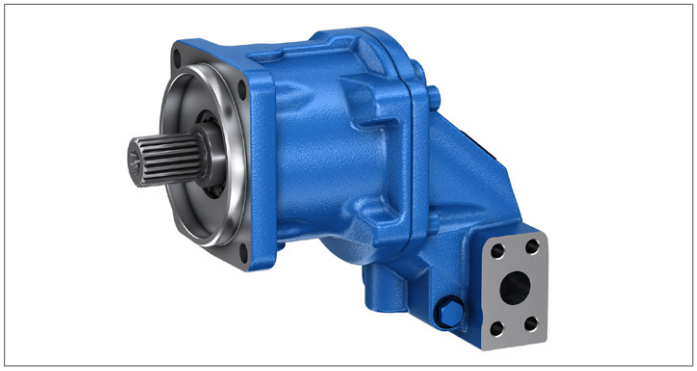
RE-A 91071/2022-07-27
Replaces: 2021-01-15

rexroth
A Bosch Company

Axial piston fixed motor A2FM Series 70

Americas



- A2FMN (Sizes 28 to 107):
  Nominal pressure 4350 psi (300 bar)
  Maximum pressure 5100 psi (350 bar)
- A2FMM (Sizes 23 to 180):
  Nominal pressure 5800 psi (400 bar)
  Maximum pressure 6500 psi (450 bar)
- A2FMH (Sizes 45 to 125):
  Nominal pressure 6500 psi (450 bar)
  Maximum pressure 7250 psi (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
- Design with SAE mounting flange and UNF resp. UNC threads
- Also available as plug-in version and with metric threads
- 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 – compact design
- High total efficiency
- Good starting efficiency
- Integrated flushing valve optional

Contents

Values in the US customary unit system are converted and rounded values. In case of doubt, only metric values are valid.

Type code

01	02	03	04		05	06	07	08	09	10	11	12	13	14		15
A2F	**M**			**/**	**70**	**C**	**W**	**V**						**0**	–	

Axial piston unit

01	Bent-axis design, fixed displacement	**A2F**

Operating mode

02	Motor, standard version	**M**

Pressure range		**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
03	Nominal pressure: 4350 psi (300 bar) Maximum pressure: 5100 psi (350 bar)	–	●	●	●	●	●	●	●	●	●	–	–	–	**N**
	Nominal pressure: 5800 psi (400 bar) Maximum pressure: 6500 psi (450 bar)	●	●	●	–	●	●	●	●	●	●	●	●	●	**M**
	Nominal pressure: 6500 psi (450 bar) Maximum pressure: 7250 psi (500 bar)	–	–	–	–	●	●	●	●	●	●	●	–	–	**H**

Size (NG)

04	Geometrical displacement, see technical data on page 8	**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	

Series

05	Series 7, index 0	**70**

Version of port and fastening threads

06	Ports with O-ring seal based on ISO 11926 (ANSI), metric fastening thread according to DIN 13	**C**

Direction of rotation

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

Sealing material

08	FKM (fluorcarbon rubber)	**V**

Mounting flange			**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
09	SAE J744	101-2	●	●	●	●	●[1)]	–	–	–	–	–	–	–	–	**B2**
		127-4	●	●	●	●	●	●	●	●	●	●	●	–	–	**C4**
		152-4	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**D4**

Drive shaft			**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
10	Splined shaft SAE J744 (ANSI B92.1a)	1 1/4 in 14T 12/24 DP	●	●	●	●	●	●[2)]	●[2)]	●[2)]	●[2)]	●[1)]	–	–	–	**S7**
		1 3/8 in 21T 16/32 DP	–	–	–	–	–	●	●	●	●[2)]	●[1)]	–	–	–	**V8**
		1 1/2 in 23T 16/32DP	–	–	–	–	–	–	–	–	–	●[3)]	●[2)]	–	–	**V9**
		1 3/4 in 13T 8/16 DP	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●[13)]	**T1**
	Parallel keyed shaft DIN 6885	ø 25	●	●	●	–	–	–	–	–	–	–	–	–	–	**P5**
		ø 30	●	●	●	●	●	●	–	–	–	–	–	–	–	**P6**
		ø 35	–	–	–	–	–	●	●	●	–	–	–	–	–	**P8**
		ø 40	–	–	–	–	–	–	–	●[3)]	●	●	–	–	–	**P9**
		ø 45	–	–	–	–	–	–	–	–	–	●[3)]	●	●	–	**B1**
		ø 50	–	–	–	–	–	–	–	–	–	–	–	●	●	**B2**

