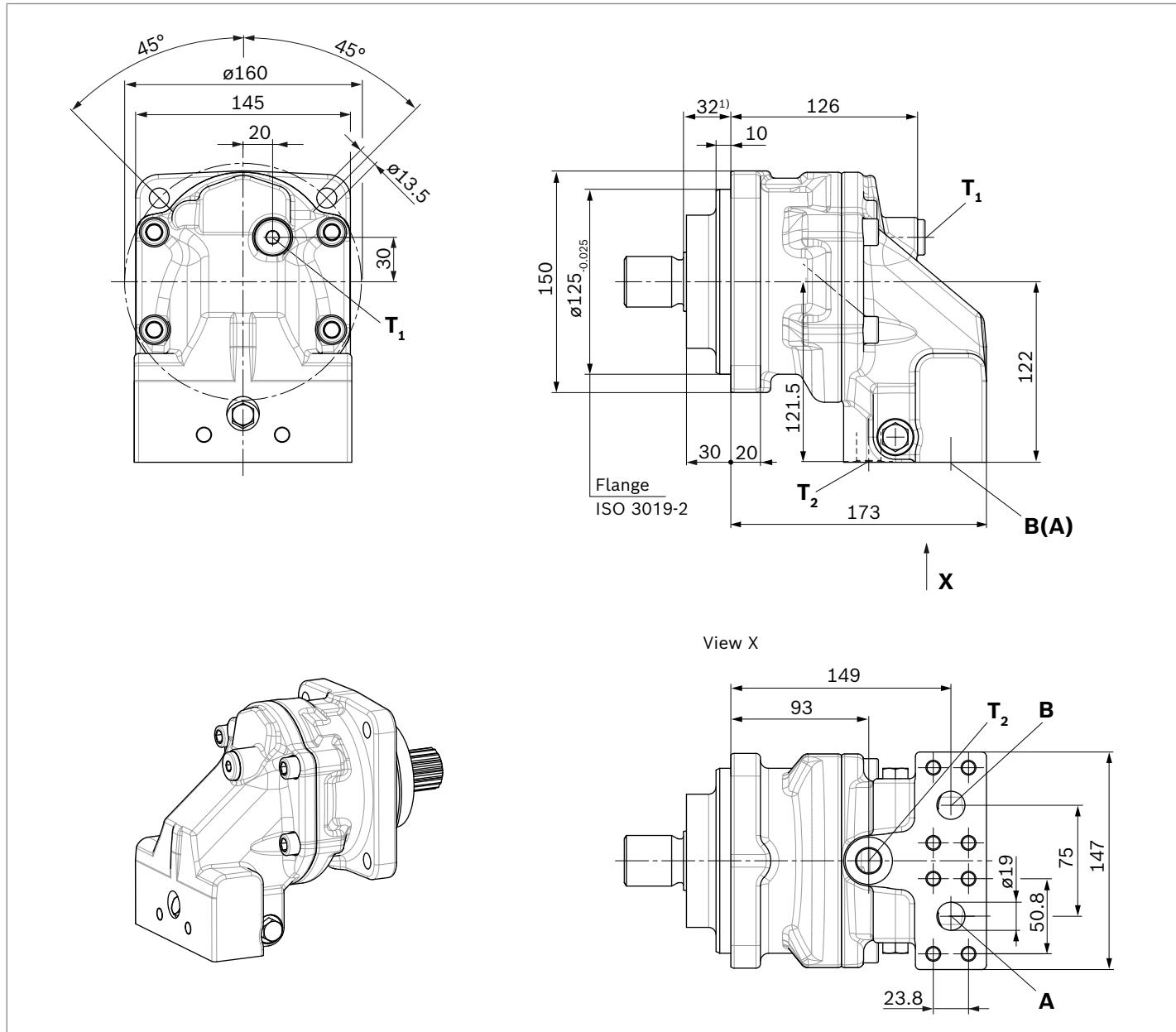
4) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

Dimensions A2FM, SAE working ports A and B at bottom (11)

A2FMN sizes 56, 63 and 80

A2FMM sizes 45, 56 and 63

A2FMH sizes 45, 56 and 63



Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 x 1.5; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

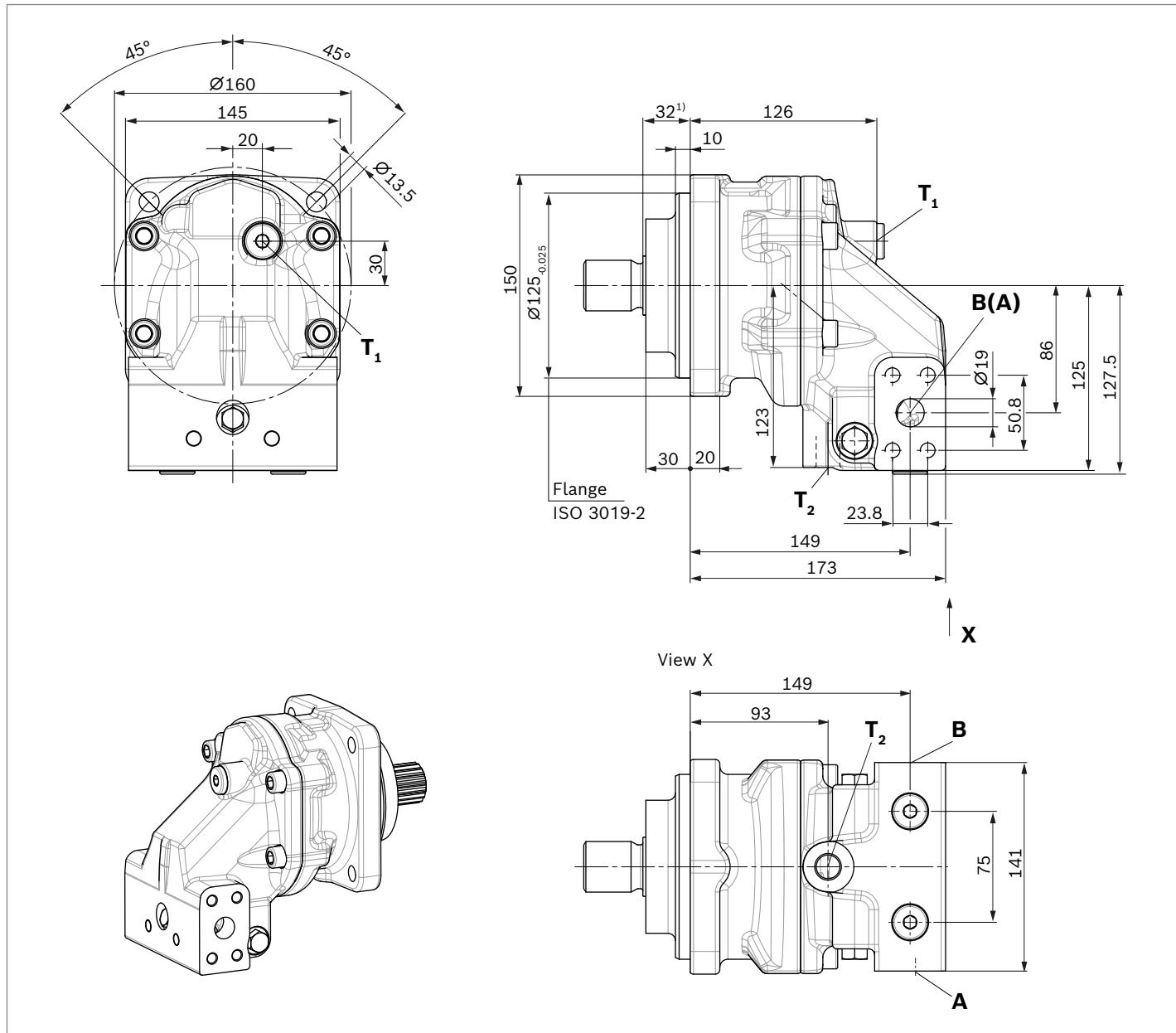
X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports A and B at side, opposite (02)

A2FMN sizes 56, 63 and 80

A2FMM sizes 45, 56 and 63

A2FMH sizes 45, 56 and 63



Ports		Standard	Size ²⁾	p_{\max} [bar ³⁾	State ⁶⁾
A, B	Working port	SAE J518	3/4 in	500	O
	Fastening thread A/B	DIN 13	M10 × 1.5; 17 deep		
T₁	Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

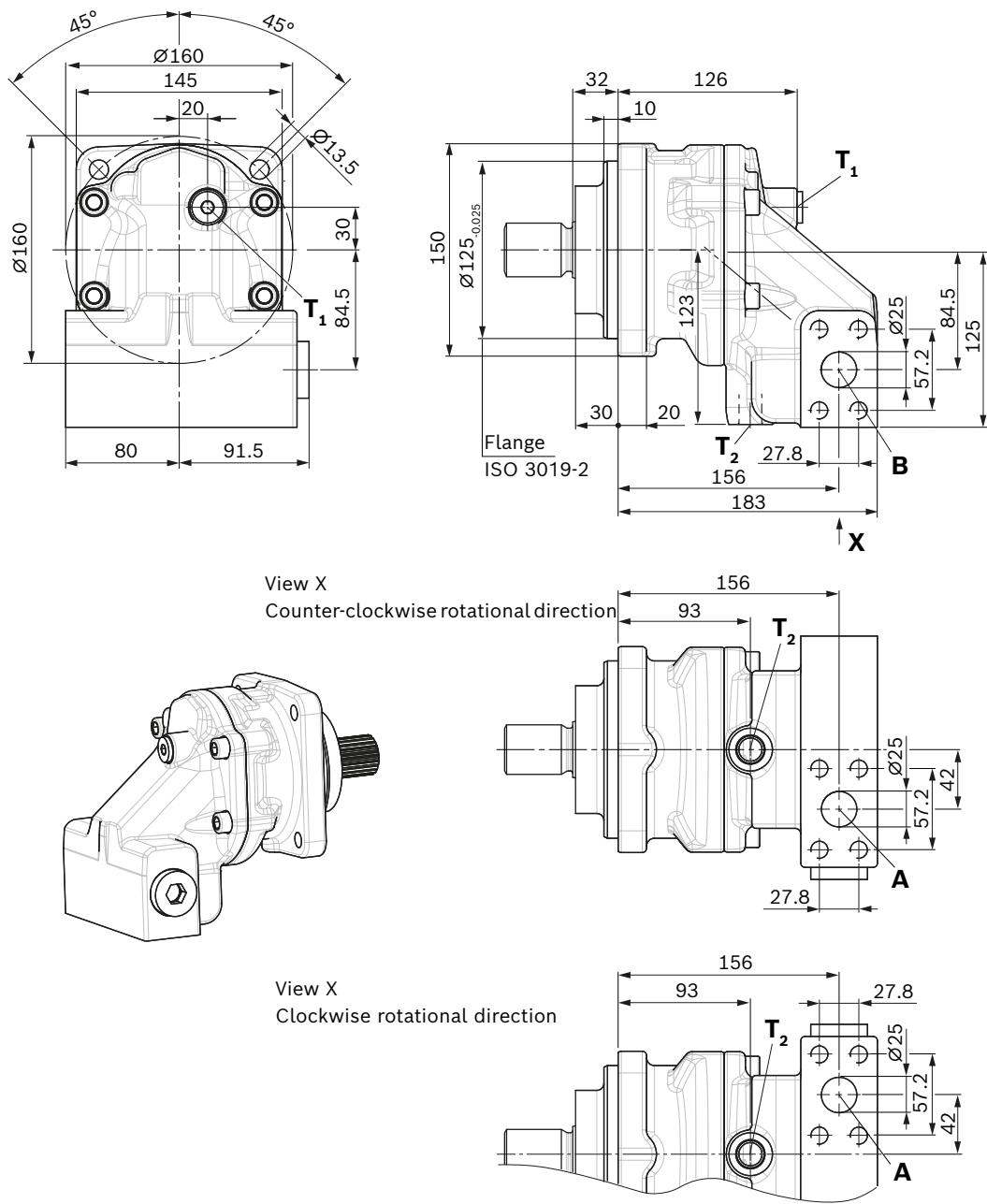
5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports, 1 x at side and 1 x at bottom⁷⁾⁸⁾ (12)

A2FMN sizes 56, 63 and 80



Ports		Standard	Size ²⁾	p_{\max} [bar ³⁾	State ⁶⁾
A, B	Working port	SAE J518	1 in	350	O
	Fastening thread A/B	DIN 13	M12 × 1.75; 17 deep		
T₁	Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

- 4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 46).

