

# Axial piston fixed motor

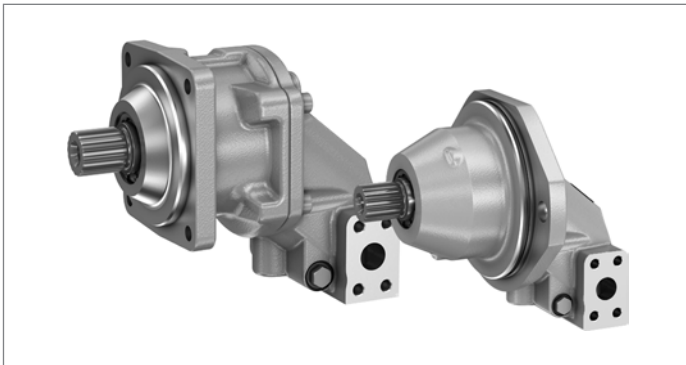
## A2FM Series 70

## A2FE Series 70

**RE 91071**

Edition: 05.2017

Replaces 12.2015



- ▶ A2FMN, A2FEN (sizes 56 to 107):  
Nominal pressure 300 bar  
Maximum pressure 350 bar
- ▶ A2FMM, A2FEM (sizes 45 to 90):  
Nominal pressure 400 bar  
Maximum pressure 450 bar
- ▶ A2FMH, A2FEH (sizes 45 to 90):  
Nominal pressure 450 bar  
Maximum pressure 500 bar

### 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 is dependent 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
- ▶ Integrated flushing valve option

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## Type code

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

### Axial piston unit

01	Bent-axis design, fixed displacement	<b>A2F</b>
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### Operating mode

02	Motor, standard version	<b>M</b>
	Motor, plug-in version	<b>E</b>

### Pressure range

		045	056	063	080	090	107	
03	Nominal pressure: 300 bar, maximum pressure: 350 bar	○	●	●	●	●	●	<b>N</b>
	Nominal pressure: 400 bar, maximum pressure: 450 bar	●	●	●	●	●	○	<b>M</b>
	Nominal pressure: 450 bar, maximum pressure: 500 bar	●	●	●	●	●	○	<b>H</b>

### Size (NG)

04	Geometric displacement, see technical data on page 7	<b>045</b>	<b>056</b>	<b>063</b>	<b>080</b>	<b>090</b>	<b>107</b>
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### Series

05	Series 7, Index 0	<b>70</b>
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### Design of ports and fastening threads

06	Metric, DIN 3852 with profiled seal (Europe, ROW)	<b>N</b>
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### Direction of rotation

07	Viewed on drive shaft, bidirectional	<b>W</b>
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### Sealing material

08	FKM (fluoroelastomer)	<b>V</b>
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### Mounting flange

		045	056	063	080	090	107		
09	ISO 3019-2 metric	125-4 (only available for A2FM)	●	●	●	● <sup>1)</sup>	-	-	<b>M4</b>
		140-4 (only available for A2FM)	-	-	-	●	●	● <sup>1)</sup>	<b>N4</b>
		160-2 (only available for A2FE)	●	●	●	● <sup>1)</sup>	-	-	<b>P2</b>
		190-2 (only available for A2FE)	-	-	-	●	●	● <sup>1)</sup>	<b>Y2</b>

### Drive shaft

		045	056	063	080	090	107		
10	Splined shaft DIN 5480	W30x2x14x9g	●	● <sup>2)</sup>	-	-	-	-	<b>Z6</b>
		W35x2x16x9g	-	●	●	●	-	-	<b>Z8</b>
		W40x2x18x9g	-	-	-	● <sup>3)</sup>	●	●	<b>Z9</b>
	Parallel keyed shaft DIN 6885	∅ 30	●	●	-	-	-	-	<b>P6</b>
		∅ 35	-	●	●	●	-	-	<b>P8</b>
		∅ 40	-	-	-	● <sup>3)</sup>	●	●	<b>P9</b>

### Port for working lines

		045	056	063	080	090	107	
11	SAE flange ports A and B at bottom	●	●	●	●	●	●	<b>11</b>
	SAE flange ports A and B at side, opposite	●	●	●	●	●	●	<b>02</b>
	Threaded ports A and B at side, opposite	○	○	○	-	-	-	<b>05</b>

● = 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)

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

**Valves**

		045	056	063	080	090	107	
12	Without valves	•	•	•	•	•	•	<b>0</b>
	Integrated flushing and boost pressure valve	•	•	•	•	•	•	<b>C</b>
	Flushing flow when: $\Delta p = p_{ND} - p_G = 25$ bar and $v = 10$ mm <sup>2</sup> /s							
	<b>Flushing flow [l/min] / orifice ø [mm]</b>							
	<b>2.6 / 1.0</b>	•	•	•	•	•	•	<b>E</b>
	<b>6.0 / 1.5</b>	•	•	•	•	•	•	<b>F</b>
	<b>7.4 / 1.7</b>	•	•	•	•	•	•	<b>G</b>
	<b>8.5 / 1.8</b>	•	•	•	•	•	•	<b>I</b>
	<b>11.4 / 2.3</b>	•	•	•	•	•	•	<b>J</b>
	<b>12.5 / 3</b>	•	•	•	•	•	•	

**Speed sensor**

13	Without speed sensor	<b>0</b>
	Prepared for DSA sensor	<b>A</b>
	DSA speed sensor mounted	<b>B</b>
	Prepared for DSM sensor (not available for A2FE)	<b>N</b>
	Speed sensor DSM mounted (not available for A2FE)	<b>M</b>

**Special version**

14	Standard version	<b>0</b>
	Long-life bearing <sup>4)</sup>	<b>L</b>
	Special version for slew drives	<b>J</b>

**Standard / special version**

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

• = Available    ◦ = On request    - = Not available

**Notes**

► Note the project planning notes on page 23.

<sup>4)</sup> 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 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-resistant, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC)

### Details regarding the selection of hydraulic fluid

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).

### Note

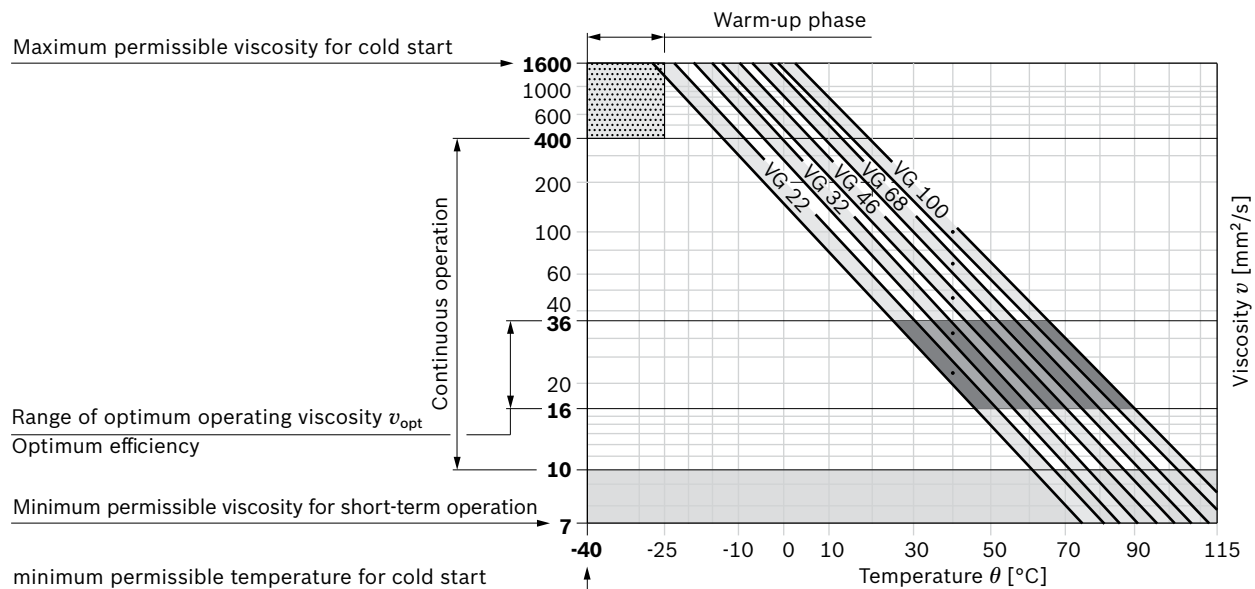
At no point on the component may the temperature be higher than 115 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend the use of a flushing and boost pressure valve (see page 19).

### Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	$v_{max} \leq 1600 \text{ mm}^2/\text{s}$	$\theta_{St} \geq -40 \text{ °C}$	$t \leq 3 \text{ min}$ , $n \leq 1000 \text{ rpm}$ , without load $p \leq 50 \text{ bar}$
Permissible temperature difference		$\Delta T \leq 25 \text{ K}$	between axial piston unit and hydraulic fluid in the system
Warm-up phase	$v < 1600 \text{ to } 400 \text{ mm}^2/\text{s}$	$\theta = -40 \text{ °C to } -25 \text{ °C}$	at $p \leq 0.7 \times p_{nom}$ , $n \leq 0.5 \times n_{nom}$ and $t \leq 15 \text{ min}$
Continuous operation	$v = 400 \text{ to } 10 \text{ mm}^2/\text{s}$		this corresponds, for VG 46 for example, to a temperature range of +5 °C to +85 °C (see selection diagram)
		$\theta = -25 \text{ °C to } +103 \text{ °C}$	measured at port <b>T</b> note the permissible temperature range of the shaft seal ( $\Delta T = \text{approx. } 12 \text{ K}$ between bearing/shaft seal and port <b>T</b> )
	$v_{opt} = 36 \text{ to } 16 \text{ mm}^2/\text{s}$		range of optimum operating viscosity and efficiency
Short-term operation	$v_{min} \geq 7 \text{ mm}^2/\text{s}$		$t < 3 \text{ min}$ , $p < 0.3 \times p_{nom}$

### ▼ 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 very high hydraulic fluid temperatures (90 °C to maximum 103 °C, measured at port **T**), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

**Flow direction**

Direction of rotation, viewed on drive shaft	
clockwise	counter clockwise
<b>A to B</b>	<b>B to A</b>

**Shaft seal**

**Permissible pressure loading**

The service life of the shaft seal is influenced by the speed of the axial piston unit and the leakage pressure in the housing (case pressure). The mean differential pressure of 2 bar between the housing and the ambient pressure may not be enduringly exceeded at normal operating temperature. Momentary pressure peaks ( $t < 0.1$  s) up to 10 bar are allowed. The service life of the shaft seal decreases with increasing frequency of pressure spikes and increasing mean differential pressure.

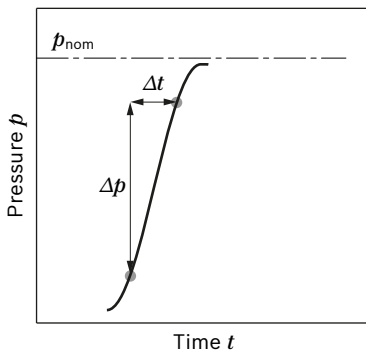
The case pressure must be equal to or higher than the ambient pressure.

The FKM shaft seal ring may be used for leakage temperatures from -25 °C to +115 °C. For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

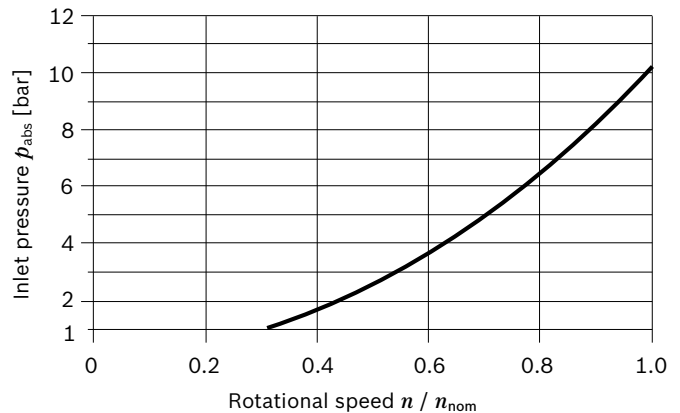
## Working pressure range

Pressure at working port A or B		Definition
Nominal pressure $p_{nom}$	A2FMN, A2FEN	300 bar absolute
	A2FMM, A2FEM	400 bar absolute
	A2FMH, A2FEH	450 bar absolute
Maximum pressure $p_{max}$	A2FMN, A2FEN	350 bar absolute
	A2FMM, A2FEM	450 bar absolute
	A2FMH, A2FEH	500 bar absolute
Single operating period		10 s
Total operating period		300 h
Minimum pressure (high-pressure side)	25 bar absolute	Minimum pressure at the high-pressure side ( <b>A</b> or <b>B</b> ) required to prevent damage to the axial piston unit.
Minimum pressure – pump operating mode (inlet)	see characteristic	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 $p_{Su}$ (pressure <b>A</b> + pressure <b>B</b> )	700 bar absolute	The summation pressure is the sum of the pressures at both work ports ( <b>A</b> and <b>B</b> ).
Rate of pressure change $R_{A\ max}$		Maximum permissible rate of pressure build-up and reduction during a pressure change across the entire pressure range.
with built-in pressure relief valve	9000 bar/s	
without pressure relief valve	16000 bar/s	

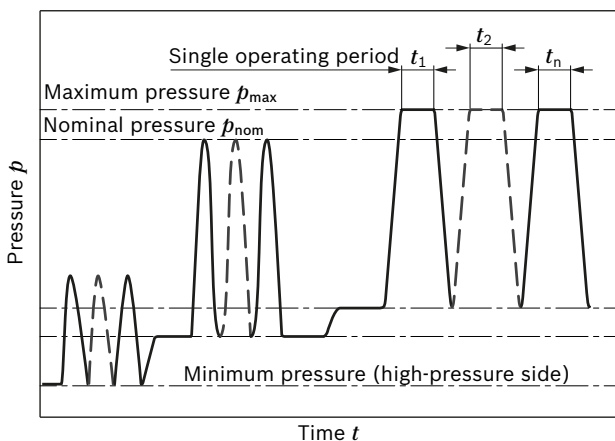
### ▼ Rate of pressure change $R_{A\ max}$



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



### ▼ Pressure definition



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

Please contact us if these conditions cannot be satisfied.

#### Note

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

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

## Technical data

### A2FMN, A2FEN

Size	NG		56	63	80	90	107
Displacement, geometric, per revolution	$V_g$	cm <sup>3</sup>	56.6	63.0	81.7	90.5	108.8
Maximum rotational speed <sup>1)</sup>	$n_{nom}$	rpm	3750	3750	3375	3375	3000
	$n_{max}^{2)}$	rpm	4125	4125	3700	3700	3300
Inlet flow	$q_{v max}$	l/min	210	236	370	270	321
Torque <sup>3)</sup> at $\Delta p = 300$ bar	$T$	Nm	270	301	390	432	519
Rotary stiffness	$c_{min}$	kNm/rad	6.83	8.09	7.94	9.84	10.9
Moment of inertia for rotary group	$J_{TW}$	kgm <sup>2</sup>	0.0032	0.0032	0.0034	0.0054	0.0061
Maximum angular acceleration	$\alpha$	rad/s <sup>2</sup>	10000	12200	19800	4500	6000
Case volume	$V$	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	$m$	kg	17	17	17	23	23

### A2FMM, A2FEM

Size	NG		45	56	63	80	90
Displacement, geometric, per revolution	$V_g$	cm <sup>3</sup>	44.9	56.6	63.0	79.8	90.5
Maximum rotational speed <sup>1)</sup>	$n_{nom}$	rpm	5000	5000	5000	4500	4500
	$n_{max}^{2)}$	rpm	5500	5500	5500	5000	5000
Inlet flow	$q_{v max}$	l/min	225	280	315	360	405
Torque <sup>3)</sup> at $\Delta p = 400$ bar	$T$	Nm	286	360	401	508	576
Rotary stiffness	$c_{min}$	kNm/rad	4.52	6.83	8.09	9.09	9.84
Moment of inertia for rotary group	$J_{TW}$	kgm <sup>2</sup>	0.0032	0.0032	0.0032	0.0058	0.0054
Maximum angular acceleration	$\alpha$	rad/s <sup>2</sup>	5400	9000	11100	4500	4500
Case volume	$V$	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	$m$	kg	17	17	17	23	23