● = Available ○ = On request – = Not available ▲ = Phase out

01	02	03	04		05	06	07	08	09	10	11	12	13	14		15
A2F	**M**			**/**	**70**	**C**	**W**	**V**						**0**	–	

Working port			**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
11	SAE working ports **A** and **B** at bottom		●	●	●	●	●	●	●	●	●	●	●	●	●	**11**
	SAE working ports **A** and **B**, 1× at side and 1× at bottom[1)14)]		–	–	–	–	–	●	●	●	–	–	–	–	–	**12**
	SAE working ports **A** and **B** at rear		●	●	●	●	●	●	●	●	●	●	●	●	●	**01**
	SAE working ports **A** and **B** at side, opposite		●	●	●	●	●	●	●	●	●	●	●	●	●	**02**
	Threaded ports **A** and **B** at side and at rear[4)]		●	●	●	●	●	●	●	●[1)]	–	–	–	–	–	**03**
	Threaded ports **A** and **B** at side, opposite[4)]		●	●	●	●	●[1)]	–	–	–	–	–	–	–	–	**05**
	Version with pressure relief valves for mounting a counterbalance valve BVD/20[2)3)10)12)]		–	–	–	–	●	●	●	●	●	●	●	–	–	**07**
	Version with pressure relief valves for mounting a counterbalance valve BVD/BVE25[2)3)10)12)]		–	–	–	–	–	–	–	–	–	●	●	–	–	**08**
	Version with pressure relief valves[2)3)11)12)]		–	–	–	–	●	●	●	●	●	●	●	–	–	**09**

Valves			**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
12	Without valves		●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	With check valve, only for clockwise or counterclockwise rotation[1)6)]		●	●	●	●	●	●	●	●	●	●	–	–	–	**U**
	Integrated flushing and boost-pressure valve Flushing flow when: $\Delta p = p_{ND} - p_G$ = 365 psi (25 bar) and ν = 10 cSt	**Flushing flow [gpm (l/min)]** **0.69 (2.6)**	●	●	●	●	●	●	●	●	●	–	–	–	–	**C**
		1.06 (4.0)	●	●	●	●	●	●	●	●	●	●	●	●	●	**D**
		1.58 (6.0)	●	●	●	●	●	●	●	●	●	●	●	●	●	**E**
		1.95 (7.4)	●	●	●	●	●	●	●	●	●	●[1)]	–	–	–	**F**
		2.25 (8.5)	●	●	●	●	●	●	●	●	●	●	●	●	●	**G**
		2.64 (10.0)	●	●	●	●	●	●	●	●	●	●	●	●	●	**H**
		3.01 (11.4)	●	●	●	●	●	●	●	●	●	–	–	–	–	**I**
		3.30 (12.5)	●	●	●	●	●	●	●	●	●	–	–	–	–	**J**
		3.96 (15)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**K**
		4.75 (18)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**L**
		5.55 (21)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**M**
		7.13 (27)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**N**
		8.19 (31)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**O**
		9.77 (37)	–	–	–	–	–	–	–	–	–	●[3)]	●	●	●	**P**
	Pressure relief valves (without pressure sequencing stage)[2)3)7)]		–	–	–	–	●	●	●	●	●	●	●	–	–	**R**
	Pressure relief valves (with pressure sequencing stage)[2)3)7)]		–	–	–	–	●	●	●	●	●	●	●	–	–	**S**
	Counterbalance valve BVD mounted[2)3)8)9)]		–	–	–	–	●	●	●	●	●	●	●	–	–	**W**

● = Available ○ = On request – = Not available ▲ = Phase out

1) Only available for A2FMN (pressure range 300 to 350 bar)
2) Not available for A2FMH (pressure range 450 to 500 bar)
3) Not available for A2FMN (pressure range 300 to 350 bar)
4) Only with type code "A" (Ports based on ISO 11926 with O-ring seal (ANSI), fastening thread according to ASME B1.1) at position 06 "Design of ports and fastening threads"
5) Type code version “L” not available in combination with A2FMH since in the case of pressure range “H” the long-life bearing is already included in the standard version (type code designation “0”).
6) only in combination with working ports 11 or 12
7) only in combination with working ports 09
8) only in combination with working ports 07 or 08
9) Type code for counterbalance valve to be quoted separately in accordance with data sheet 95522 (BVD) and 95526 (BVE)
10) Only in combination with mounted counterbalance valve (valve design W)
11) Only in combination with pressure relief valve (valve designs R or S)
12) Only with metric ports according to DIN 3852 with profile sealing ring, metric fastening thread according to DIN 13
13) Restricted data
14) Only in combination with check valve (valve design U)
15) Specify ordering code of sensor according to data sheet 95131 (DST) respectively data sheet 95126 (DSA/20) separately.

01	02	03	04		05	06	07	08	09	10	11	12	13	14		15
A2F	**M**			**/**	**70**	**C**	**W**	**V**						**0**	–	

Speed sensor		**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
13	Without speed sensor	●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	Prepared for DSA/20 or DST sensor	●	●	●	●	●	●	●	●	●	●	●	●	●	**W**
	Speed sensor DSA/20 mounted[15)]	●	●	●	●	●	●	●	●	●	●	●	●	●	**C**
	Speed sensor DST mounted[15)]	●	●	●	●	●	●	●	●	●	●	●	●	●	**E**

Special version		**023**	**028**	**032**	**037**	**045**	**056**	**063**	**080**	**090**	**107**	**125**	**160**	**180**	
14	Standard version	●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	Long-life bearing[5)]	–	–	–	–	●[3)]	●	●	●	●	●	●	●	●	**L**
	Special version for slew drives	●	●	●	●	●	●	●	●	●	●	●	●	●	**J**[2)]

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 ▲ = Phase out

Information

- ▶ Note the project planning notes on page 59
- ▶ Please note that not all type code combinations are available although the individual functions are marked as being available