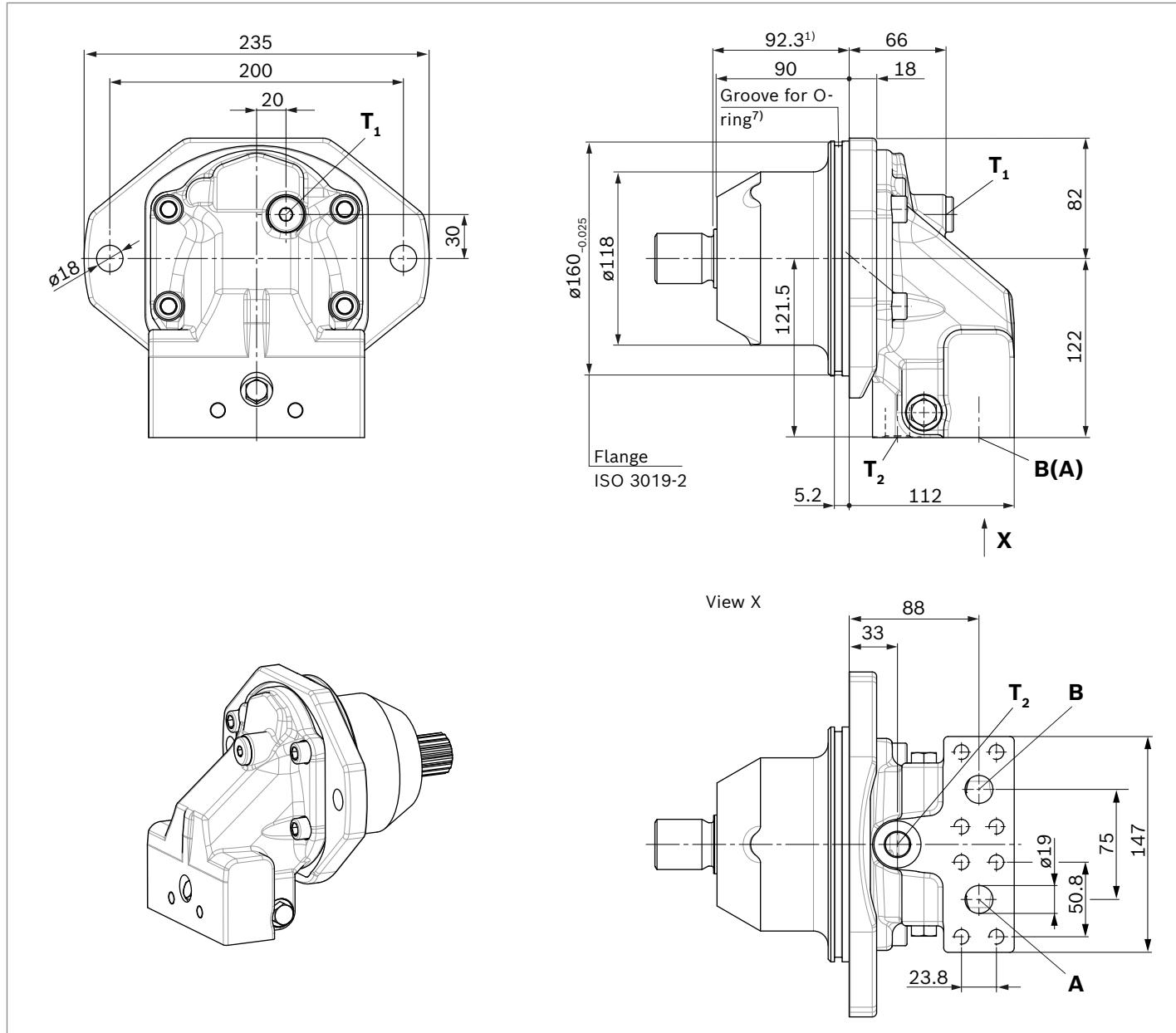
5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

7) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

8) Only in combination with check valve (valve design U)

Dimensions A2FE, SAE working ports A and B at bottom (11)**A2FEN sizes 56, 63 and 80****A2FEM sizes 45, 56 and 63****A2FEH sizes 45, 56 and 63**

Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 x 1.5; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

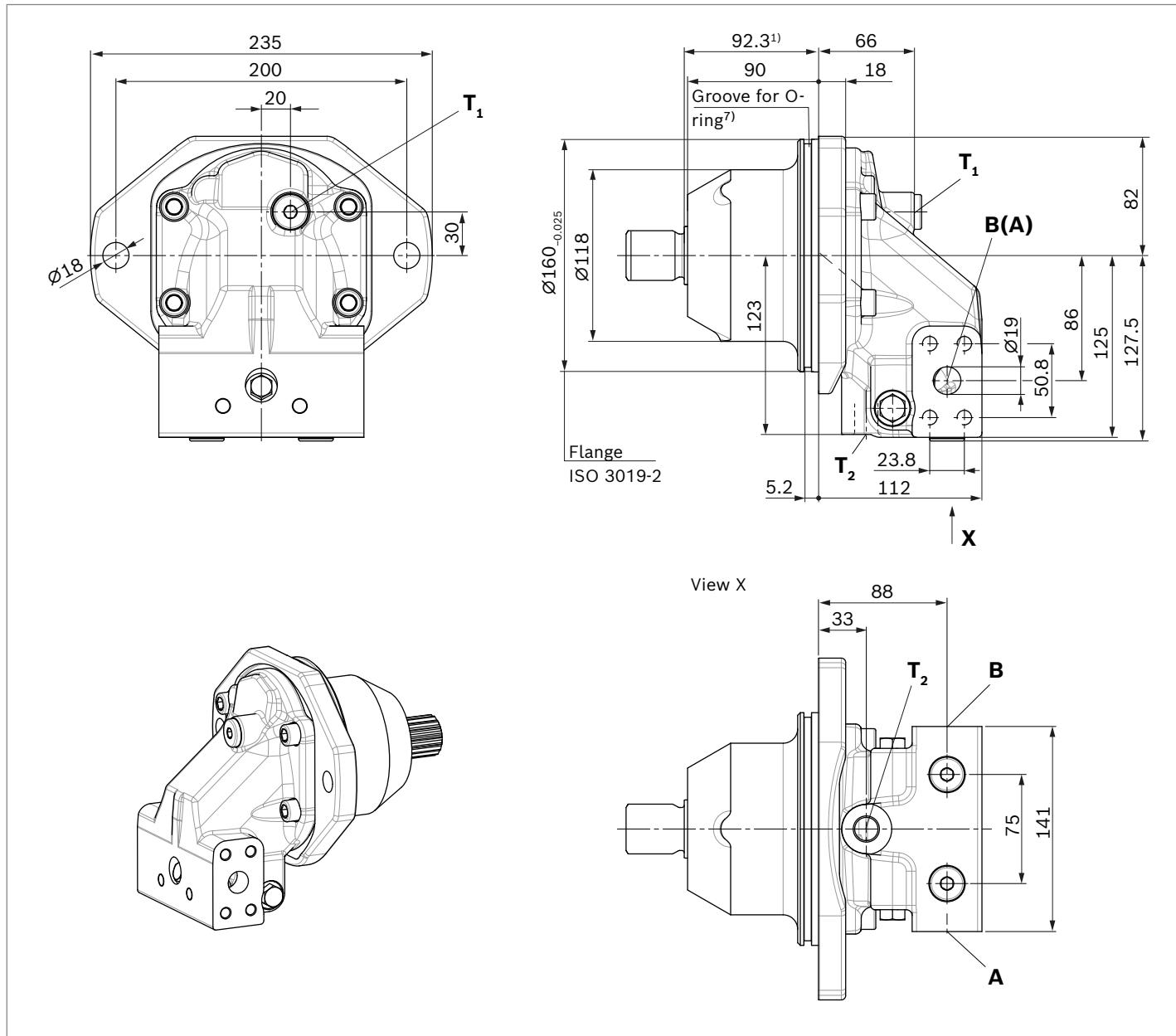
⁷⁾ O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports at side, opposite (02)

A2FEN sizes 56, 63 and 80

A2FEM sizes 45, 56 and 63

A2FEH sizes 45, 56 and 63



Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 x 1.5; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

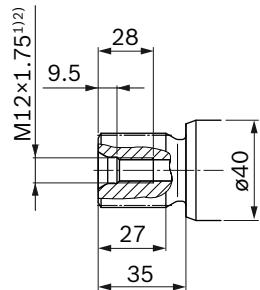
6) O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

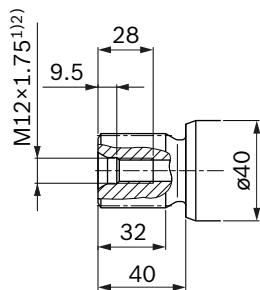
7) O-ring is not included in the scope of delivery.

▼ **Splined shaft DIN 5480,
Sizes 45⁴⁾ and 56³⁾**

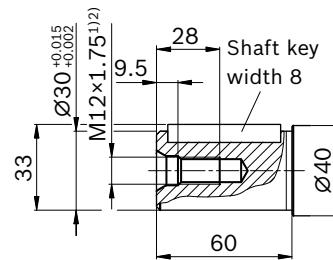
Z6 – W30×2×14×9 g

▼ **Splined shaft DIN 5480,
Sizes 56⁴⁾, 63 and 80⁵⁾**

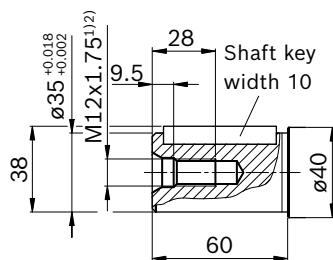
Z8 – W35×2×16×9 g

▼ **Parallel keyed shaft DIN 6885,
Sizes 45⁴⁾ and 56³⁾**

P6 – AS8×7×50

▼ **Parallel keyed shaft DIN 6885,
Sizes 56⁴⁾, 63 and 80⁵⁾**

P8 – AS10×8×50



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

2) For notes on tightening torques, see the instruction manual

3) Not available for A2FMH, A2FEH (pressure range 450 to 500 bar)

4) Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

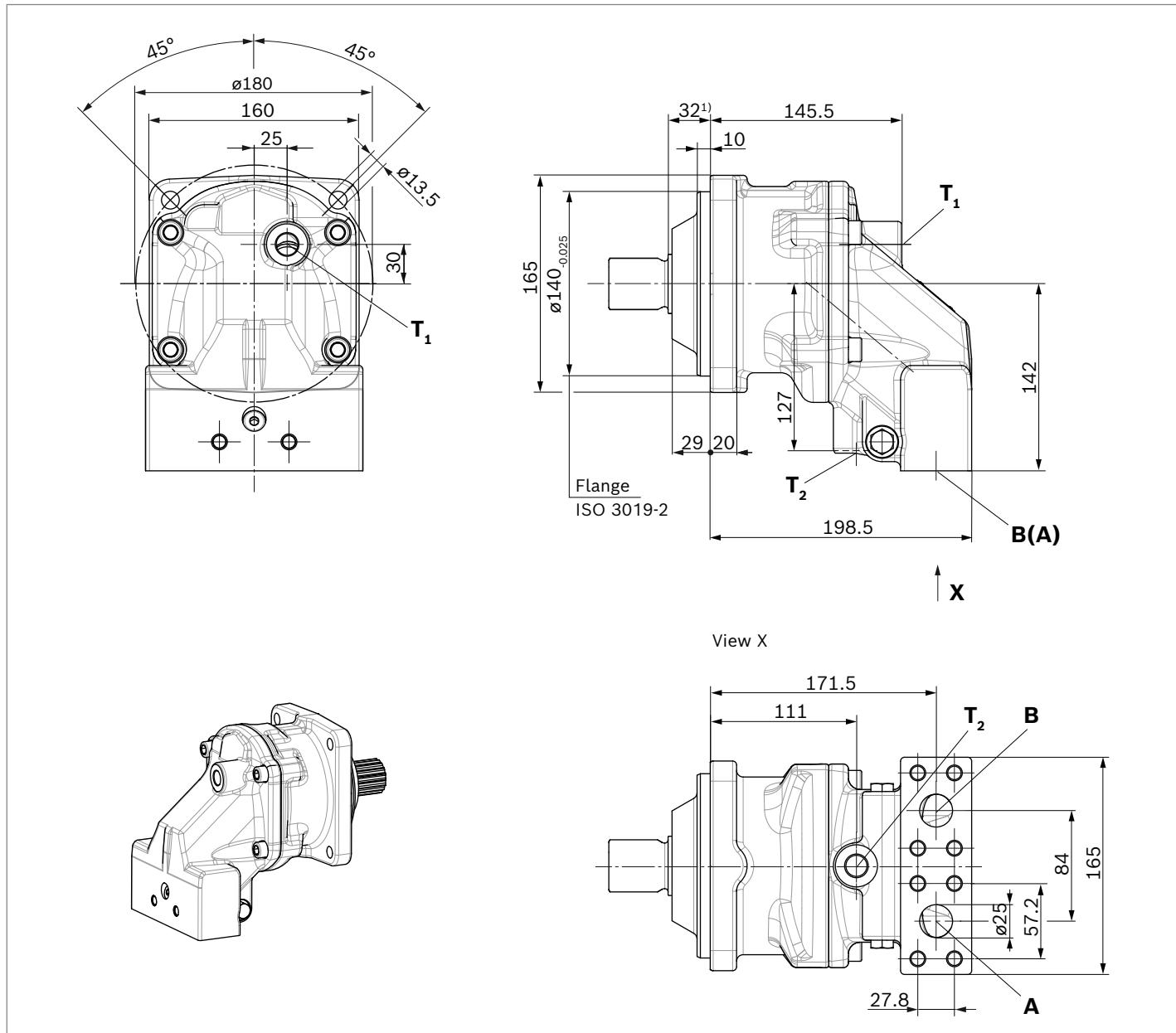
5) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