### A2FMH, A2FEH

Size	NG		45	56	63	80	90
Displacement, geometric, per revolution	$V_g$	cm <sup>3</sup>	44.9	56.6	63.0	79.8	90.5
Maximum rotational speed <sup>1)</sup>	$n_{nom}$	rpm	5000	5000	5000	4500	4500
	$n_{max}^{2)}$	rpm	5500	5500	5500	5000	5000
Inlet flow	$q_{v max}$	l/min	225	280	315	360	405
Torque <sup>3)</sup> at $\Delta p = 450$ bar	$T$	Nm	322	405	451	571	648
Rotary stiffness	$c_{min}$	kNm/rad	4.52	6.83	8.09	9.09	9.84
Moment of inertia for rotary group	$J_{TW}$	kgm <sup>2</sup>	0.0032	0.0032	0.0032	0.0058	0.0054
Maximum angular acceleration	$\alpha$	rad/s <sup>2</sup>	5000	8550	10500	4500	4500
Case volume	$V$	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	$m$	kg	17	17	17	23	23

## 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.


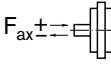
1) The valid values (observing the maximum permissible flow):  
 – to the optimum viscosity range from  $\nu_{opt} = 36$  to 16 mm<sup>2</sup>/s  
 – with hydraulic fluid based on mineral oil

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


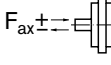
3) Torque without radial force, with radial force see page 8

**Permissible radial and axial forces of the drive shafts**


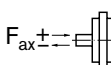
**A2FMN, A2FEN**

Size		NG		Z6/P6	Z8/P8	Z8/P8	Z8/P8	Z9/P9	Z9/P9
				56	56	63	80	90	107
Drive shaft	with splined shaft	$\emptyset$	mm	30	35	35	35	40	40
	with parallel keyed shaft	$\emptyset$	mm	30	35	35	35	40	40
Maximum radial force <sup>1)</sup> at distance a (from shaft collar)		$F_{q \max}$	kN	7.1	6.1	6.9	8.7	8.6	10.4
		a	mm	18	18	18	18	20	20
Maximum torque at $F_{q \max}$		$T_{q \max}$	Nm	267	267	301	382	430	519
Maximum differential pressure at $F_{q \max}$		$\Delta p_{q \max}$	bar	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
		$- F_{ax \max}$	N	800	800	800	800	1000	1000
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm}/\text{bar}}$	N/bar	8.7	8.7	8.7	8.7	10.6	10.6

**A2FMM, A2FEM**

Size		NG		Z6/P6	Z6/P6	Z8/P8	Z8/P8	Z8/P8	Z9/P9	Z9/P9
				45	56	56	63	80	80	90
Drive shaft	with splined shaft	$\emptyset$	mm	30	30	35	35	35	40	40
	with parallel keyed shaft	$\emptyset$	mm	30	30	35	35	35	40	40
Maximum radial force <sup>1)</sup> at distance a (from shaft collar)		$F_{q \max}$	kN	7.6	9.5	8.1	9.2	11.6	10.2	11.5
		a	mm	18	18	18	18	20	20	20
Maximum torque at $F_{q \max}$		$T_{q \max}$	Nm	286	357	357	401	509	509	573
Maximum differential pressure at $F_{q \max}$		$\Delta p_{q \max}$	bar	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
		$- F_{ax \max}$	N	800	800	800	800	1000	1000	1000
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm}/\text{bar}}$	N/bar	8.7	8.7	8.7	8.7	10.6	10.6	10.6

**A2FMH, A2FEH**

Size		NG		Z6/P6	P6	Z8/P8	Z8/P8	Z8/P8	Z9/P9	Z9/P9
				45	56	56	63	80	80	90
Drive shaft	with splined shaft	$\emptyset$	mm	30	-	35	35	35	40	40
	with parallel keyed shaft	$\emptyset$	mm	30	30	35	35	35	40	40
Maximum radial force <sup>1)</sup> at distance a (from shaft collar)		$F_{q \max}$	kN	8.6	10.7	9.2	10.3	13.1	10.2	11.5
		a	mm	18	18	18	18	20	20	20
Maximum torque at $F_{q \max}$		$T_{q \max}$	Nm	322	401	401	451	573	573	645
Maximum differential pressure at $F_{q \max}$		$\Delta p_{q \max}$	bar	450	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	0
		$- F_{ax \max}$	N	800	800	800	800	1000	1000	1000
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm}/\text{bar}}$	N/bar	8.7	8.7	8.7	8.7	10.6	10.6	10.6

1) With intermittent operation



Calculation of 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 <sup>3</sup> ]	
	$\Delta p$	= Differential pressure [bar]	
	$n$	= Rotational speed [rpm]	
	$\eta_v$	= Volumetric efficiency	
	$\eta_{mh}$	= Mechanical-hydraulic efficiency	
	$\eta_t$	= Total efficiency ( $\eta_t = \eta_v \times \eta_{mh}$ )	

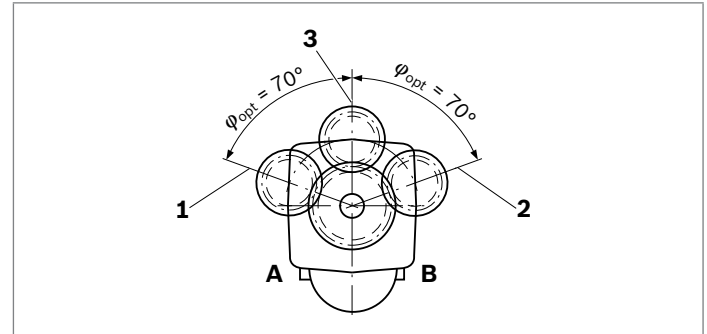
**Notes**

- ▶ 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 permissible axial force in direction  $-F_{ax}$  is to be avoided as the lifetime of the bearing is reduced.
- ▶ Special requirements apply in the case of belt drives. 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:

▼ **Gear output drive**



- 1 “Counter-clockwise” rotation Pressure at port **B**
- 2 “Clockwise” rotation Pressure at port **A**
- 3 “Alternating” direction of rotation