1) Only available for A2FMN (pressure range 300 to 350 bar)
2) Not available for A2FMH (pressure range 450 to 500 bar)
3) Not available for A2FMN (pressure range 300 to 350 bar)
4) Only with type code "A" (Ports based on ISO 11926 with O-ring seal (ANSI), fastening thread according to ASME B1.1) at position 06 "Design of ports and fastening threads"
5) Type code version “L” not available in combination with A2FMH since in the case of pressure range “H” the long-life bearing is already included in the standard version (type code designation “0”).
6) only in combination with working ports 11 or 12
7) only in combination with working ports 09
8) only in combination with working ports 07 or 08
9) Type code for counterbalance valve to be quoted separately in accordance with data sheet 95522 (BVD) and 95526 (BVE)
10) Only in combination with mounted counterbalance valve (valve design W)
11) Only in combination with pressure relief valve (valve designs R or S)
12) Only with metric ports according to DIN 3852 with profile sealing ring, metric fastening thread according to DIN 13
13) Restricted data
14) Only in combination with check valve (valve design U)
15) Specify ordering code of sensor according to data sheet 95131 (DST) respectively data sheet 95126 (DSA/20) separately.

Hydraulic fluid

The axial piston unit 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

Selection of hydraulic fluid
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235. Hydraulic fluids with positive evaluation in the Fluid Rating are provided in the following technical data sheet:

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

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

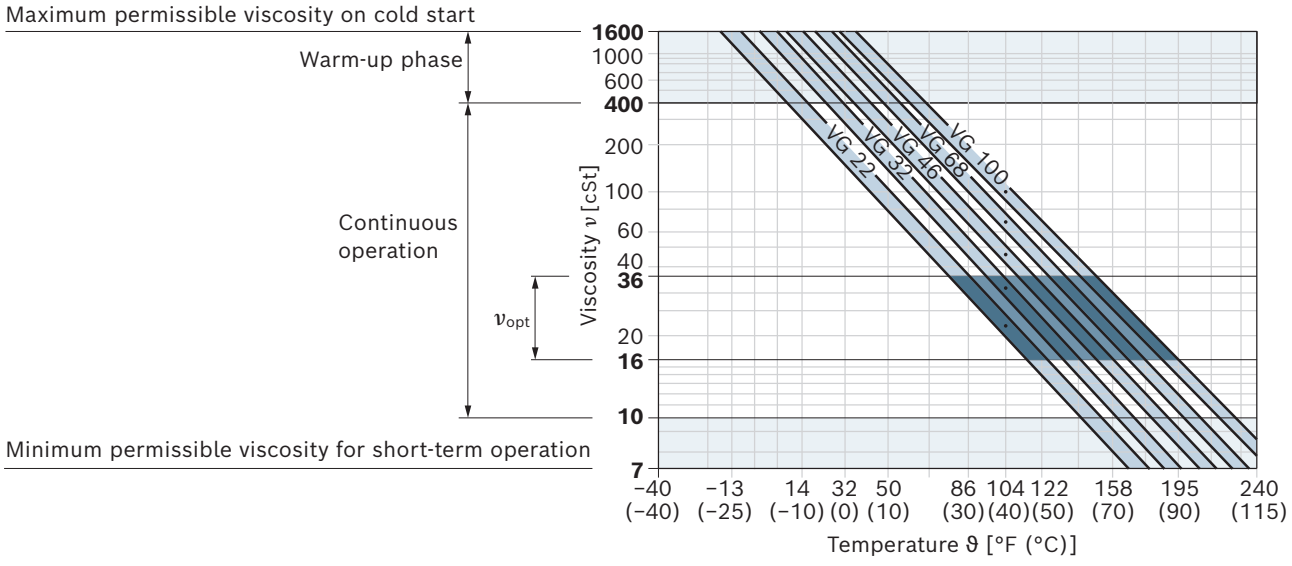
Notice
For operation with HF hydraulic fluids, please contact us.

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[3]	Comment
Cold start	v_{max} ≤ 1600 cSt	NBR[2]	ϑ_{St} ≥ −40 °F (−40 °C)	t ≤ 3 min, without load (p ≤ 725 psi (50 bar)), n ≤ 1000 rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
		FKM	ϑ_{St} ≥ −13 °F (−25 °C)	
Warm-up phase	v = 1600 ... 400 cSt			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Continuous operation	v = 400 ... 10 cSt[1]	NBR[2]	ϑ ≤ +172 °F (+78 °C)	measured at port **T**
		FKM	ϑ ≤ +217 °F (103 °C)	
	v_{opt} = 36 ... 16 cSt			Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} = 10 ... 7 cSt	NBR[2]	ϑ ≤ +172 °F (+78 °C)	t ≤ 3 min, p ≤ 0.3 × p_{nom} , measured at port **T**
		FKM	ϑ ≤ +217 °F (103 °C)	

Notice
The maximum circuit temperature of +239 °F (+115 °C) must not be exceeded at working ports **A** and **B**, while maintaining the permissible viscosity.