Dimensions A2FM, SAE working ports at bottom (11)

A2FMN sizes 90 and 107

A2FMM sizes 80 and 90

A2FMH sizes 80 and 90



Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 x 1.75; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

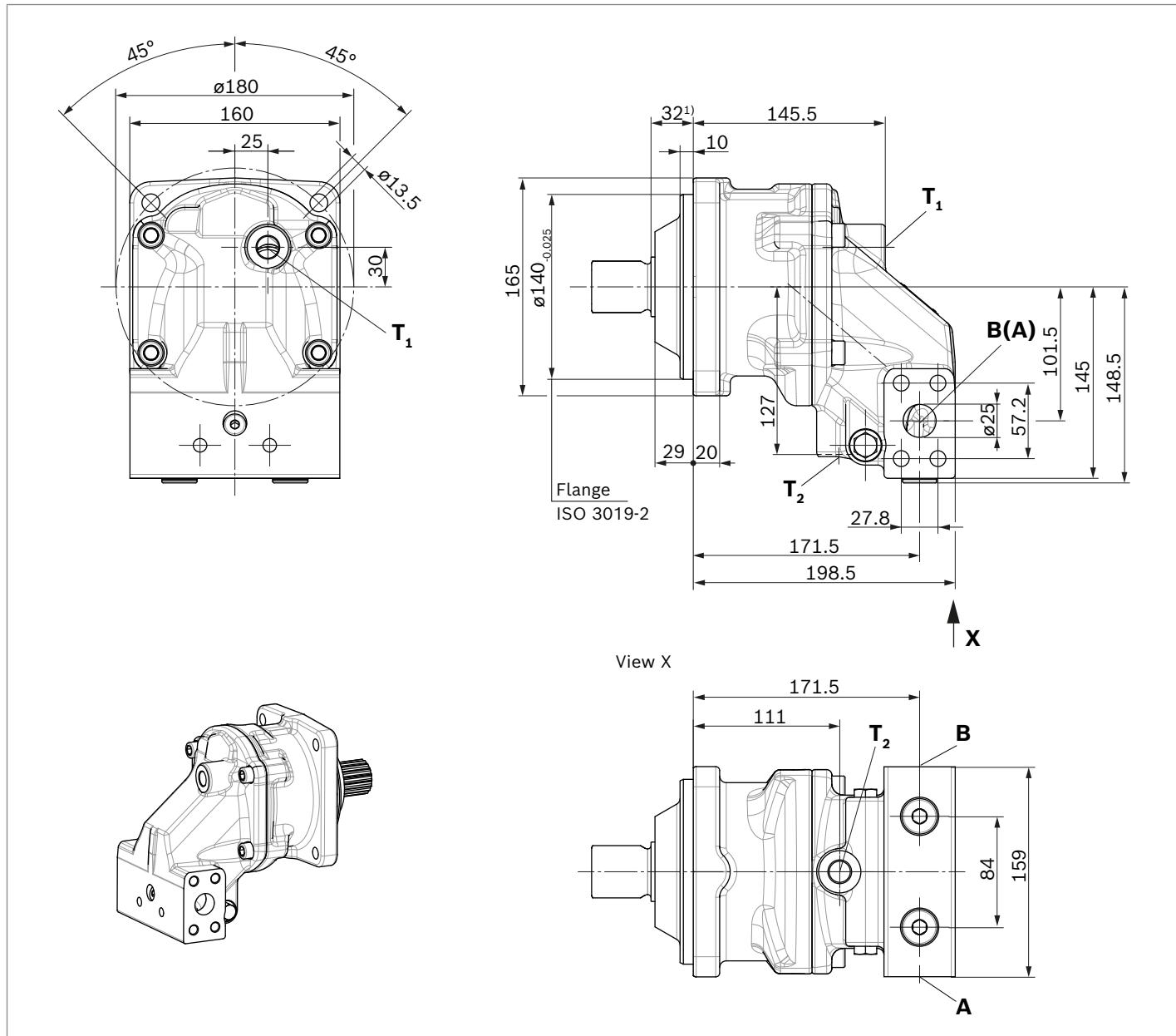
Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports at side, opposite (02)**A2FMN sizes 90 and 107****A2FMM sizes 80 and 90****A2FMH sizes 80 and 90**

Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 x 1.75; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

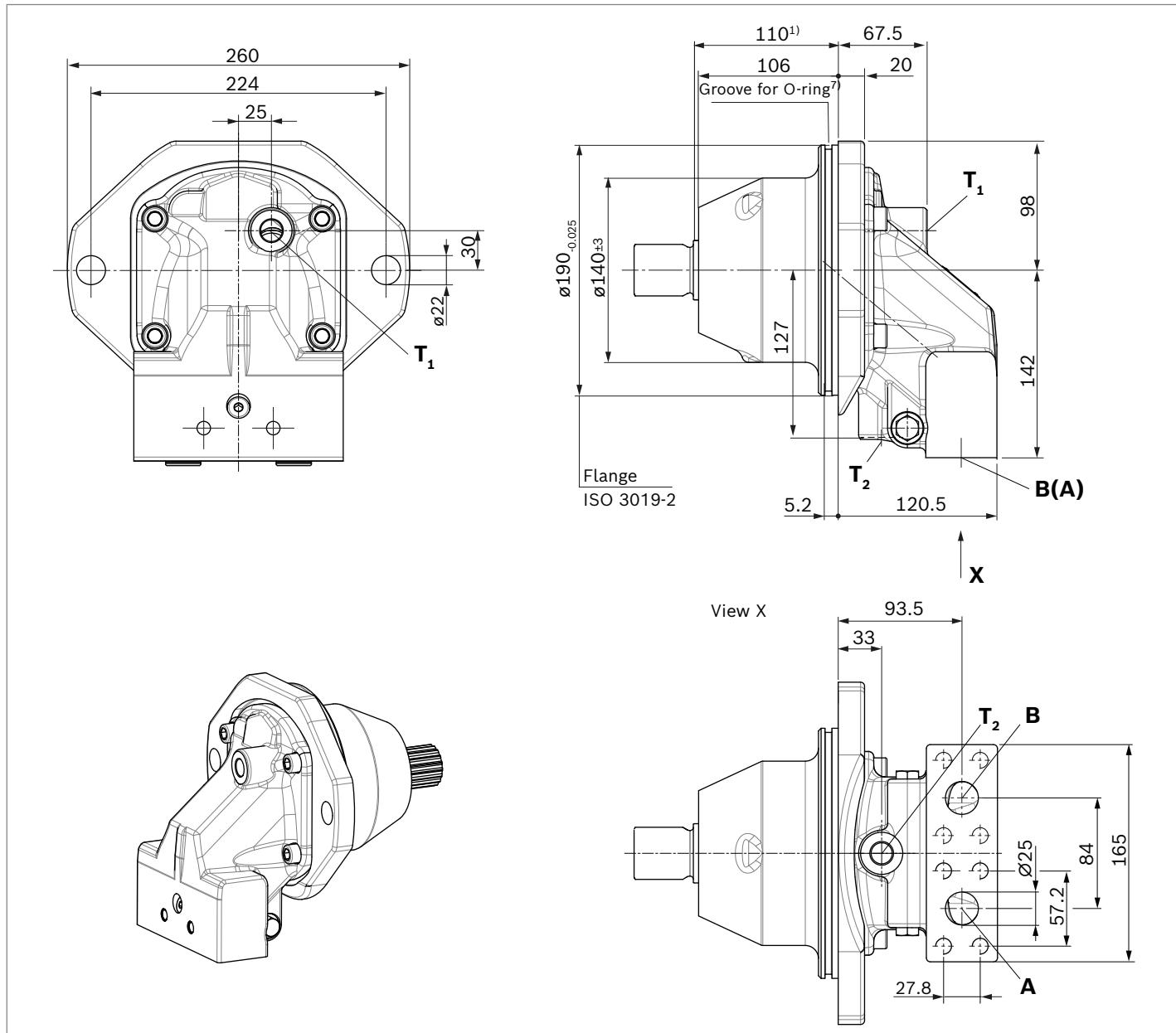
X = Plugged (in normal operation)

Dimensions A2FE, SAE working ports at bottom (11)

A2FEN sizes 90 and 107

A2FEM sizes 80 and 90

A2FEH sizes 80 and 90



Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 x 1.75; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

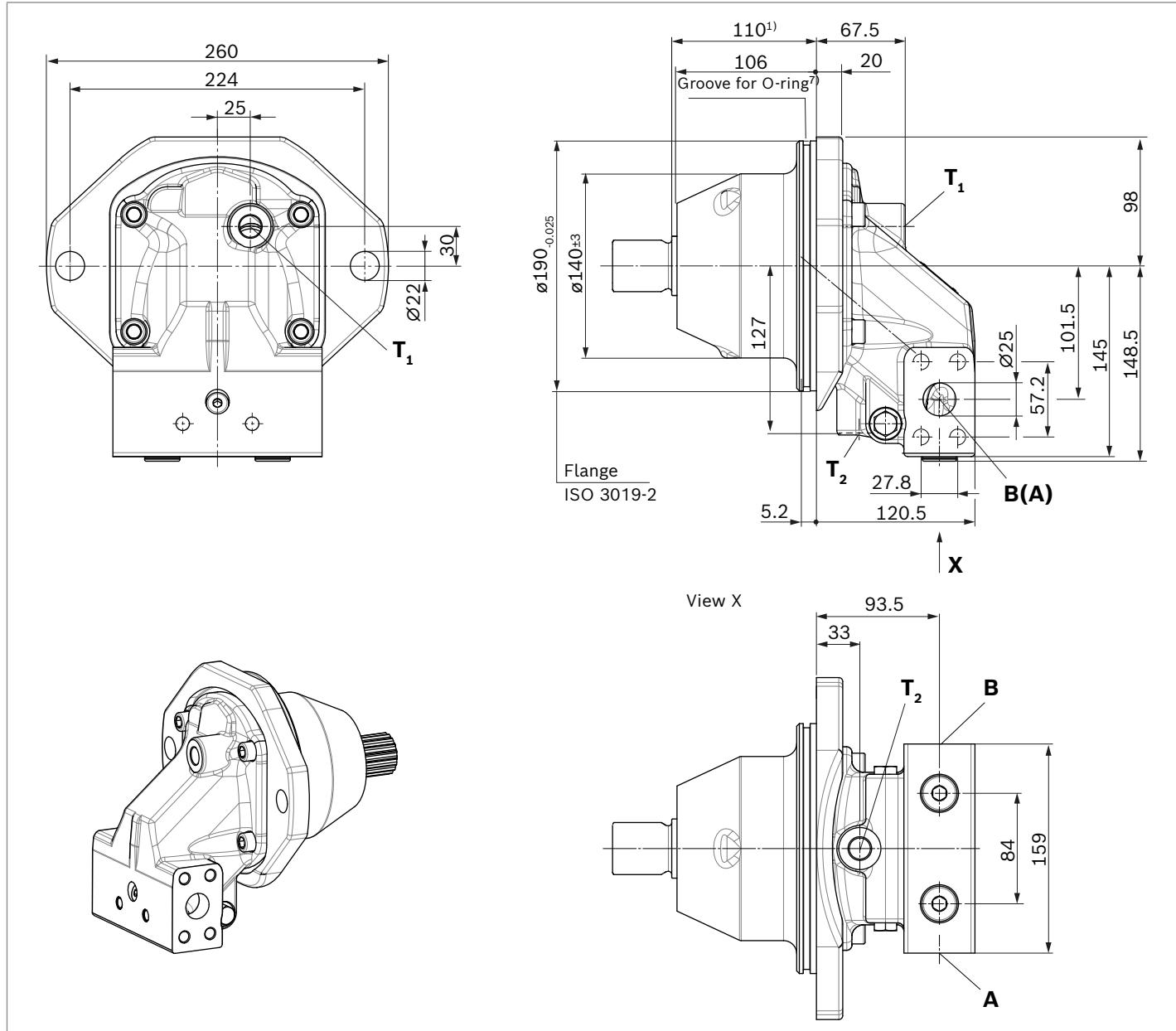
4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