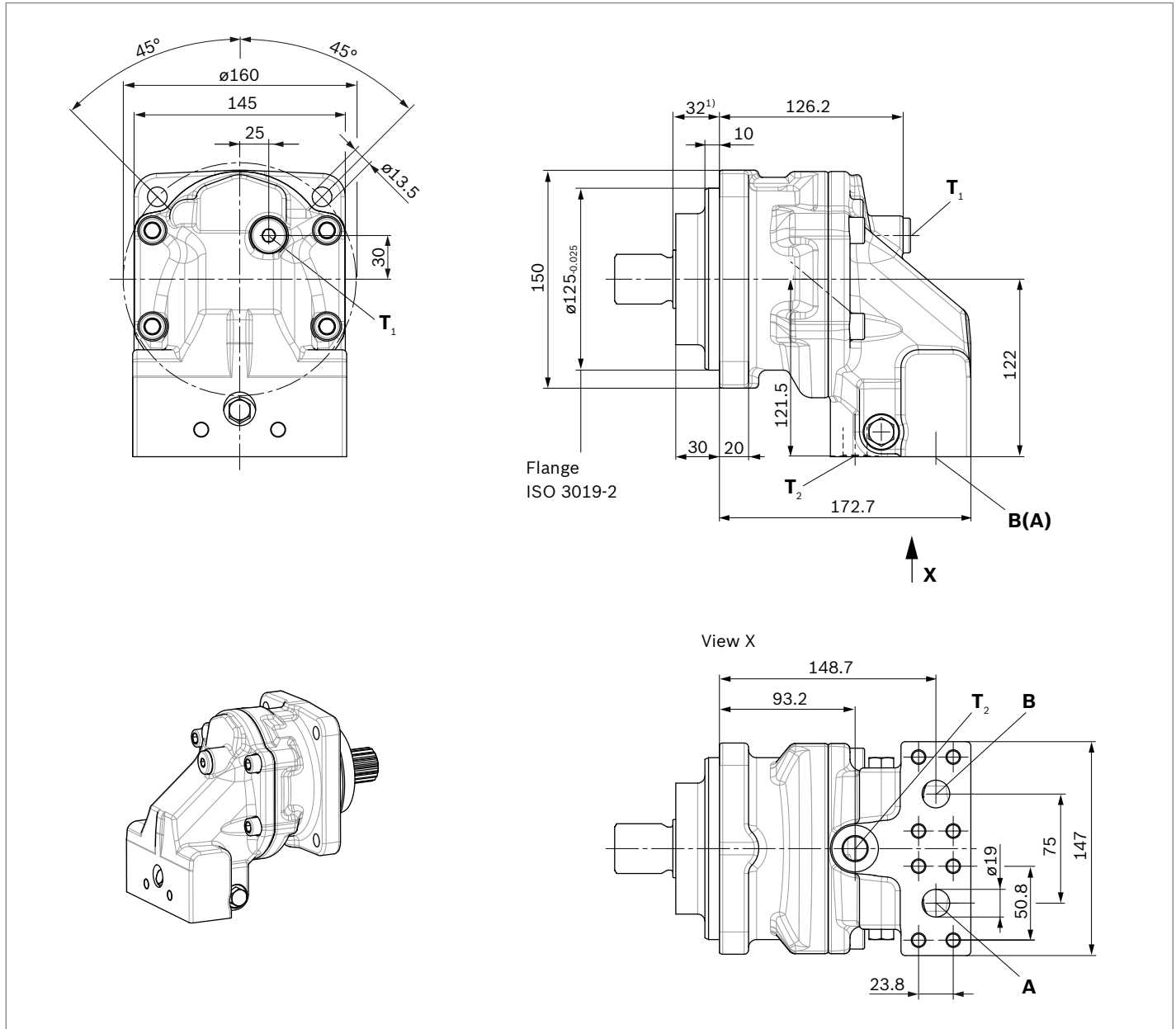
w

## A2FM dimensions, SAE flange ports at bottom

**A2FMN sizes 56, 63 and 80**

**A2FMM sizes 45, 56 and 63**

**A2FMH sizes 45, 56 and 63**



Ports		Standard	Size <sup>2)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
<b>T<sub>1</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

1) To shaft collar

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

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

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected  
(see also installation instructions on page 21).

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

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

X = Plugged (in normal operation)

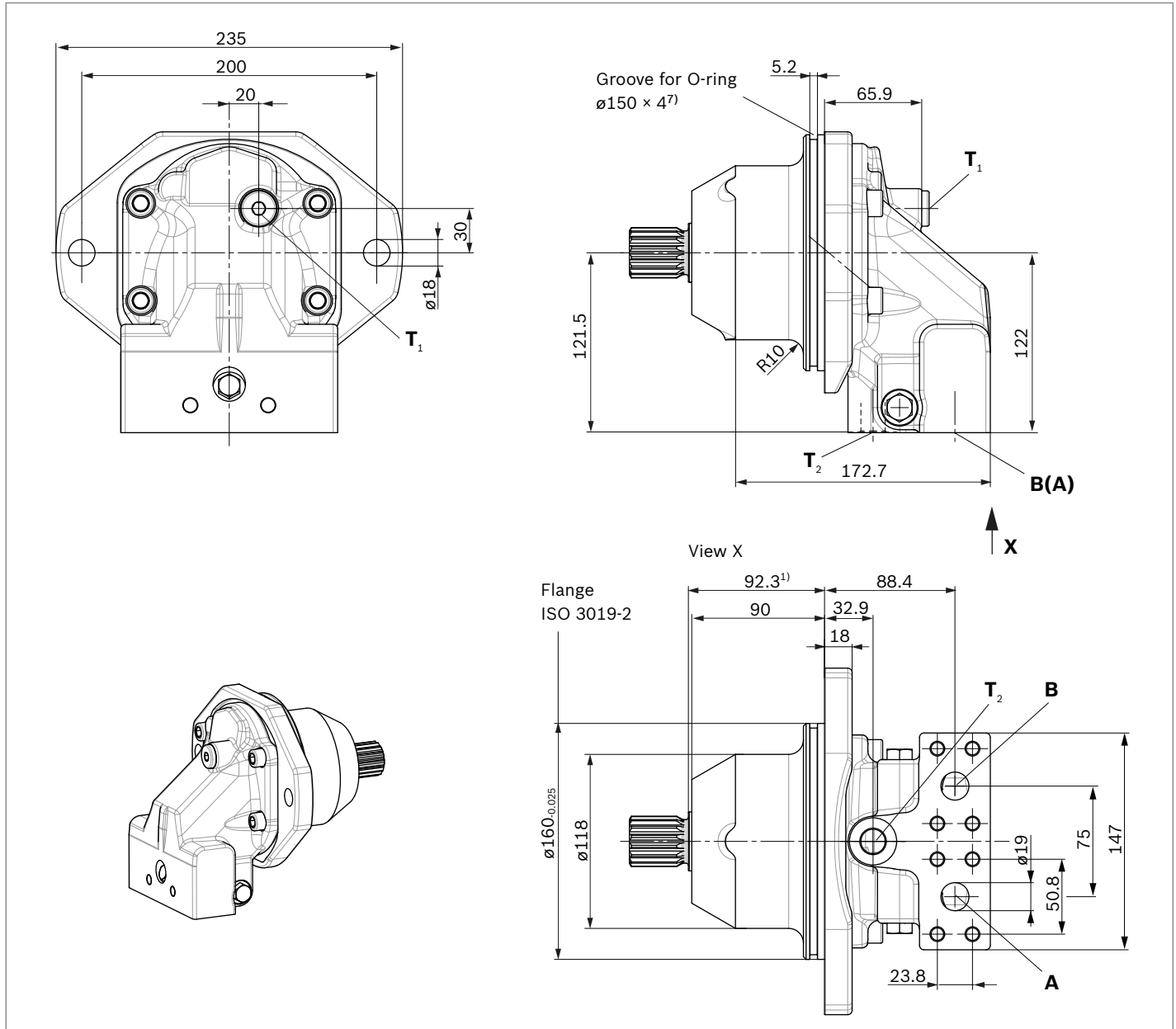


## A2FE dimensions, SAE flange ports at bottom

**A2FEN sizes 56, 63 and 80**

**A2FEM sizes 45, 56 and 63**

**A2FEH sizes 45, 56 and 63**



Ports		Standard	Size <sup>2)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
<b>T<sub>1</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

- 1) To shaft collar
- 2) For notes on tightening torques, see instruction manual.
- 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
- 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

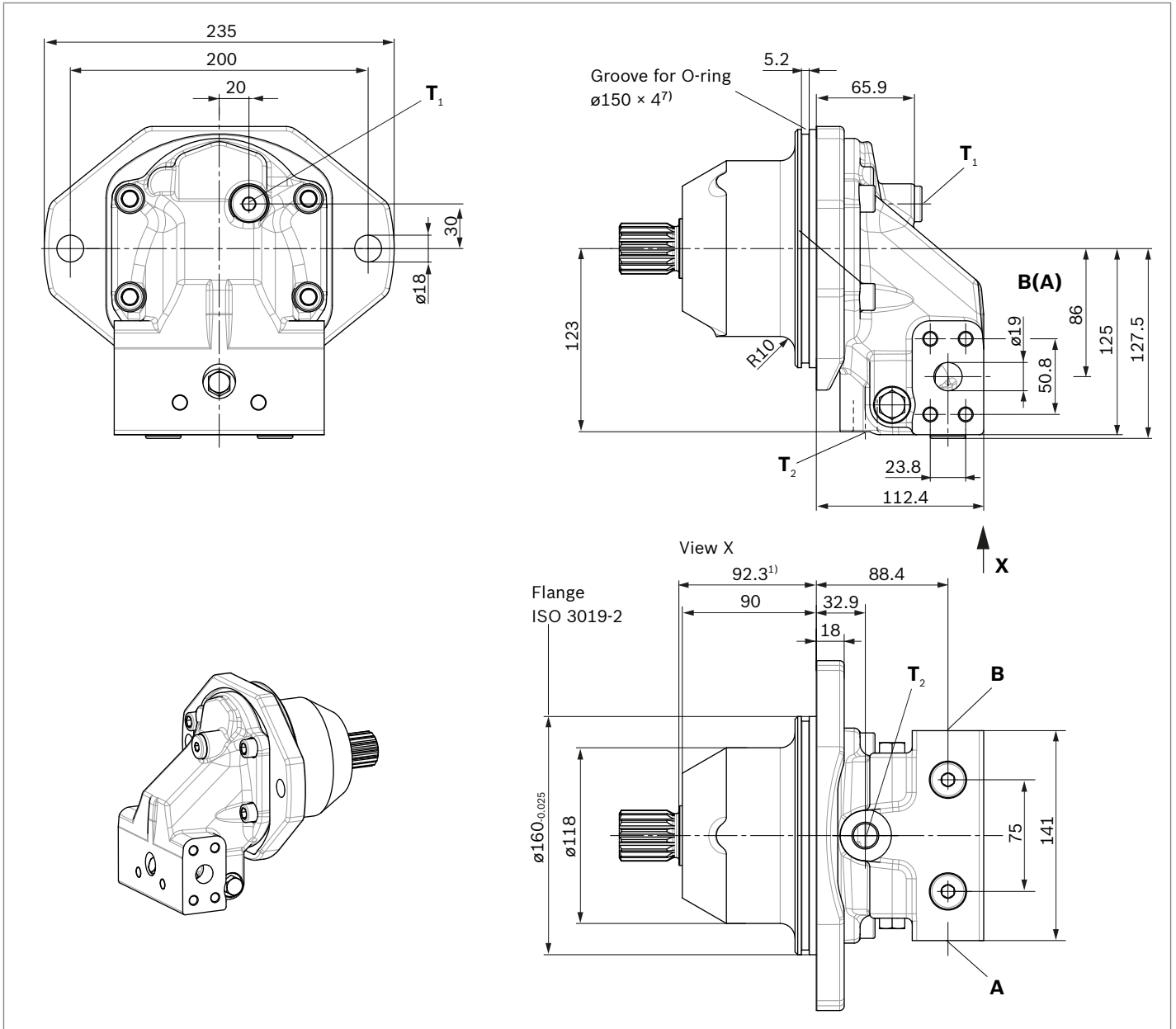
- 5) The spot face can be deeper than as specified in the standard
- 6) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)
- 7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601553.