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +39.2 °F ... +185 °F (+4 C ... +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 cSt (e.g. due to high temperatures in short-term operation) a cleanliness level of at least 19/17/14 according to ISO 4406 is required.
For example, the viscosity 10 cSt at:

- HLP 32 a temperature of 163.4 °F (73 °C)
- HLP 46 a temperature of 185 °F (85 °C)

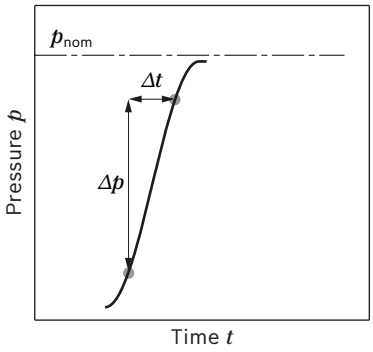
Flow direction

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

Working pressure range

Pressure at working ports A or B			Definition
Nominal pressure p_{nom}	A2FMN	4350 psi (300 bar)	The nominal pressure corresponds to the maximum design pressure.
	A2FMM	5800 psi (400 bar)	
	A2FMH	6500 psi (450 bar)	
Maximum pressure p_{max}	A2FMN	5100 psi (350 bar)	The maximum pressure corresponds to the maximum working pressure during a single operating period. The sum of single operating periods must not exceed the total operating period.
	A2FMM	6500 psi (450 bar)	
	A2FMH	7250 psi (500 bar)	
Maximum single operating period		10 s	
Total operating period		300 h	
Minimum pressure (high pressure side)		365 psi (25 bar)	Minimum pressure at the high-pressure side (**A** or **B**) which is required in order to prevent damage to the axial piston unit.
Minimum pressure – pump operating mode (inlet)		see diagram (next page)	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}		10150 psi (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 $R_{A\,max}$			Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
with integrated pressure relief valve		130530 psi/s (9000 bar/s)	
without pressure relief valve		232060 psi/s (16000 bar/s)	
Case pressure at port T			
Continuous differential pressure $\Delta p_{T\,cont}$		30 psi (2 bar)	Maximum averaged differential pressure at the shaft seal (case to ambient pressure)
Pressure peaks $p_{T\,peak}$		145 psi (10 bar)	t < 0.1 s

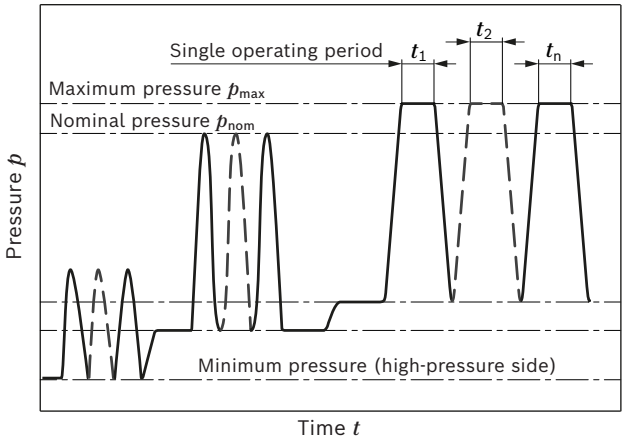
▼ **Rate of pressure change** $R_{A\,max}$



Notice

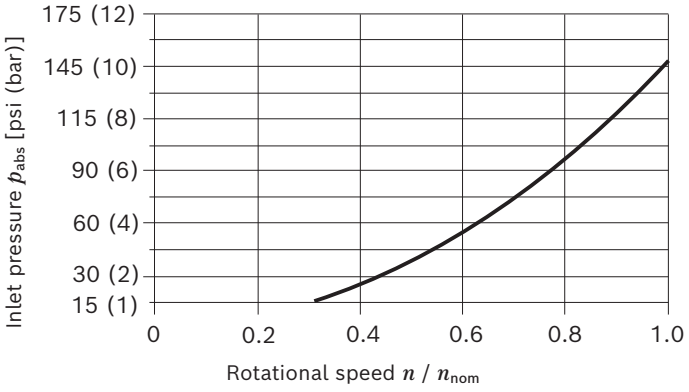
- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and 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 higher than the external pressure (ambient pressure) at the shaft seal.

▼ **Pressure definition**



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

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



This diagram is only valid for the optimum viscosity range of v_{opt} = 36 to 16 cSt.
Please contact us if these conditions cannot be satisfied.

Technical data

A2FMN

Size	NG		28	32	37	45	
Displacement geometric, per revolution	V_g	in³ (cm³)	1.71 (28.1)	1.95 (32)	2.25 (36.8)	2.7 (44.2)	
Maximum rotational speed[1]	n_{nom}	rpm	4725	4725	4200	4200	
	n_{max}[2]	rpm	5175	5175	4650	4650	
Inlet flow at n_{nom}	q_v	gpm (l/min)	35.07 (133)	39.94 (151)	40.83 (155)	49.04 (186)	
Torque[3] at Δp = 4350 psi (300 bar)	M	lb-ft (Nm)	99 (134)	113 (153)	130 (176)	156 (211)	
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	1.62 (2.2)	1.81 (2.46)	3.16 (4.29)	3.57 (4.84)	
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.024 (0.001)	0.026 (0.0011)	0.028 (0.0012)	0.028 (0.0012)	
Case volume	V	gal (l)	0.08 (0.3)	0.08 (0.3)	0.08 (0.3)	0.08 (0.3)	
Weight approx.	m	lbs (kg)	23.6 (10.7)	23.6 (10.7)	23.6 (10.7)	23.6 (10.7)	