7) O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports at side, opposite (02)**A2FEN sizes 90 and 107****A2FEM sizes 80 and 90****A2FEH sizes 80 and 90**

Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 × 1.5; 12 deep	3	O ⁴⁾

¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

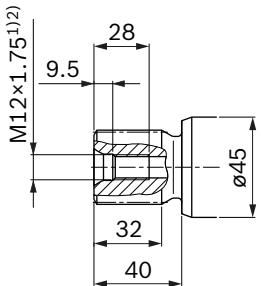
⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

⁷⁾ O-ring is not included in the scope of delivery.

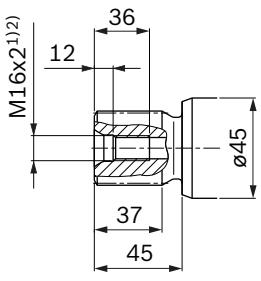
▼ **Splined shaft DIN 5480,
Size 80³⁾⁴⁾**

Z8 – W35×2×16×9 g



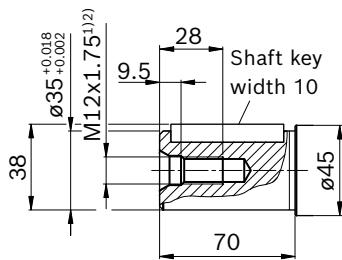
▼ **Splined shaft DIN 5480,
Size 80⁴⁾, 90 and 107⁵⁾**

Z9 – W40×2×18×9 g



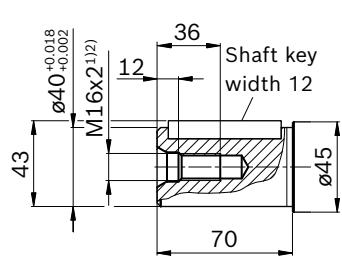
▼ **Parallel keyed shaft DIN 6885,
Size 80³⁾⁴⁾**

P8 – AS10×8×56



▼ **Parallel keyed shaft DIN 6885,
Size 80⁴⁾, 90 and 107⁵⁾**

P9 – AS12×8×56



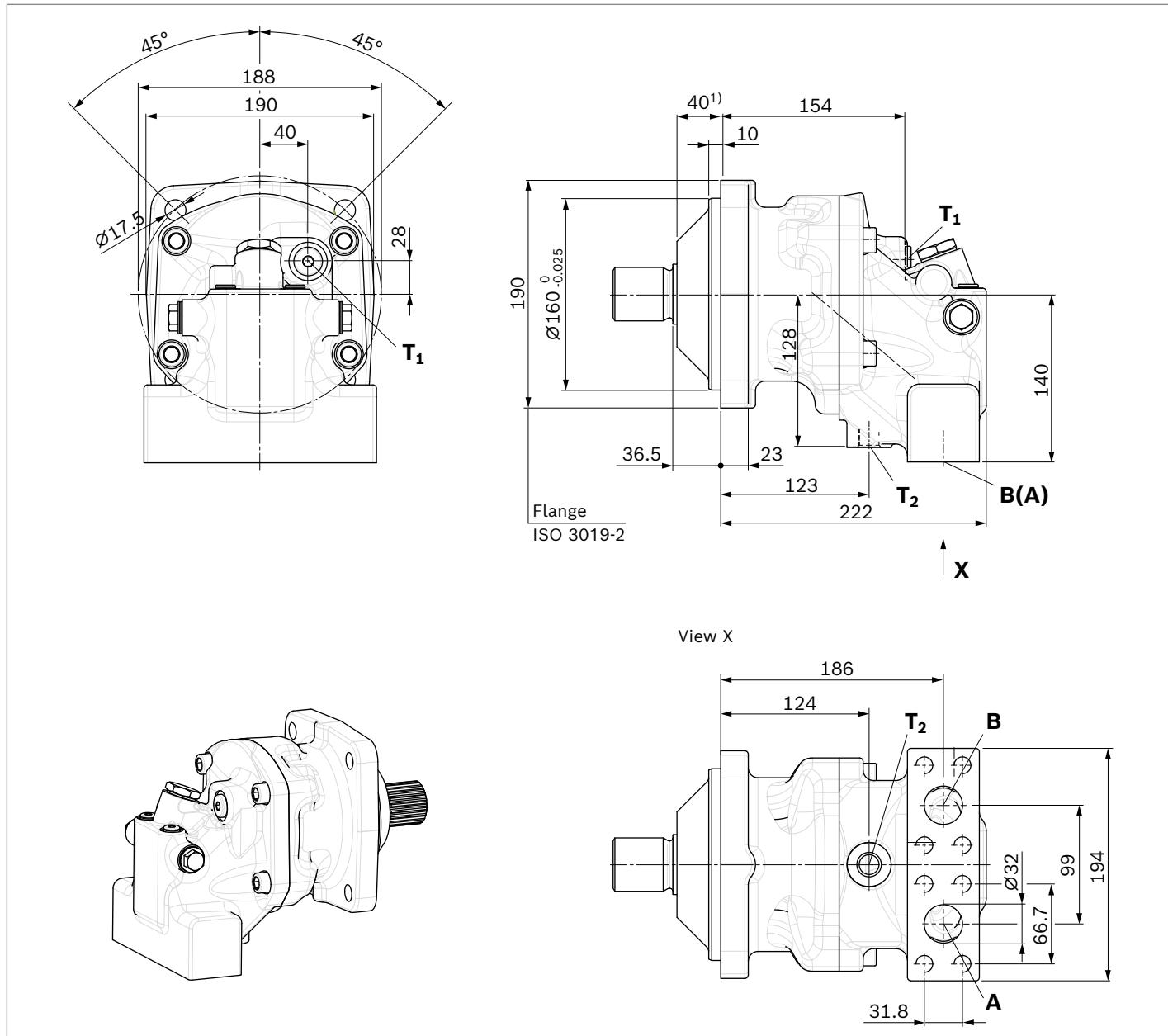
¹⁾ Center bore according to DIN 332 (thread according to DIN 13)

²⁾ For notes on tightening torques, see the instruction manual

³⁾ Not available for A2FMH, A2FEH (pressure range 450 to 500 bar)

⁴⁾ Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

⁵⁾ Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

Dimensions A2FM, SAE working ports at bottom (11)**A2FMM sizes 107 and 125****A2FMH sizes 107 and 125**

Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 1/4 in M14 x 2; 23 deep	500	O
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

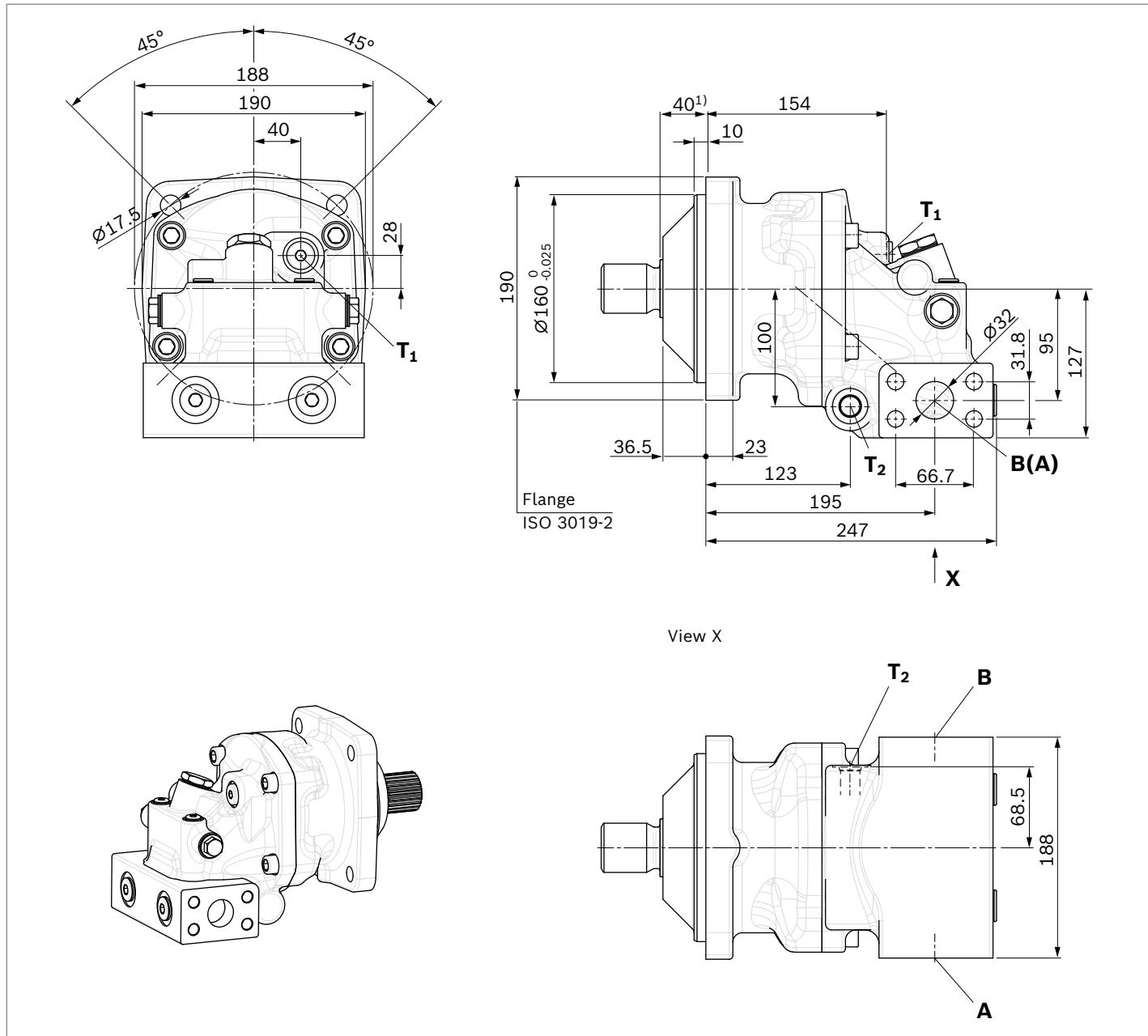
¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring instruments and fittings.⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports at side, opposite (02)

A2FMM sizes 107 and 125

A2FMH sizes 107 and 125



Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port Fastening thread A/B	SAE J518 DIN 13	1 1/4 in M14 x 2; 23 deep	500	O
T ₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T ₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