**A2FE dimensions, SAE flange ports at side**

**A2FEN sizes 56, 63 and 80**

**A2FEM sizes 45, 56 and 63**

**A2FEH sizes 45, 56 and 63**



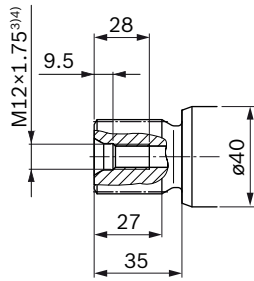
Ports	Standard	Size <sup>2)</sup>	$p_{max abs}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
<b>T<sub>1</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

1) To shaft collar  
 2) For notes on tightening torques, see instruction manual.  
 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.  
 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

5) The spot face can be deeper than as specified in the standard  
 6) O = Must be connected (plugged on delivery)  
 X = Plugged (in normal operation)  
 7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601553.

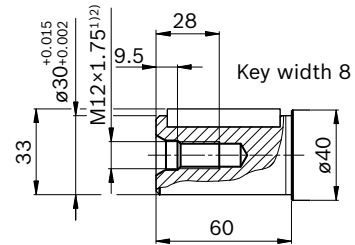
▼ **Splined shaft DIN 5480,**  
**sizes 45 and 56**

**Z6** – W30×2×14×9g



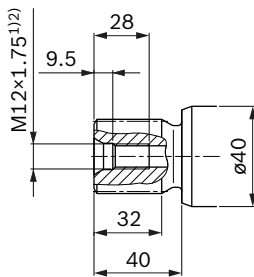
▼ **Parallel keyed shaft, DIN 6885,**  
**sizes 45 and 56**

**P6** – AS8×7×50



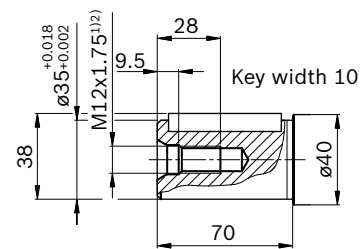
▼ **Splined shaft DIN 5480,**  
**sizes 56, 63 and 80**

**Z8** – W35×2×16×9g



▼ **Parallel keyed shaft, DIN 6885,**  
**sizes 56, 63 and 80**

**P8** – AS10×8×56



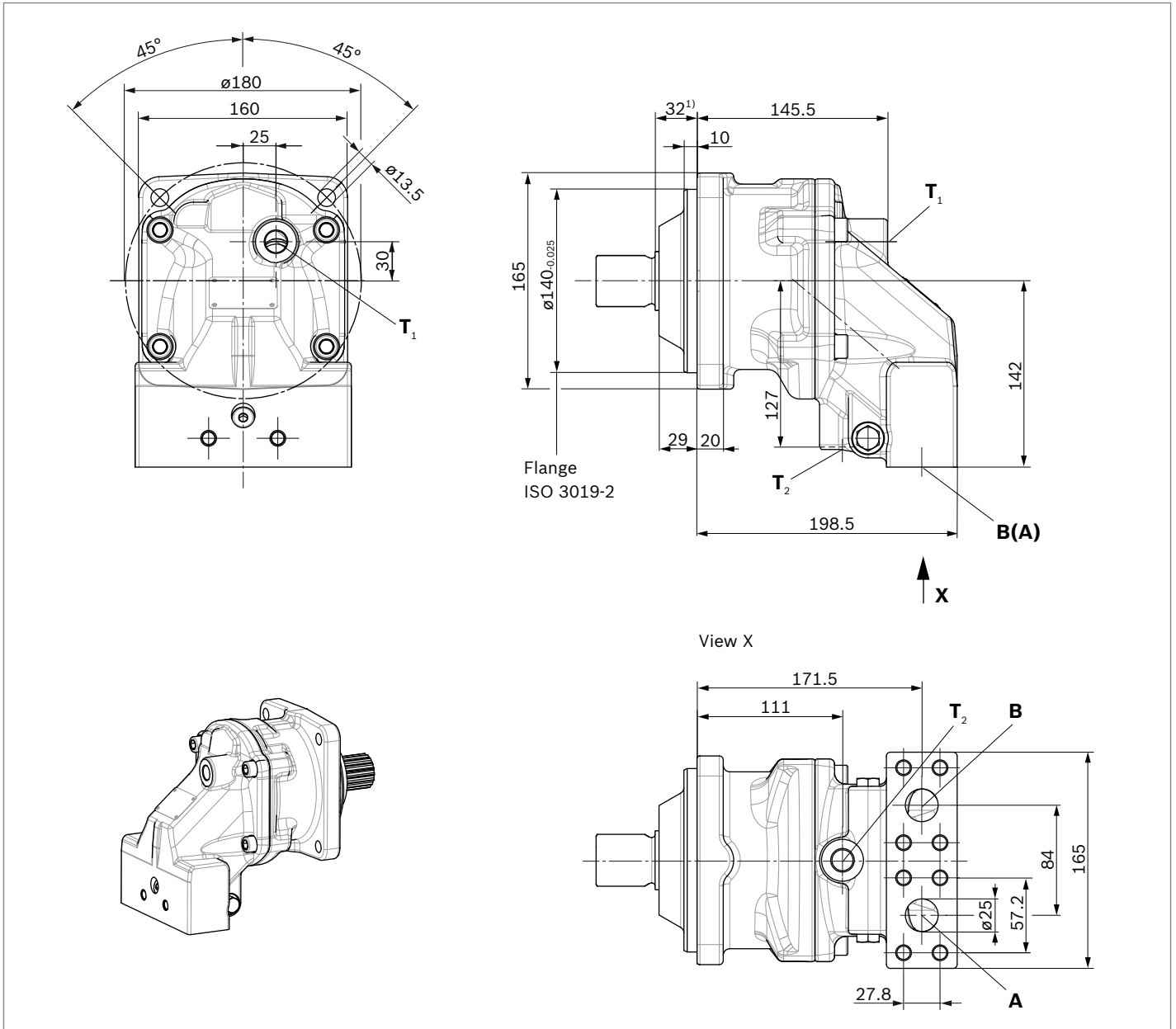
1) Center bore according to DIN 332 (thread according to DIN 13)  
 2) For notes on tightening torques, see instruction manual.