Size	NG		56	63	80	90	107
Displacement geometric, per revolution	V_g	in³ (cm³)	3.45 (56.6)	3.84 (63.0)	4.99 (81.7)	5.52 (90.5)	6.64 (108.8)
Maximum rotational speed[1]	n_{nom}	rpm	3750	3750	3375	3375	3000
	n_{max}[2]	rpm	4125	4125	3700	3700	3300
Inlet flow at n_{nom}	q_v	gpm (l/min)	56.07 (212)	62.41 (236)	72.84 (276)	80.69 (305)	86.23 (326)
Torque[3] at Δp = 4350 psi (300 bar)	M	lb-ft (Nm)	199 (270)	222 (301)	288 (390)	319 (432)	383 (519)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	5.14 (6.97)	5.98 (8.11)	6.25 (8.47)	7.26 (9.85)	8.08 (10.96)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.081 (0.0034)	0.083 (0.0035)	0.088 (0.0037)	0.138 (0.0058)	0.145 (0.0061)
Case volume	V	gal (l)	0.16 (0.6)	0.16 (0.6)	0.16 (0.6)	0.17 (0.65)	0.17 (0.65)
Weight approx.	m	lbs (kg)	37.5 (17)	37.5 (17)	37.5 (17)	50.7 (23)	50.7 (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 inlet flow):
   – for the optimum viscosity range from v_{opt} = 36 to 16 cSt
   – with hydraulic fluid based on mineral oil

2) Intermittent maximum speed: Overspeed for unload and over-hauling processes, t < 5 s and Δp < 2200 psi (150 bar)

3) Torque without radial force, with radial force see page 11

A2FMM

Size	NG		23	28	32	45
Displacement geometric, per revolution	V_g	in³ (cm³)	1.4 (22.9)	1.71 (28.1)	1.95 (32)	2.74 (44.9)
Maximum rotational speed[1]	n_{nom}	rpm	6300	6300	6300	5000
	n_{max}[2]	rpm	6900	6900	6900	5500
Inlet flow	$q_{v\,max}$	gpm (l/min)	38.11 (144)	46.77 (177)	53.26 (202)	59.31 (225)
Torque[3] at Δp = 5800 psi (400 bar)	M	lb-ft (Nm)	108 (146)	132 (179)	150 (204)	211 (286)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	1.3 (1.76)	1.62 (2.2)	1.81 (2.46)	3.43 (4.65)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.024 (0.001)	0.024 (0.001)	0.026 (0.0011)	0.078 (0.0033)
Case volume	V	gal (l)	0.08 (0.3)	0.08 (0.3)	0.08 (0.3)	0.16 (0.6)
Weight approx.	m	lbs (kg)	23.6 (10.7)	23.6 (10.7)	23.6 (10.7)	37.5 (17)

Size	NG		56	63	80	90
Displacement geometric, per revolution	V_g	in³ (cm³)	3.45 (56.6)	3.84 (63.0)	4.87 (79.8)	5.52 (90.5)
Maximum rotational speed[1]	n_{nom}	rpm	5000	5000	4500	4500
	n_{max}[2]	rpm	5500	5500	5000	5000
Inlet flow	$q_{v\,max}$	gpm (l/min)	74.76 (283)	83.21 (315)	94.86 (359)	107.58 (407)
Torque[3] at Δp = 5800 psi (400 bar)	M	lb-ft (Nm)	266 (360)	296 (401)	375 (508)	425 (576)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	5.14 (6.97)	5.98 (8.11)	6.71 (9.1)	7.26 (9.85)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.081 (0.0034)	0.083 (0.0035)	0.133 (0.0056)	0.138 (0.0058)
Case volume	V	gal (l)	0.16 (0.6)	0.16 (0.6)	0.17 (0.65)	0.17 (0.65)
Weight approx.	m	lbs (kg)	37.5 (17)	37.5 (17)	50.7 (23)	50.7 (23)

Size	NG		107	125	160	180
Displacement geometric, per revolution	V_g	in³ (cm³)	6.51 (106.7)	7.63 (125)	9.79 (160.41)	10.98 (180.01)
Maximum rotational speed[1]	n_{nom}	rpm	4000	4000	3600	3600
	n_{max}[2]	rpm	4400	4400	4000	4000
Inlet flow	$q_{v\,max}$	gpm (l/min)	112.75 (427)	132.09 (500)	152.55 (577)	171.19 (648)
Torque[3] at Δp = 5800 psi (400 bar)	M	lb-ft (Nm)	501 (679)	587 (796)	753 (1021)	845 (1146)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	9.21 (12.49)	10.07 (13.65)	15.72 (21.32)	16.99 (23.04)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.209 (0.0088)	0.216 (0.0091)	0.589 (0.0248)	0.603 (0.0254)
Case volume	V	gal (l)	0.29 (1.1)	0.29 (1.1)	0.21 (0.8)	0.21 (0.8)
Weight approx.	m	lbs (kg)	72.3 (32.8)	72.3 (32.8)	90.4 (41)	90.4 (41)

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 inlet flow):
   – for the optimum viscosity range from v_{opt} = 36 to 16 cSt
   – with hydraulic fluid based on mineral oil

2) Intermittent maximum speed: Overspeed for unload and over-hauling processes, t < 5 s and Δp < 2200 psi (150 bar)