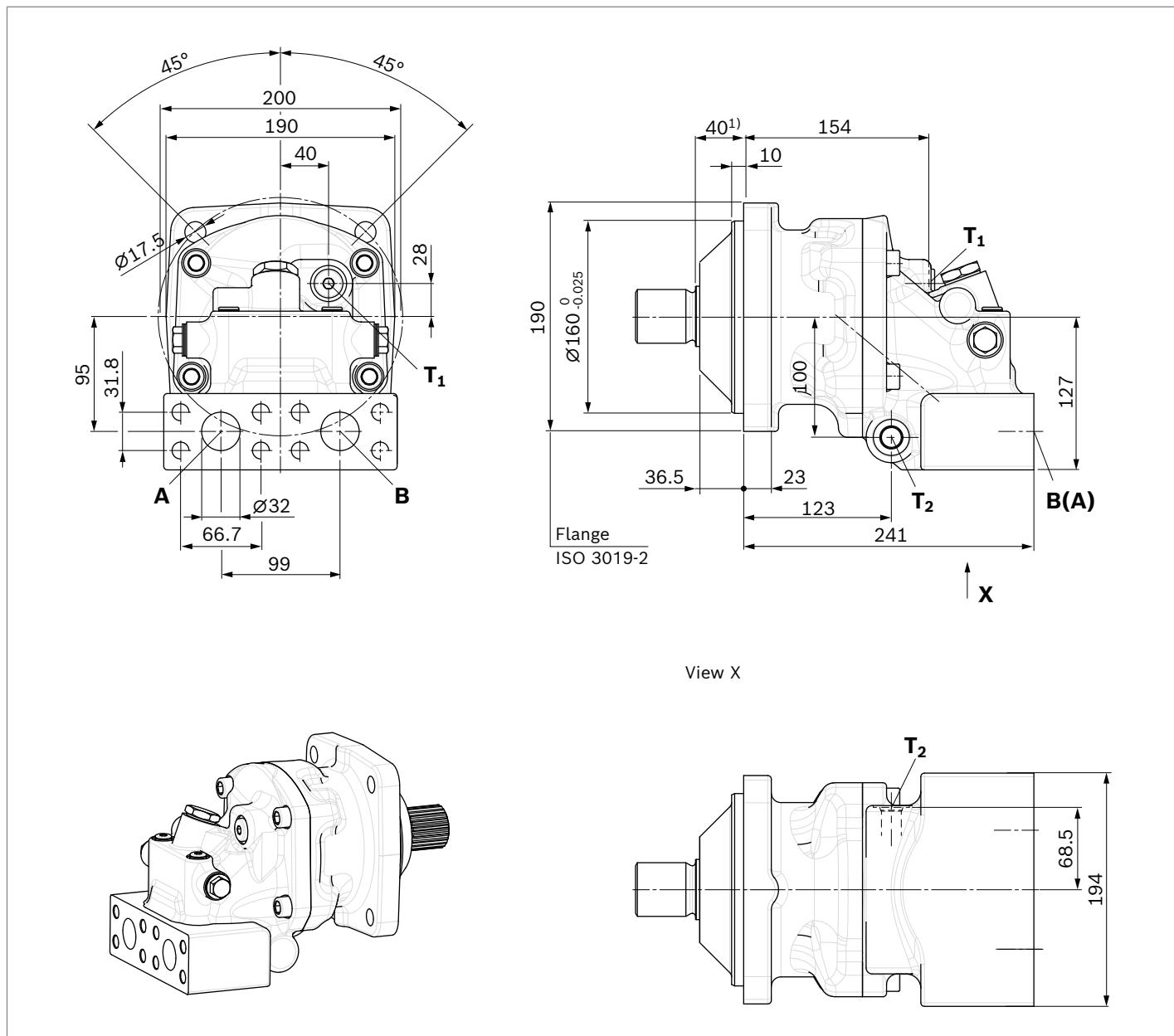
Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports at rear (01)**A2FMM sizes 107 and 125****A2FMH sizes 107 and 125**

Ports	Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B Working port	SAE J518	1 1/4 in	500	O
Fastening thread A/B	DIN 13	M14 x 2; 23 deep		
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

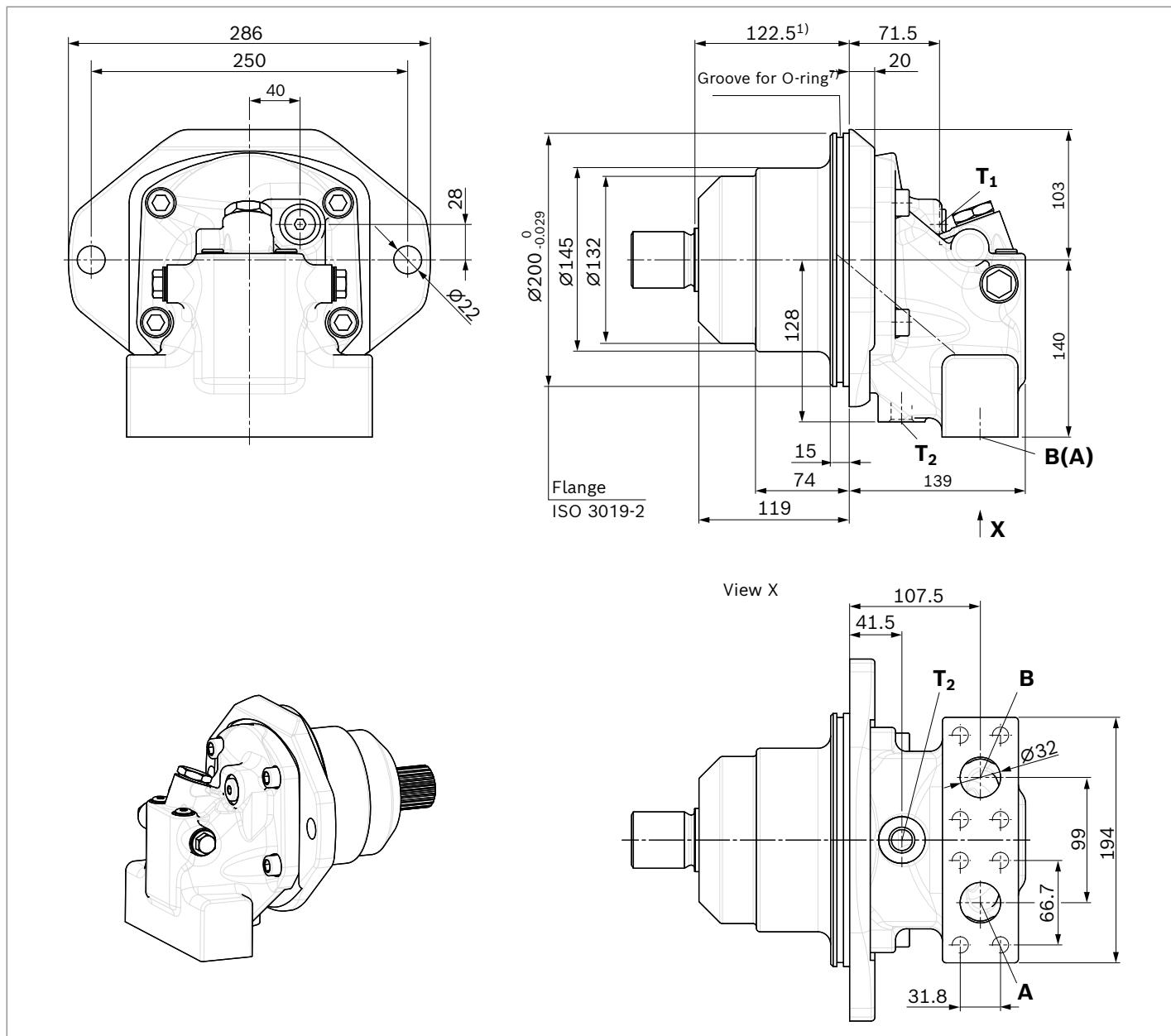
¹⁾ To shaft collar²⁾ For notes on tightening torques, see the instruction manual.³⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring instruments and fittings.⁴⁾ Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).⁵⁾ The countersink may be deeper than specified in the standard.⁶⁾ O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

Dimensions A2FM, SAE working ports at bottom (11)

A2FEM sizes 107 and 125

A2FEH sizes 107 and 125



Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B Working port	SAE J518	1 1/4 in	500	O
Fastening thread A/B	DIN 13	M14 x 2; 23 deep		
T₁ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂ Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

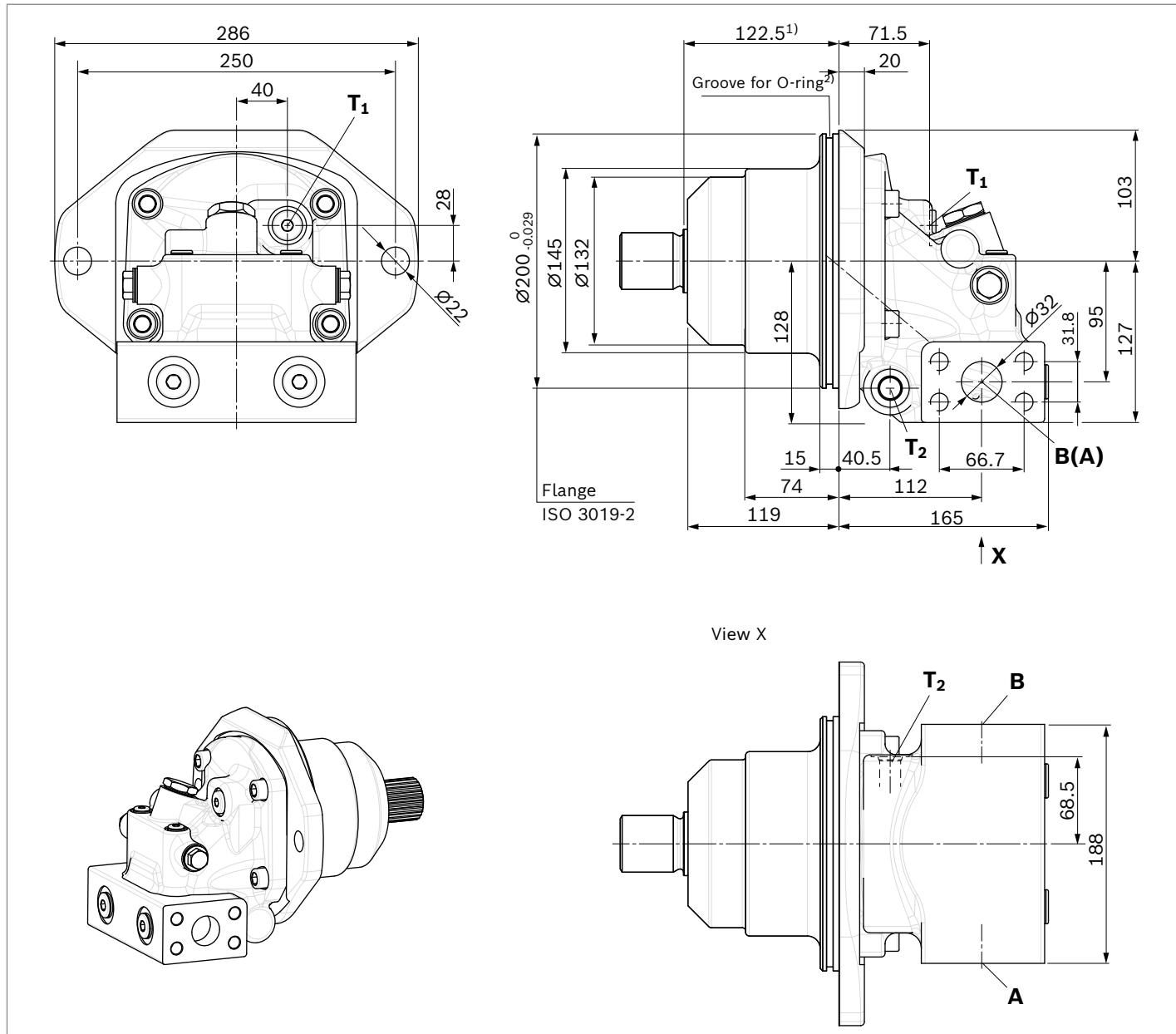
X = Plugged (in normal operation)

7) O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports at side, opposite (02)

A2FEM sizes 107 and 125

A2FEH sizes 107 and 125



Ports		Standard	Size ²⁾	p_{\max} [bar] ³⁾	State ⁶⁾
A, B	Working port	SAE J518	1 1/4 in	500	O
	Fastening thread A/B	DIN 13	M14 x 2; 23 deep		
T₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	X ⁴⁾
T₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3	O ⁴⁾