**A2FM dimensions, SAE flange ports at bottom**

**A2FMN sizes 90 and 107**

**A2FMM sizes 80 and 90**

**A2FMH sizes 80 and 90**



Ports		Standard	Size <sup>2)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
<b>T<sub>1</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

- 1) To shaft collar
- 2) For notes on tightening torques, see instruction manual.
- 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
- 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

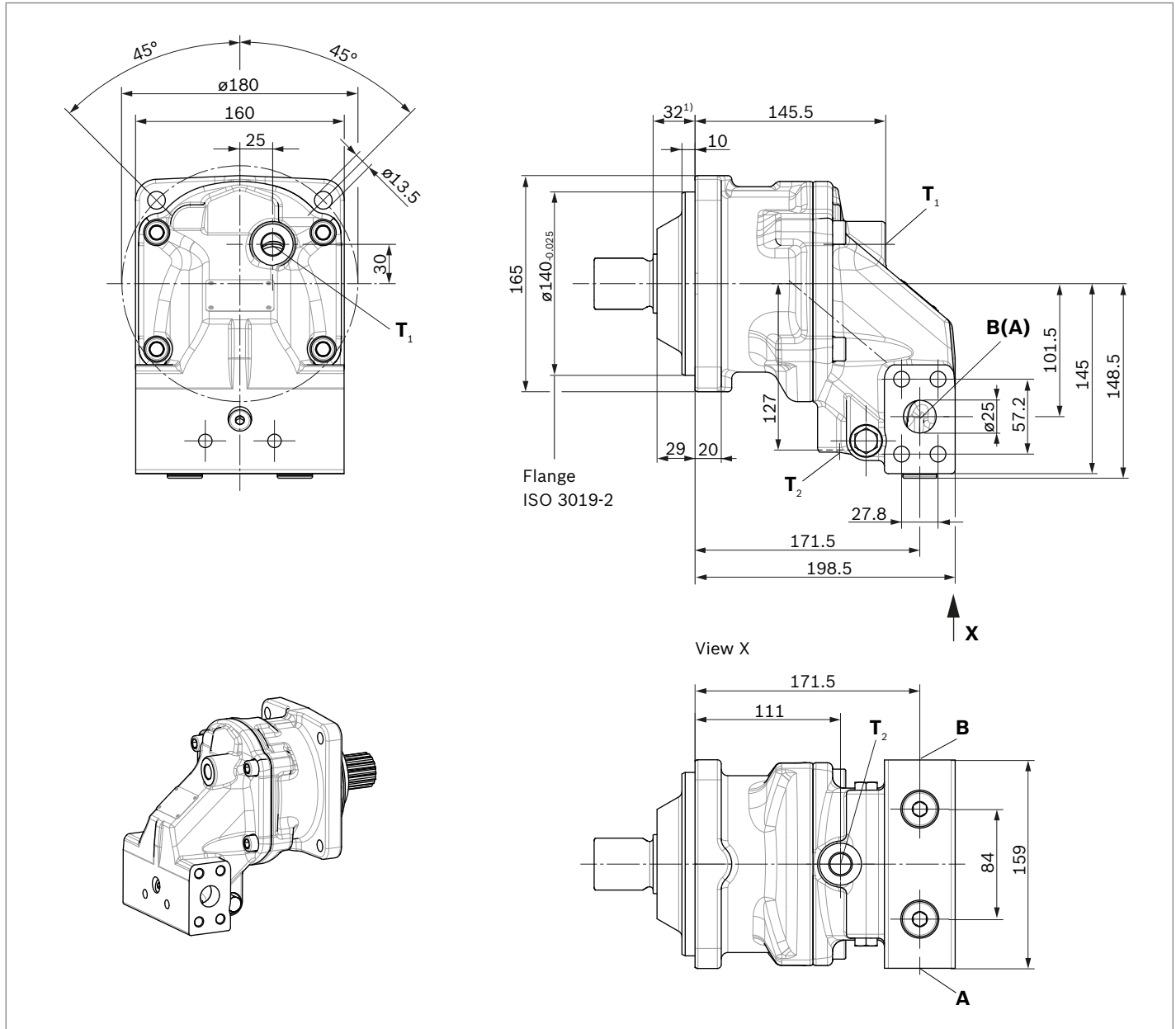
- 5) The spot face can be deeper than as specified in the standard
- 6) O = Must be connected (plugged on delivery)  
 X = Plugged (in normal operation)

## A2FM dimensions, SAE flange ports at side

**A2FMN sizes 90 and 107**

**A2FMM sizes 80 and 90**

**A2FMH sizes 80 and 90**



Ports	Standard	Size <sup>2)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
<b>T<sub>1</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

- 1) To shaft collar
- 2) For notes on tightening torques, see instruction manual.
- 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
- 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

- 5) The spot face can be deeper than as specified in the standard
- 6) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)

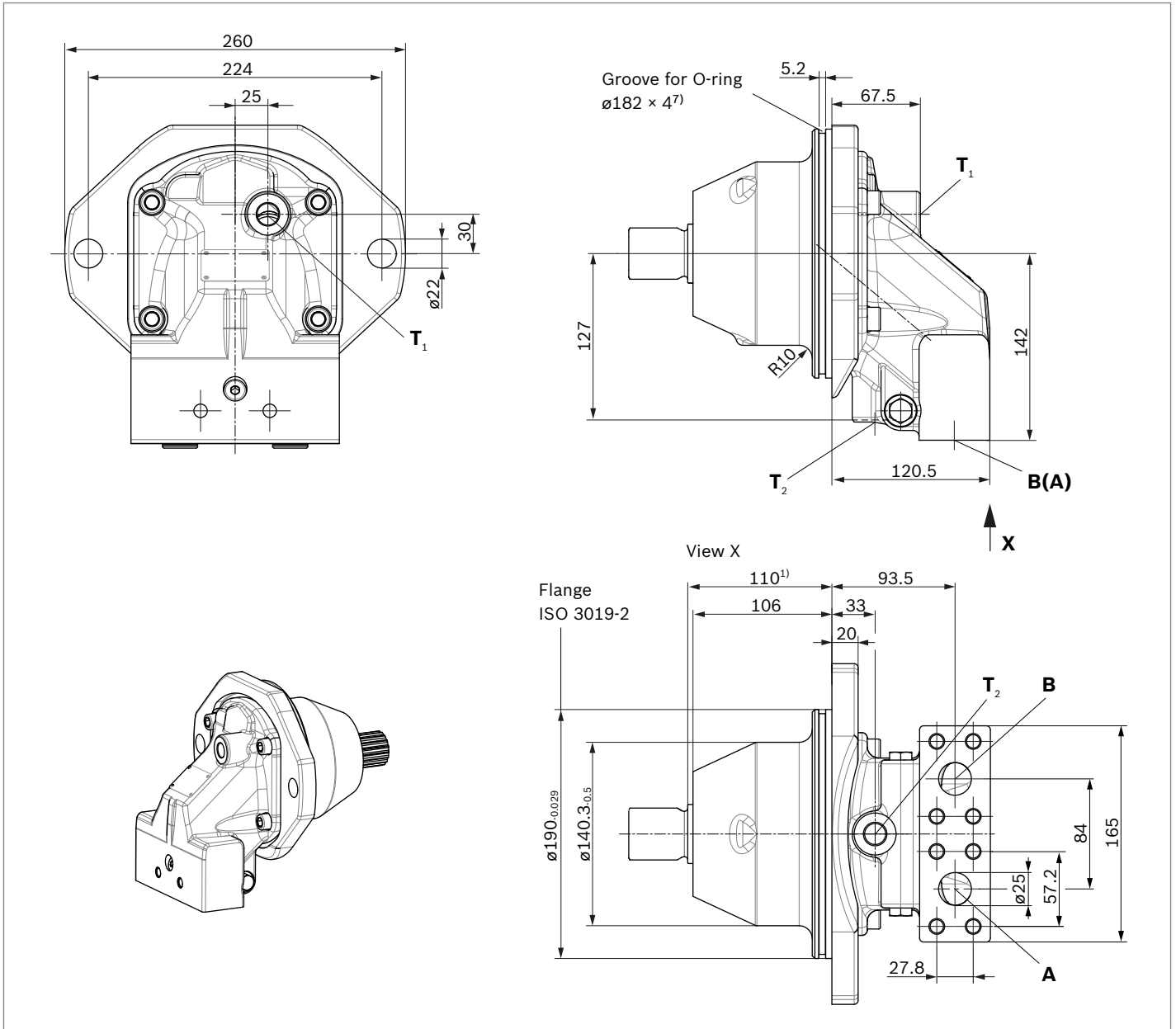


**A2FE dimensions, SAE flange ports at bottom**

**A2FEN sizes 90 and 107**

**A2FEM sizes 80 and 90**

**A2FEH sizes 80 and 90**



Ports		Standard	Size <sup>2)</sup>	$p_{max\ abs}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
<b>T<sub>1</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	Drain port	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