3) Torque without radial force, with radial force see page 11

A2FMH

Size	NG		45	56	63	80
Displacement geometric, per revolution	V_g	in³ (cm³)	2.74 (44.9)	3.45 (56.6)	3.84 (63.0)	4.87 (79.8)
Maximum rotational speed[1]	n_{nom}	rpm	5000	5000	5000	4500
	n_{max}[2]	rpm	5500	5500	5500	5000
Inlet flow	$q_{v\,max}$	gpm (l/min)	59.31 (225)	74.76 (283)	83.21 (315)	94.86 (359)
Torque[3] at Δp = 6500 psi (450 bar)	M	lb-ft (Nm)	237 (322)	299 (405)	333 (451)	422 (572)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	3.43 (4.65)	5.14 (6.97)	5.98 (8.11)	6.71 (9.1)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.078 (0.0033)	0.081 (0.0034)	0.083 (0.0035)	0.133 (0.0056)
Case volume	V	gal (l)	0.16 (0.6)	0.16 (0.6)	0.16 (0.6)	0.17 (0.65)
Weight approx.	m	lbs (kg)	37.5 (17)	37.5 (17)	37.5 (17)	50.7 (23)

Size	NG		90	107	125
Displacement geometric, per revolution	V_g	in³ (cm³)	5.52 (90.5)	6.51 (106.7)	7.63 (125)
Maximum rotational speed[1]	n_{nom}	rpm	4500	4000	4000
	n_{max}[2]	rpm	5000	4400	4400
Inlet flow	$q_{v\,max}$	gpm (l/min)	107.58 (407)	112.75 (427)	132.09 (500)
Torque[3] at Δp = 6500 psi (450 bar)	M	lb-ft (Nm)	478 (648)	564 (764)	660 (895)
Rotary stiffness	c_{min}	klb-ft/rad (kNm/rad)	7.26 (9.85)	9.21 (12.49)	10.07 (13.65)
Moment of inertia for rotary group	J_{GR}	lb-ft² (kgm²)	0.138 (0.0058)	0.209 (0.0088)	0.216 (0.0091)
Case volume	V	gal (l)	0.17 (0.65)	0.29 (1.1)	0.29 (1.1)
Weight approx.	m	lbs (kg)	50.7 (23)	72.3 (32.8)	72.3 (32.8)

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.

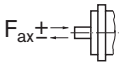
1) The valid values (observing the maximum permissible inlet flow):
   – for the optimum viscosity range from v_{opt} = 36 to 16 cSt
   – with hydraulic fluid based on mineral oil

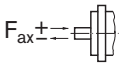
2) Intermittent maximum speed: Overspeed for unload and overhauling processes, t < 5 s and Δp < 2200 psi (150 bar)

3) Torque without radial force, with radial force see page 11

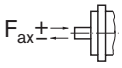
Permissible radial and axial forces of the drive shafts

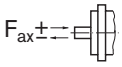
A2FMN

Size		NG		28			32		
Drive shaft	type code			S7	P5	P6	S7	P5	P6
	with splined shaft	ø	in	1 1/4	–	–	1 1/4	–	–
	with parallel keyed shaft	ø	in	–	0.98	1.18	–	0.98	1.18
			mm	–	25	30	–	25	30
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	764	967	809	877	1102	922
			kN	3.4	4.3	3.6	3.9	4.9	4.1
		a	in	0.94	0.63	0.63	0.94	0.63	0.63
			mm	24	16	16	24	16	16
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	99	99	99	113	113	113
			Nm	134	134	134	153	153	153
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	4350	4350	4350	4350	4350	4350
			bar	300	300	300	300	300	300
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0
		– $F_{ax\ max}$	lbf	112.4	112.4	112.4	112.4	112.4	112.4
			N	500	500	500	500	500	500
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.08	0.08	0.08	0.08	0.08	0.08
			N/bar	5.2	5.2	5.2	5.2	5.2	5.2

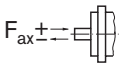
Size		NG		37		45	
Drive shaft	type code			S7	P6	S7	P6
	with splined shaft	ø	in	1 1/4	–	1 1/4	–
	with parallel keyed shaft	ø	in	–	1.18	–	1.18
			mm	–	30	–	30
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	989	1057	1191	1259
			kN	4.4	4.7	5.3	5.6
		a	in	0.94	0.63	0.94	0.63
			mm	24	16	24	16
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	130	130	156	156
			Nm	176	176	211	211
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	4350	4350	4350	4350
			bar	300	300	300	300
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0
		– $F_{ax\ max}$	lbf	112.4	112.4	112.4	112.4
			N	500	500	500	500
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.08	0.08	0.08	0.08
			N/bar	5.2	5.2	5.2	5.2