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T_1 or T_2 must be connected (see a) in the following section (see page 16).

installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

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

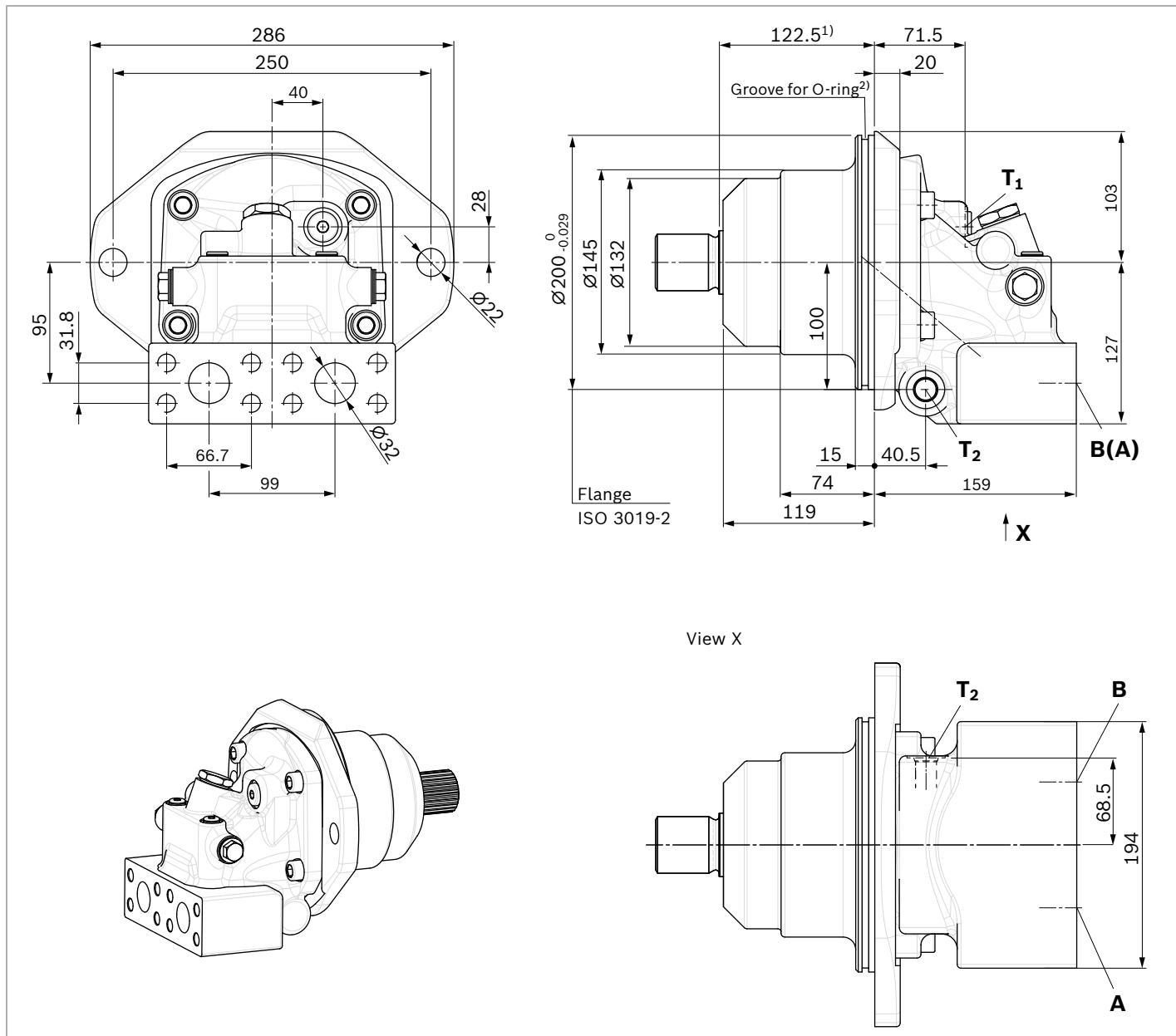
X = Plugged (in normal operation)

7) O-ring is not included in the scope of delivery.

Dimensions A2FE, SAE working ports at rear (01)

A2FEM sizes 107 and 125

A2FEH sizes 107 and 125



Ports	Standard	Size ²⁾	p_{max} [bar] ³⁾	State ⁶⁾
A, B	Working port	SAE J518	1 1/4 in	500
	Fastening thread A/B	DIN 13	M14 x 2; 23 deep	O
T₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3
T₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5; 12 deep	3

1) To shaft collar

2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur.

Keep this in mind when selecting measuring instruments and fittings.

4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 46).

5) The countersink may be deeper than specified in the standard.

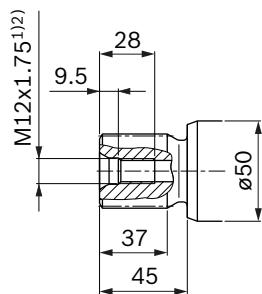
6) O = Must be connected (condition on delivery: plugged)

X = Plugged (in normal operation)

7) O-ring is not included in the scope of delivery.

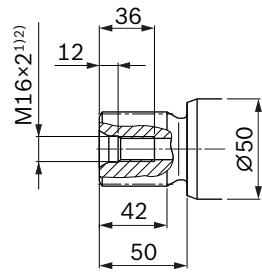
▼ **Splined shaft DIN 5480,
Size 107³⁾**

Z9 – W40×2×18×9 g



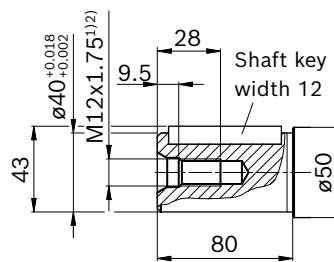
▼ **Splined shaft DIN 5480,
Sizes 107³⁾ and 125**

A1 – W45×2×21×9 g



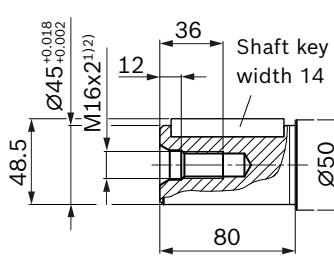
▼ **Parallel keyed shaft DIN 6885,
Size 107³⁾**

P9 – AS12×8×63



▼ **Parallel keyed shaft DIN 6885,
Sizes 107³⁾ and 125**

B1 – AS14x9x63



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

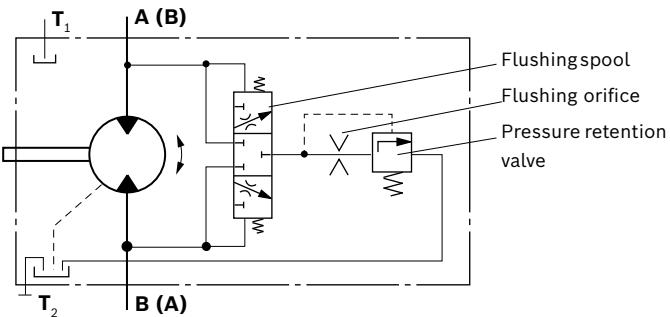
2) For maximum tightening torques, see instruction manual.

3) Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

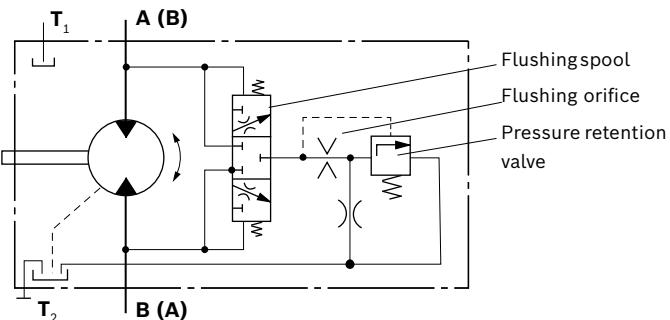
Flushing and boost-pressure valve, integrated

The flushing and boost-pressure valve is used to remove heat from the hydraulic circuit. In a closed circuit, it is used for flushing the case and safeguarding the minimum boost pressure. 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. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.

▼ Circuit diagram, sizes 23 to 90



▼ Circuit diagram, sizes 107 to 125



Cracking pressure of pressure retention valve

(observe when setting the primary valve)

- Size 23 to 125, fixed setting 16 bar

Switching pressure of flushing spool

- Sizes 23 to 107(N)
 $\Delta p = 8 \pm 1$ bar
- Sizes 107 and 125
 $\Delta p = 17.5 \pm 1.5$ bar

Flushing flow

Orifices can be used to adjust the flushing flows as required. The following parameters are based on: $\Delta p_{ND} = p_{ND} - p_G = 25$ bar and $v = 10 \text{ mm}^2/\text{s}$ (p_{ND} = low pressure, p_G = case pressure)

Size	Orifice dia. [mm]	Flushing flow q_v [l/min]
23, 28, 32, 37, 45, 56, 63, 80, 90	1.0	2.6
	1.3	4
	1.5	6
	1.7	7.4
	1.8	8.5
	2.0	10
	2.3	11.4
	3	12.5
107, 125	1.2	4
	1.4	6
	1.6	7.4
	1.8	8.5
	2.0	10
	2.5	15
	2.8	18
	3.1	21
	3.8	27
	4.0	31
	5.0	37

Pressure relief valve

The MHDB pressure relief valves (see data sheets 64602 and 64612) 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.

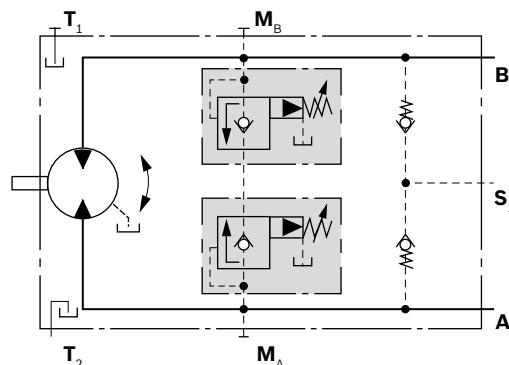
The pressure relief valves are only available in conjunction with the working ports 07 and 09 (for the counterbalance valve for mounting to working ports 07 see next page).

Cracking pressure setting range 50 to 420 bar

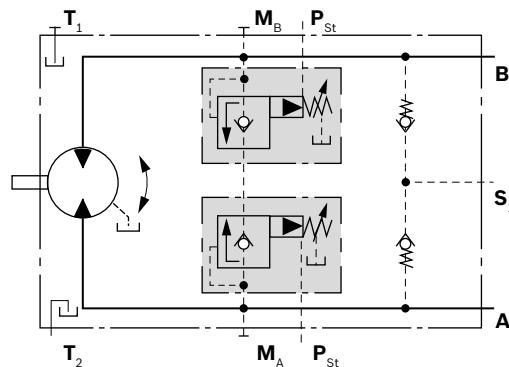
For versions "with pressure sequencing stage" 09S, a higher pressure setting can be implemented by connecting an external pilot pressure of 25 up to 30 bar at port P_{St} . When ordering, state in plain text:

- ▶ Cracking pressure of pressure relief valve
- ▶ Cracking pressure with pilot pressure applied to P_{St} (only with version 09S)

▼ Circuit diagram version without pressure boost facility 09R



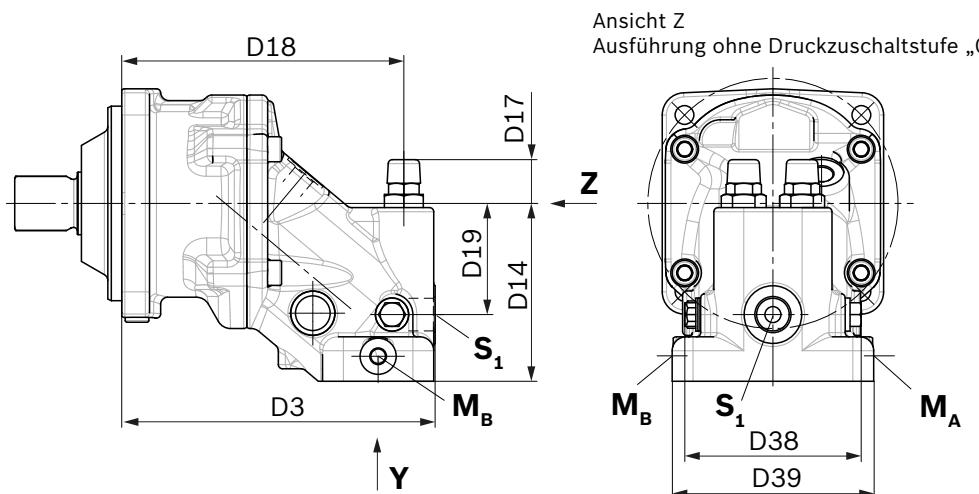
▼ Circuit diagram version with pressure boost facility 09S