- 1) To shaft collar
- 2) For notes on tightening torques, see instruction manual.
- 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
- 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

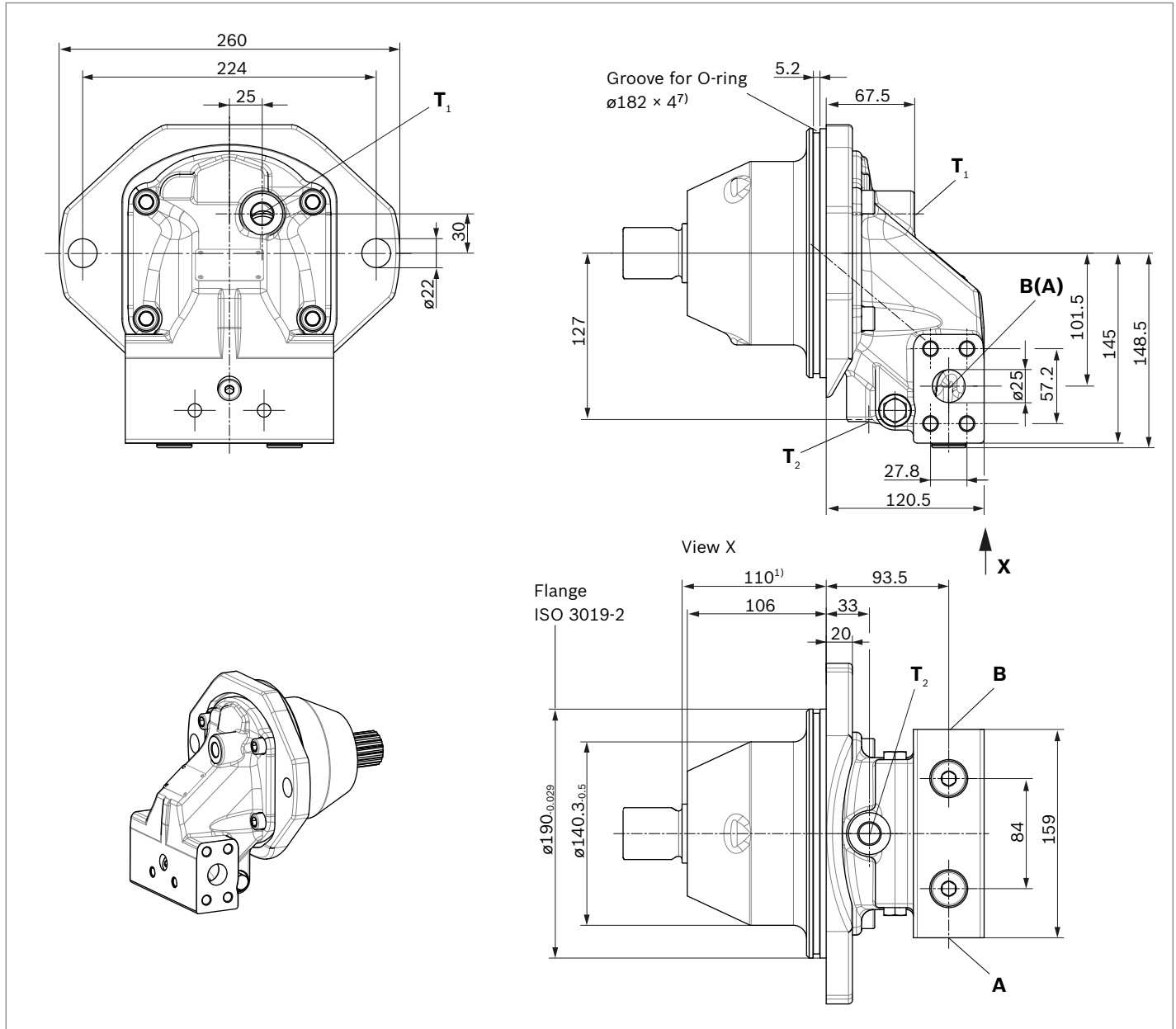
- 5) The spot face can be deeper than as specified in the standard
- 6) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)
- 7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601554.

## A2FE dimensions, SAE flange ports at side

**A2FEN sizes 90 and 107**

**A2FEM sizes 80 and 90**

**A2FEH sizes 80 and 90**



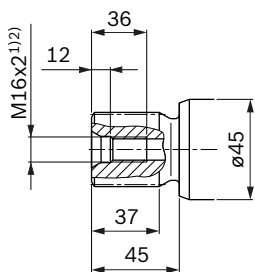
Ports	Standard	Size <sup>2)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>3)</sup>	Status <sup>6)</sup>
<b>A, B</b>	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
<b>T<sub>1</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	X <sup>4)</sup>
<b>T<sub>2</sub></b>	DIN 3852 <sup>5)</sup>	M18 × 1.5; 12 deep	3	O <sup>4)</sup>

- 1) To shaft collar
- 2) For notes on tightening torques, see instruction manual.
- 3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
- 4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on page 21).

- 5) The spot face can be deeper than as specified in the standard.
- 6) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)
- 7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601554.

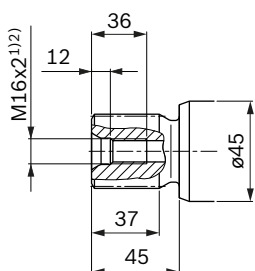
▼ **Splined shaft DIN 5480, size 80**

**Z8** – W35×2×16×9g



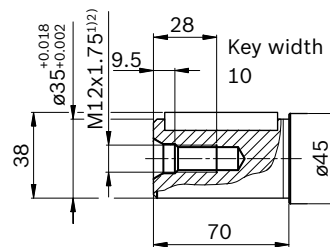
▼ **Splined shaft DIN 5480, sizes 80, 90 and 107**

**Z9** – W40×2×18×9g



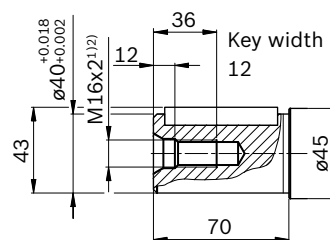
▼ **Parallel keyed shaft, DIN 6885, size 80**

**P8** – AS10×8×56



▼ **Parallel keyed shaft, DIN 6885, sizes 80, 90 and 107**

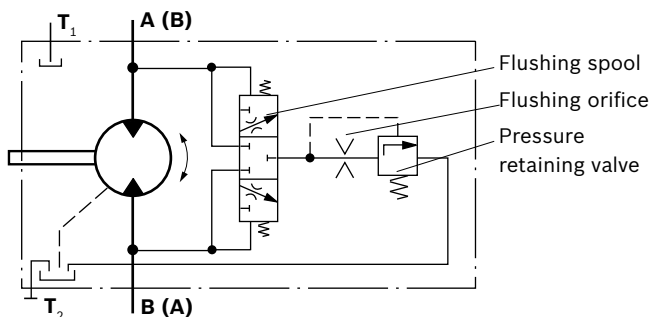
**P9** – AS12×8×56



**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 case flushing and safeguarding the minimum boost pressure. Hydraulic fluid is directed from the respective low pressure side into the motor case. This is then fed into the reservoir, together with the leakage. The hydraulic fluid removed from the closed circuit must be replaced by cooled hydraulic fluid from the boost pump.

**Circuit diagram**



**Cracking pressure of pressure retaining valve**

(observe when setting the primary valve)  
 ► Sizes 45 to 107(N), fixed setting 16 bar

**Switching pressure of flushing spool**

► Sizes 45 to 107(N)  $\Delta p = 8 \pm 1$  bar

**Flushing flow**

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 and  $v = 10$  mm<sup>2</sup>/s  
 ( $p_{ND}$  = low pressure,  $p_G$  = case pressure)

Size	Throttle $\varnothing$ [mm]	Flushing flow $q_v$ [l/min]
45, 56, 63, 80, 90, 107(N)	1.0	2.6
	1.5	6
	1.7	7.4
	1.8	8.5
	2.3	11.4
	3	12.5

1) Center bore according to DIN 332 (thread according to DIN 13)  
 2) For notes on tightening torques, see instruction manual.