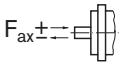
A2FMN

Size		NG		56				63			80		
Drive shaft	type code			V8	S7	P6	P8	V8	S7	P8	V8	S7	P8
	with splined shaft	ø	in	1 3/8	1 1/4	–	–	1 3/8	1 1/4	–	1 3/8	1 1/4	–
	with parallel keyed shaft	ø	in	–	–	1.18	1.38	–	–	1.38	–	–	1.38
			mm	–	–	30	35	–	–	35	–	–	35
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	1394	1529	1619	1394	1551	1709	1551	2001	2136	2001
			kN	6.2	6.8	7.2	6.2	6.9	7.6	6.9	8.9	9.5	8.9
		a	in	0.94	0.94	0.71	0.71	0.94	0.94	0.71	0.94	0.94	0.71
			mm	24	24	18	18	24	24	18	24	24	18
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	199	199	199	199	222	222	222	288	278	288
			Nm	270	270	270	270	301	301	301	390	377	390
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	4350	4350	4350	4350	4350	4350	4350	4350	4210	4350
			bar	300	300	300	300	300	300	300	300	290	300
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	179.8	179.8	179.8	179.8	179.8	179.8	179.8	179.8	179.8	179.8
			N	800	800	800	800	800	800	800	800	800	800
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
			N/bar	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7

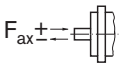
Size		NG		90			107		
Drive shaft	type code			V8	S7	P9	V8	S7	P9
	with splined shaft	ø	in	1 3/8	1 1/4	–	1 3/8	1 1/4	–
	with parallel keyed shaft	ø	in	–	–	1.57	–	–	1.57
			mm	–	–	40	–	–	40
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	2226	2113	1933	2675	2113	2338
			kN	9.9	9.4	8.6	11.9	9.4	10.4
		a	in	0.94	0.94	0.79	0.94	0.94	0.79
			mm	24	24	20	24	24	20
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	319	276	319	383	274	383
			Nm	432	374	432	519	372	519
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	4350	3770	4350	4350	3120	4350
			bar	300	260	300	300	215	300
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	224.8	224.8	224.8	224.8	224.8	224.8
			N	1000	1000	1000	1000	1000	1000
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.16	0.16	0.16	0.16	0.16	0.16
			N/bar	10.6	10.6	10.6	10.6	10.6	10.6

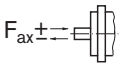
A2FMM

Size		NG		23			28			32		
Drive shaft	type code			S7	P5	P6	S7	P5	P6	S7	P5	P6
	with splined shaft	ø	in	1 1/4	–	–	1 1/4	–	–	1 1/4	–	–
	with parallel keyed shaft	ø	in	–	0.98	1.18	–	0.98	1.18	–	0.98	1.18
			mm	–	25	30	–	25	30	–	25	30
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	832	1057	877	1012	1281	1079	1147	1461	1214
			kN	3.7	4.7	3.9	4.5	5.7	4.8	5.1	6.5	5.4
		a	in	0.94	0.63	0.63	0.94	0.63	0.63	0.94	0.63	0.63
			mm	24	16	16	24	16	16	24	16	16
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	108	108	108	132	132	132	150	150	150
			Nm	146	146	146	179	179	179	204	204	204
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	5800	5800	5800	5800	5800	5800	5800	5800	5800
			bar	400	400	400	400	400	400	400	400	400
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	112.4	112.4	112.4	112.4	112.4	112.4	112.4	112.4	112.4
			N	500	500	500	500	500	500	500	500	500
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
			N/bar	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2

Size		NG		45		56				63		
Drive shaft	type code			S7	P6	V8	S7	P6	P8	V8	S7	P8
	with splined shaft	ø	in	1 1/4	–	1 3/8	1 1/4	–	–	1 3/8	1 1/4	–
	with parallel keyed shaft	ø	in	–	1.18	–	–	1.18	1.38	–	–	1.38
			mm	–	30	–	–	30	35	–	–	35
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	1619	1709	1866	2046	2158	1843	2068	2136	2068
			kN	7.2	7.6	8.3	9.1	9.6	8.2	9.2	9.5	9.2
		a	in	0.94	0.71	0.94	0.94	0.71	0.71	0.94	0.94	0.71
			mm	24	18	24	24	18	18	24	24	18
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	211	211	266	266	266	266	296	277	296
			Nm	286	286	360	360	360	360	401	376	401
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	5800	5800	5800	5800	5800	5800	5800	5440	5800
			bar	400	400	400	400	400	400	400	375	400
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	179.8	179.8	179.8	179.8	179.8	179.8	179.8	179.8	179.8
			N	800	800	800	800	800	800	800	800	800
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
			N/bar	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7

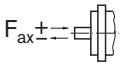
A2FMM

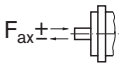
Size		NG		80				90			107			
Drive shaft	type code			V8	S7	P8	P9	V8	S7	P9	V9	T1	P9	B1
	with splined shaft	ø	in	1 3/8	1 1/4	–	–	1 3/8	1 1/4	–	1 1/2	1 3/4	–	–
	with parallel keyed shaft	ø	in	–	–	1.38	1.57	–	–	1.57	–	–	1.57	1.77
			mm	–	–	35	40	–	–	40	–	–	40	45
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	2608	2091	2608	2293	2967	2113	2585	3215	2743	3057	2720
			kN	11.6	9.3	11.6	10.2	13.2	9.4	11.5	14.3	12.2	13.6	12.1
		a	in	0.94	0.94	0.79	0.79	0.94	0.94	0.79	1.06	1.32	0.79	0.79
			mm	24	24	20	20	24	24	20	27	33.5	20	20
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	375	271	375	375	425	276	425	501	501	501	501
			Nm	508	368	508	508	576	374	576	679	679	679	679
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	5800	4210	5800	5800	5800	3770	5800	5800	5800	5800	5800
			bar	400	290	400	400	400	260	400	400	400	400	400
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0	0	0	0
		– $F_{ax\ max}$	lbf	224.8	224.8	224.8	224.8	224.8	224.8	224.8	281.0	281.0	281.0	281.0
			N	1000	1000	1000	1000	1000	1000	1000	1250	1250	1250	1250
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.20	0.20	0.20	0.20
			N/bar	10.6	10.6	10.6	10.6	10.6	10.6	10.6	12.9	12.9	12.9	12.9