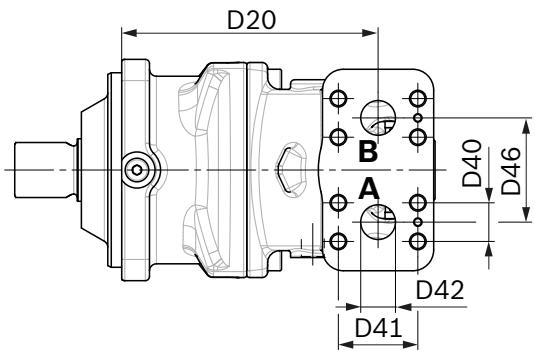
Permissible input flow or pressure for version with pressure-relief valves

Motor NG	Without valve		Limited values when using pressure relief valves			
	p_{nom}/p_{max} [bar]	q_V max [l/min]	Pressure relief valve NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code
45	400/450	255	22	350/420	240	09R, 09S
56		280				
63		315				
80		360				
90		405				

Dimensions

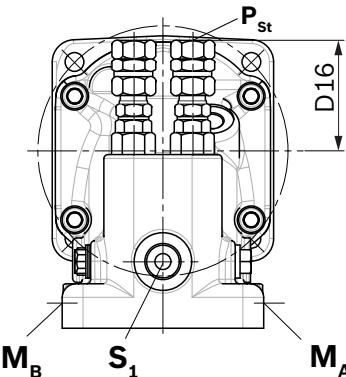


Ansicht Y



Ansicht Z

Ausführung mit Druckzuschaltstufe „09S“



Size		D3	D14	D16	D17	D18	D19	D20	D38	D39	D40	D41	D42	D46
45, 56, 63	MHDB..22	206	120	74	32.5	182	75	163	137	130	23.8	50.8	Ø19	75
80, 90	MHDB..22	225.5	128	73	31.5	203	80	184.5	127	145	27.8	57.2	Ø25	75

Size	A, B	S ₁ ¹⁾	M _A , M _B ¹⁾	P _{St} ¹⁾
45, 56, 63	3/4 in	M22 x 1.5; 14 deep	M12 x 1.5; 12 deep	G 1/4
80, 90	1 in	M26 x 1.5; 16 deep	M12 x 1.5; 12 deep	G 1/4

Ports	Standard	Size ¹⁾	p _{max} [bar] ²⁾	State ⁴⁾
A, B	SAE J518	see table above	420	O
S ₁	DIN 3852 ³⁾	see table above	5	O
M _A , M _B	DIN 3852 ³⁾	see table above	420	X
P _{St}	DIN ISO 228	see table above	30	O

1) For notes on tightening torques, see the instruction manual.

2) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring instruments and fittings.

3) The countersink may be deeper than specified in the standard.

4) O = Must be connected (condition on delivery: plugged)
X = Plugged (in normal operation)

Counterbalance valve BVD

Function

Counterbalance valves for travel drives and winches should reduce the danger of overspeed and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking, when going downhill or during the load-lowering process, the motor speed is greater than it should be for the given inlet flow and thus the supply pressure falls sharply.

If the supply pressure falls below the level specified for the relevant counterbalance valve, the counterbalance spool moves into the closed position. The cross-sectional area of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor reaches the specified value for the given inlet flow.

Notice

- ▶ BVD available in sizes 45 to 90.
- ▶ The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
- Order example:
A2FMM90/70NWVN4Z907W000 +
BVD20F27S/41B-V03K16D0400S12
- ▶ The counterbalance valve does not replace the mechanical service brake and holding brake.
- ▶ Observe the detailed notes on the BVD counterbalance valve contained in RE 95522
- ▶ For the design of the brake release valve, we must know the following data for the mechanical holding brake:
 - the cracking pressure
 - the volume of the brake 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. 15 mm²/s)

Permissible input flow or pressure for version with counterbalance valve

Motor NG	Without valve		Limited values when using counterbalance valves			
	$p_{\text{nom}}/p_{\text{max}}$ [bar]	q_V^{max} [l/min]	BVD NG	$p_{\text{nom}}/p_{\text{max}}$ [bar]	$q_V^{\text{1)}$ [l/min]	Code
45	400/450	255	20	350/420	220	07W
56		280				
63		315				
80		360				
90		405				

¹⁾ Restriction of input flow with counterbalance valve

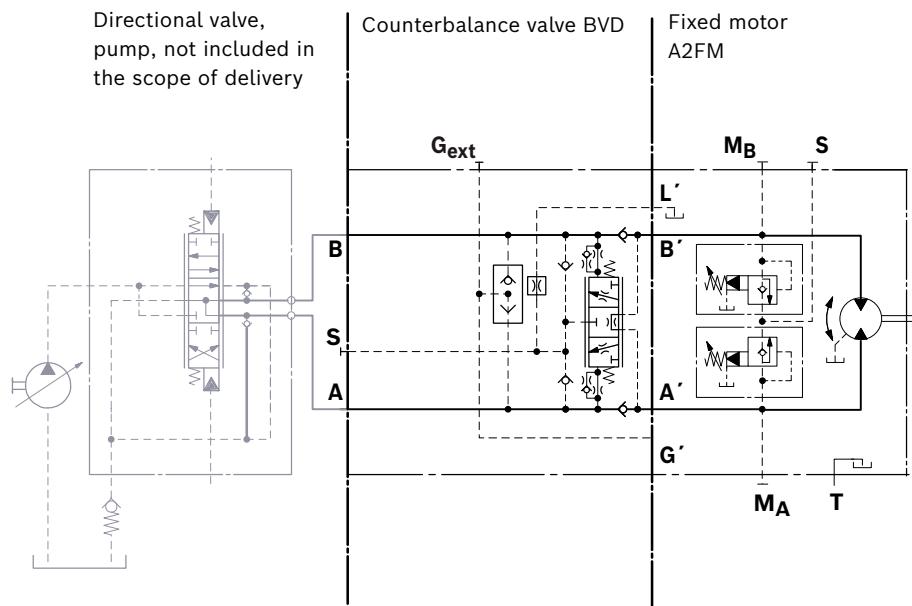
Brake valve BVD...F

Application option

- Driveline for wheeled excavators

Example circuit diagram for travel drive in wheeled excavators

A2FMM90/70NWVN4Z907W000 + BVD20F27S/41B-V03K16D0400S12



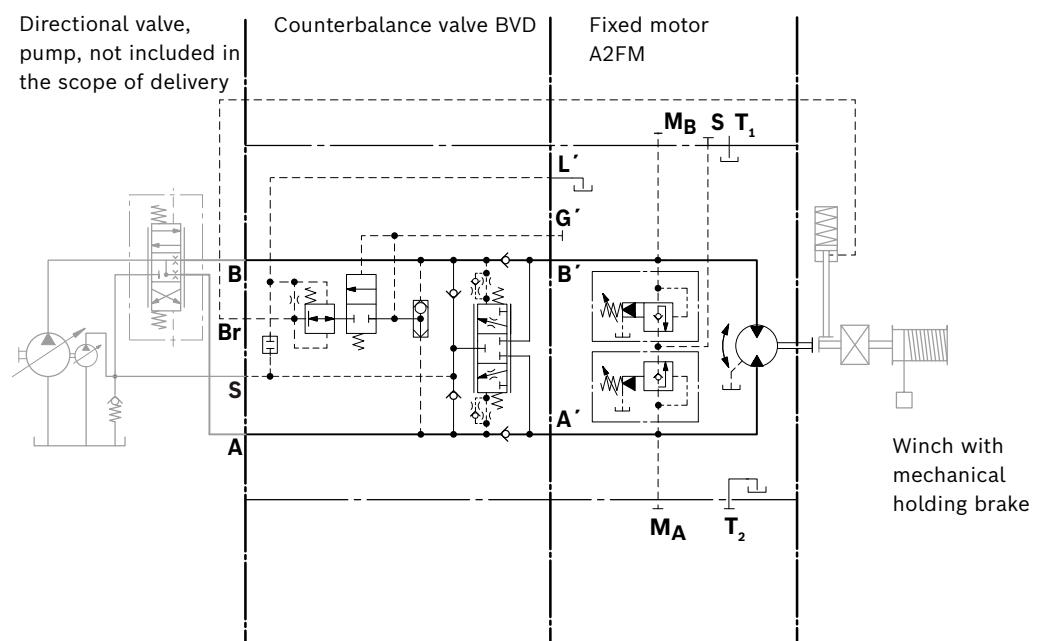
BVD...W winch counterbalance valve

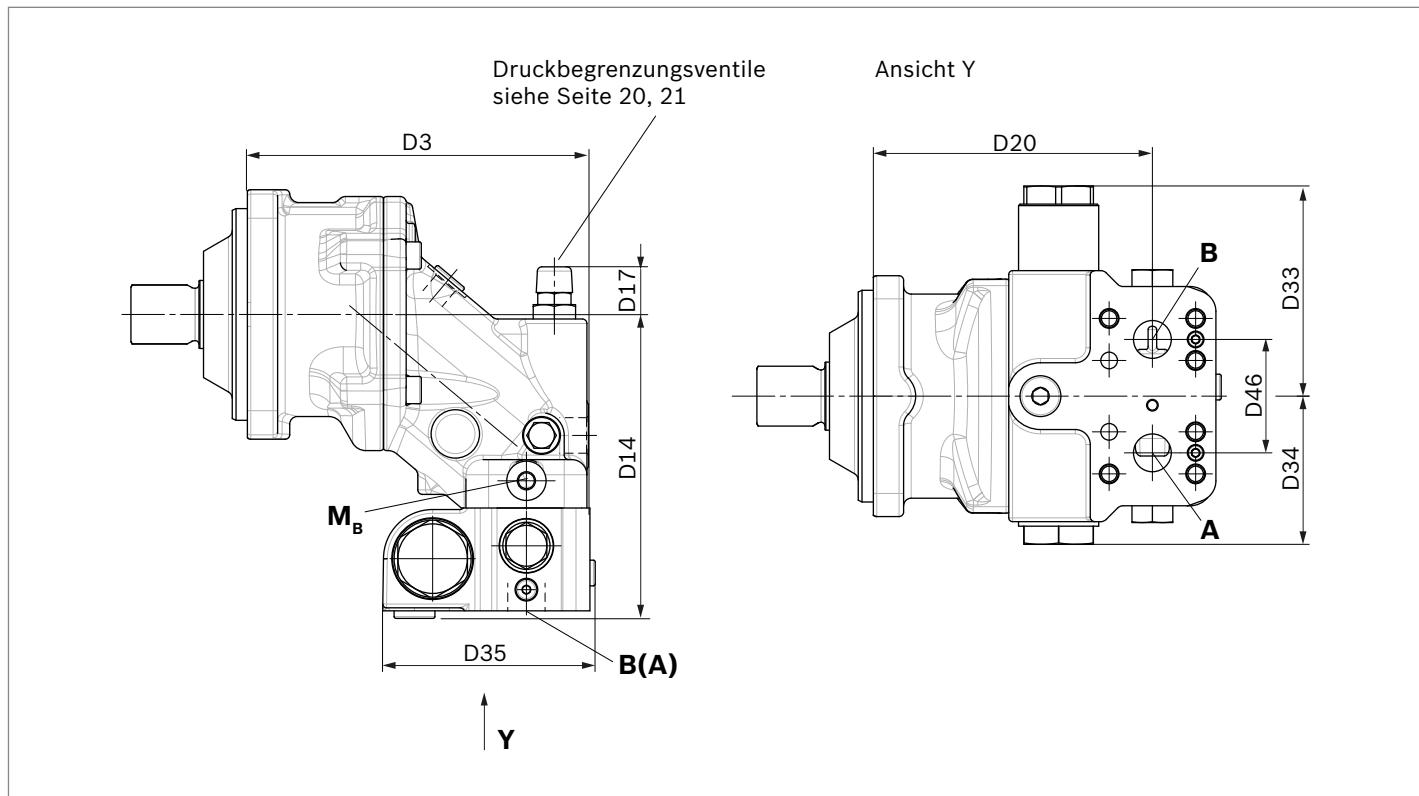
Application options

- Winch drives in cranes (BVD)
- Track drive in excavator crawlers (BVD)