## Speed sensors DSA and DSM

The versions A2F...A and A2F...N (“prepared for speed sensor”, i.e. without sensor) is equipped with splines on the rotary group.

A signal proportional to motor speed can be generated with the fitted DSA/DSM speed sensor. The DSA/DSM sensor registers the speed and direction of rotation.

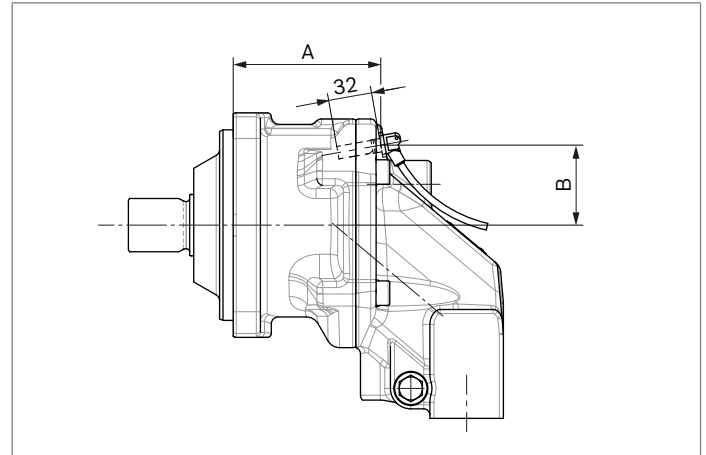
Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95133 – DSA and 95132 – DSM.

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.

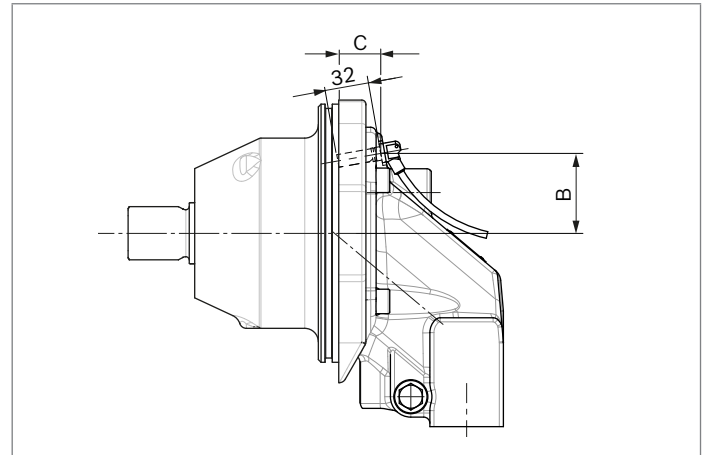
Size	A2FM/H	45, 65, 63	80, 90
	A2FN	56, 63, 80	90, 107
Number of teeth		47	53
Dimensions	A	96.6	108.4
	B	54.6	58.8
	C	36.3	30.4
	D	70.3	75
	E	94,8	99,5
	F	61.2	72.6

### Dimensions

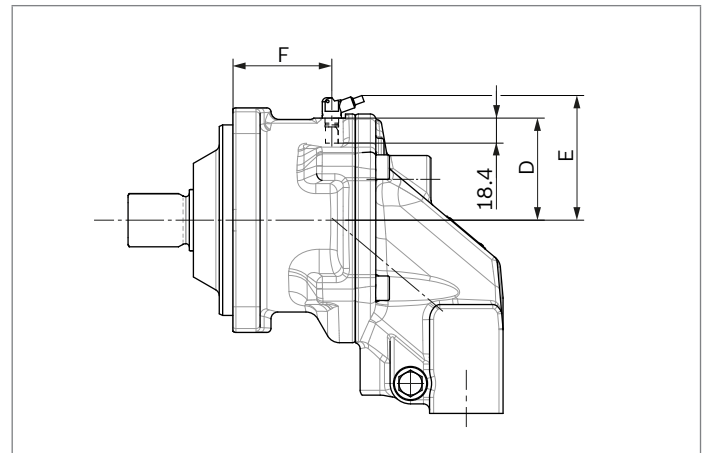
#### ▼ Version “B” A2FM with speed sensor DSA mounted



#### ▼ Version “B” A2FE with speed sensor DSA mounted



#### ▼ Version “M” A2FM with speed sensor DSM mounted



## 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 (**T<sub>1</sub>**, **T<sub>2</sub>**).

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

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

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

### Note

- ▶ 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

<b>F</b>	Filling / air bleeding Note: F is part of the external piping
<b>R</b>	Air bleed port (special version)
<b>T<sub>1</sub>, T<sub>2</sub></b>	Drain port
<b>h<sub>t min</sub></b>	Minimum required immersion depth (200 mm)
<b>h<sub>min</sub></b>	Minimum required distance to reservoir base (100 mm)

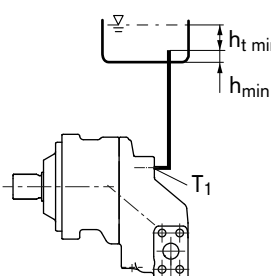
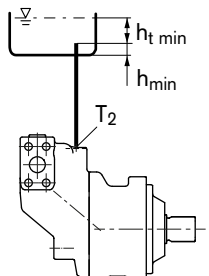
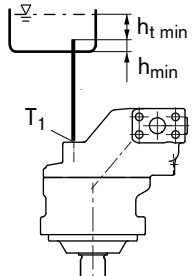
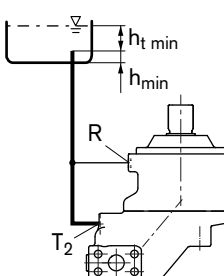
### Installation position

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

Additional installation positions are possible upon request.  
Recommended installation position: **1** and **2**

### Below-reservoir installation (standard)

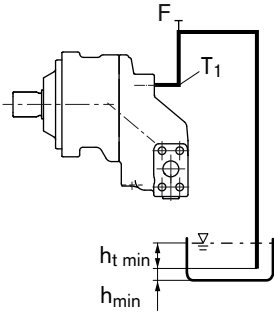
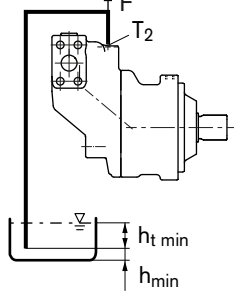
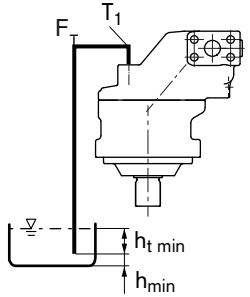
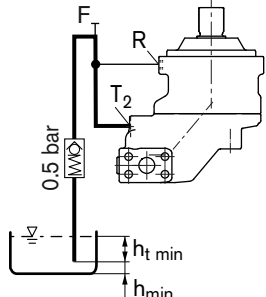
Below-reservoir installation is when the axial piston unit is installed outside of the reservoir and below the minimum fluid level.

Installation position	Air bleeding	Filling
<b>1</b> 	–	<b>T<sub>1</sub></b>
<b>2</b> 	–	<b>T<sub>2</sub></b>
<b>3</b> 	–	<b>T<sub>1</sub></b>
<b>4</b> 	<b>R</b>	<b>T<sub>2</sub></b>

**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 housing area.

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

Installation position	Air bleeding	Filling
<p><b>5</b></p> 	<b>F</b>	<b>T<sub>1</sub> (F)</b>
<p><b>6</b></p> 	<b>F</b>	<b>T<sub>2</sub> (F)</b>
<p><b>7</b></p> 	<b>F</b>	<b>T<sub>1</sub> (F)</b>
<p><b>8</b></p> 	<b>R</b>	<b>T<sub>2</sub> (F)</b>

## Project planning notes

- ▶ The motor A2FM/A2FE 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, please request a binding installation drawing.
- ▶ The specified data and notes must be observed.
- ▶ Depending on the operating state of the axial piston unit (working pressure, fluid temperature), the characteristic may shift.
- ▶ Not all variants of the product are approved for use in safety functions 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.
- ▶ Working ports:
  - The ports and fixing threads are designed for the specified peak pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, volume flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports can only be used to accommodate hydraulic lines.
- ▶ Preservation: Our axial piston units are supplied as standard with protection to preserve them 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 periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.

## 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).

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