Example circuit diagram for winch drive in cranes

A2FMM90/70NWVN4Z907W000 + BVD20W27L/41B-V01K00D0600S00



Dimensions

Size	A, B	D3	D14	D17	D20	D33	D34	D35	D46
45, 56, 63	BVD20..17	3/4 in	205	193	32.5	163	98	139	140.5
80, 90	BVD20..27	1 in	226.5	201	31.5	184.5	98	139	140.5

Ports	Version	Standard	Size ¹⁾	p_{max} [bar] ²⁾	State ⁴⁾
A, B Working port		SAE J518	see table above	420	O
S Boost port	BVD20	DIN 3852 ³⁾	M22 x 1.5; 14 deep	30	X
Br Brake release port, reduced high pressure	L	DIN 3852 ³⁾	M12 x 1.5; 12.5 deep	30	O
G_{ext} Brake release port, high pressure	S	DIN 3852 ³⁾	M12 x 1.5; 12.5 deep	420	X
M_A, M_B Measuring port pressure A/B		DIN 3852 ³⁾	M12 x 1.5; 12 deep	420	X

Mounting the counterbalance valve

When delivered, the counterbalance valve is fastened to the motor with two tacking screws (transport lock). The tacking screws may not be removed while mounting the working lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be fastened to the

motor port plate using the provided tacking screws. The counterbalance valve is finally mounted to the motor by fitting the SAE flange. The screws to be used and the instructions for mounting can be found in the instruction manual.

¹⁾ For notes on tightening torques, see the instruction manual.
²⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring instruments and fittings.

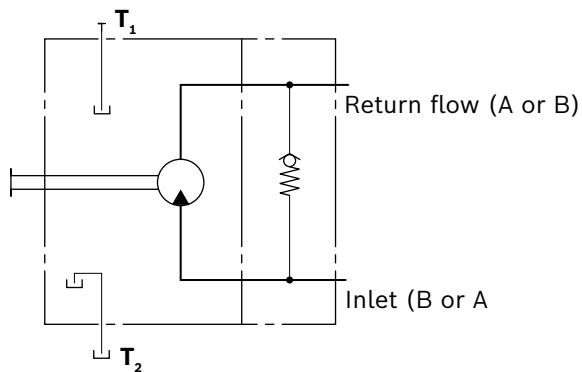
³⁾ The countersink may be deeper than specified in the standard.
⁴⁾ O = Must be connected (condition on delivery: plugged)
X = Plugged (in normal operation)

Port plate with integrated check valve (U)

Function

The motor with defined rotational direction is supplied via the inlet port (A or B). As soon as the inlet is disabled and the driven component (e.g. fan wheel) is running due to its own flywheel mass, the motor operates as pump. Since the turning motor is no longer supplied by the inlet, it will get the required hydraulic fluid via the check valve from the return line.

▼ Circuit diagram



Flow direction

Rotational direction viewed on drive shaft	
clockwise	counter-clockwise
A to B	B to A

Speed sensors DSA and DSM

The motor speed can be recorded by the fitted DSA/DSM speed sensor. The frequency signal required is generated by splines at the rotary group.

In addition to the speed, the DSA/DMS sensor will record the rotational direction of the motor.

Type code, technical data, dimensions and details on the plug, plus safety instructions about the sensor can be found in the relevant data sheet DSA (95133) or DSM (95132).

The sensor is mounted on the port provided for this purpose with a mounting bolt. On deliveries without sensor, the port is plugged with a pressure-resistant cover. We recommend ordering the A2F fixed motor complete with mounted sensor.

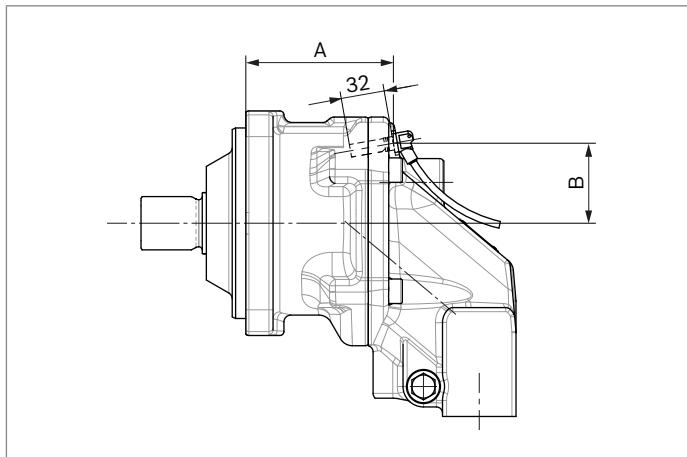
The following versions are available:

- ▶ with mounted DSA speed sensor: Code B
- ▶ with mounted DSM speed sensor: Code M
- ▶ prepared for DSA speed sensor (delivery without sensor): Code A
- ▶ prepared for DSM speed sensor (delivery without sensor): Code N

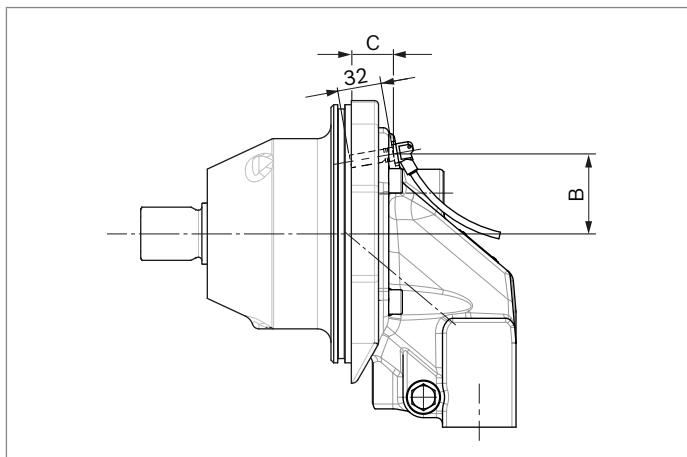
Size	A2FM/H	23, 28, 32	45, 56, 63	80, 90	107, 125
A2FN	28, 32, 37, 45	56, 63, 80	90, 107	—	
Number of teeth	38	47	53	59	
Dimensions	A	90.9	96.6	108.4	113.6
	B	44.5	54.6	58.8	62.2
	C	27.1	36.3	30.4	31.1
	D	61	71	75	78.2
	E	79.5	89.5	93.5	96.7
	F	54.9	61.2	72.6	72.6

Dimensions

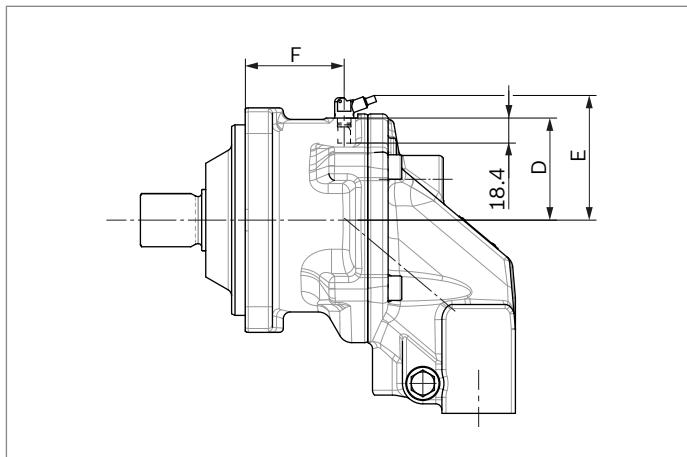
▼ A2FM with mounted DSA speed sensor (Code B)



▼ A2FE with mounted DSA speed sensor (Code B)



▼ A2FM with mounted DSM speed sensor (Code M)



Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.

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

The leakage in the housing area must be directed to the reservoir via the highest drain port (**T₁**, **T₂**).

If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible housing pressure of all connected units is not exceeded in any operating conditions, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.

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

In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Notice

- ▶ For A2FM with installation position "shaft upwards" an air bleed port **R** is required (specify in plain text when ordering, special version).
- ▶ For A2FE the "shaft upwards" installation position is not permissible.

Key

F	Filling / Air bleeding Notice: F is part of the external piping
R	Air bleed port (special version)
T₁, T₂	Drain port
h_{t min}	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

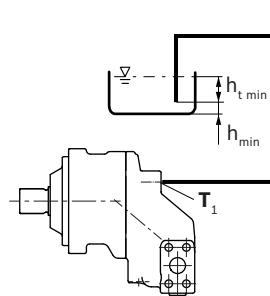
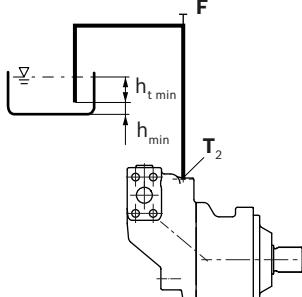
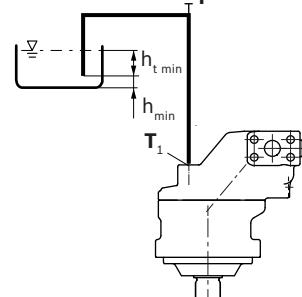
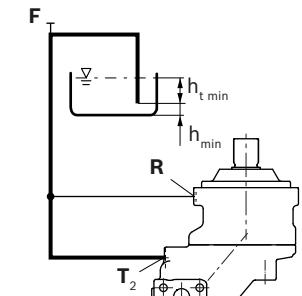
Installation position

See the following examples **1** to **8**.

Further installation positions are available upon request.
Recommended installation position: **1** and **2**

Below-reservoir installation (standard)

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

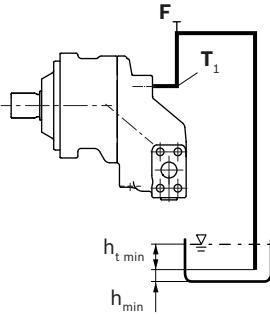
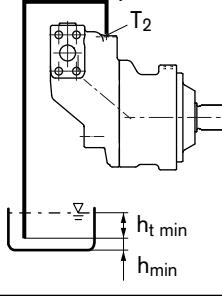
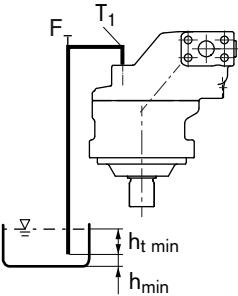
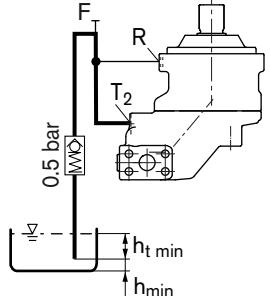
Installation position	Air bleed	Filling
1	F	T₁
		
2	F	T₂
		
3	F	T₁
		
4	R	T₂
		

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 up): A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the housing area.

Notice

Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Installation position	Air bleed	Filling
5	F	T₁ (F)
		
6	F	T₂ (F)
		
7	F	T₁ (F)
		
8	R	T₂ (F)
		

Project planning notes

- ▶ The motor A2FM/A2FE is designed to be used in open and closed circuits.
- ▶ The project planning, assembly and commissioning of the axial piston unit require the involvement of qualified skilled persons.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ Before finalizing your design, please request a binding installation drawing.
- ▶ The specified data and notes contained herein must be observed.
- ▶ Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservation is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply for optimal storage conditions, which can be found in data sheet 90312 or in the instruction manual.
- ▶ Be sure to add a pressure relief valve to the hydraulic system.
- ▶ Please note the details regarding the tightening torques of port threads and other screwed connections in the instruction manual.
- ▶ Working ports:
 - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connection elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
 - The working ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- ▶ During and shortly after operation, there is a risk of burning on the axial piston unit. Take the appropriate safety measures (e.g. by wearing protective clothing).
- ▶ Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in an undefined position due to contamination (e.g. impure hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are appropriately implemented.
- ▶ 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 manufacturer's 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.