Size		NG		125			160			180	
Drive shaft	type code			V9	T1	B1	T1	B1	B2	T1	B2
	with splined shaft	ø	in	1 1/2	1 3/4	–	1 3/4	–	–	1 3/4	–
	with parallel keyed shaft	ø	in	–	–	1.77	–	1.77	1.97	–	1.97
			mm	–	–	45	–	45	50	–	50
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	3754	3215	3170	4136	4092	3664	4406	4114
			kN	16.7	14.3	14.1	18.4	18.2	16.3	19.6	18.3
		a	in	1.06	1.32	0.79	1.32	0.98	0.98	1.32	0.98
			mm	27	33.5	20	33.5	25	25	33.5	25
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	587	587	587	753	753	753	803	845
			Nm	796	796	796	1021	1021	1021	1089	1146
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	5800	5800	5800	5800	5800	5800	5510	5800
			bar	400	400	400	400	400	400	380	400
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0
		– $F_{ax\ max}$	lbf	281.0	281.0	281.0	359.7	359.7	359.7	359.7	359.7
			N	1250	1250	1250	1600	1600	1600	1600	1600
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.20	0.20	0.20	0.26	0.26	0.26	0.26	0.26
			N/bar	12.9	12.9	12.9	16.7	16.7	16.7	16.7	16.7

1) With intermittent operation

A2FMH

Size		NG		45		56			63		80		
Drive shaft	type code			S7	P6	V8	P6	P8	V8	P8	V8	P8	P9
	with splined shaft	ø	in	1 1/4	–	1 3/8	–	–	1 3/8	–	1 3/8	–	–
	with parallel keyed shaft	ø	in	–	1.18	–	1.18	1.38	–	1.38	–	1.38	1.57
			mm	–	30	–	30	35	–	35	–	35	40
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	1821	1933	2091	2428	2091	2316	2316	2945	2945	2563
			kN	8.1	8.6	9.3	10.8	9.3	10.3	10.3	13.1	13.1	11.4
		a	in	0.94	0.71	0.94	0.71	0.71	0.94	0.71	0.94	0.79	0.79
			mm	24	18	24	18	18	24	18	24	20	20
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	237	237	299	299	299	333	333	422	422	422
			Nm	322	322	405	405	405	451	451	572	572	572
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	6530	6530	6530	6530	6530	6530	6530	6530	6530	6530
			bar	450	450	450	450	450	450	450	450	450	450
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	179.8	179.8	179.8	179.8	179.8	179.8	179.8	224.8	224.8	224.8
			N	800	800	800	800	800	800	800	1000	1000	1000
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.16	0.16	0.16
			N/bar	8.7	8.7	8.7	8.7	8.7	8.7	8.7	10.6	10.6	10.6

Size		NG		90	107				125	
Drive shaft	type code			P9	V9	T1	P9	B1	T1	B1
	with splined shaft	ø	in	–	1 1/2	1 3/4	–	–	1 3/4	–
	with parallel keyed shaft	ø	in	1.57	–	–	1.57	1.77	–	1.77
			mm	40	–	–	40	45	–	45
Maximum radial force[1] at distance a (from shaft collar) 		$F_{q\ max}$	lbf	2923	3597	3102	3440	3057	3619	3575
			kN	13	16	13.8	15.3	13.6	16.1	15.9
		a	in	0.79	1.06	1.32	0.79	0.79	1.32	0.79
			mm	20	27	33.5	20	20	33.5	20
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	lb-ft	478	563	563	563	563	660	660
			Nm	648	764	764	764	764	895	895
Maximum differential pressure at $F_{q\ max}$		$\Delta p_{\ q\ max}$	psi	6530	6530	6530	6530	6530	6530	6530
			bar	450	450	450	450	450	450	450
Maximum axial force at standstill or pressure-free operation 		+ $F_{ax\ max}$	lbf/N	0	0	0	0	0	0	0
		− $F_{ax\ max}$	lbf	224.8	281.0	281.0	281.0	281.0	281.0	281.0
			N	1000	1250	1250	1250	1250	1250	1250
Permissible axial force per bar working pressure		+ $F_{ax\ perm}$/ bar	lbf/psi	0.16	0.20	0.20	0.20	0.20	0.20	0.20
			N/bar	10.6	12.9	12.9	12.9	12.9	12.9	12.9

1) With intermittent operation

Calculation of characteristics			
Inlet flow	$q_v = \frac{V_g \times n}{231 \times \eta_v}$	[gpm]	$\left(\frac{V_g \times n}{1000 \times \eta_v}\right)$ [l/min]
Rotational speed	$n = \frac{q_v \times 231 \times \eta_v}{V_g}$	[rpm]	$\left(\frac{q_v \times 1000 \times \eta_v}{V_g}\right)$ [rpm]
Torque	$M = \frac{V_g \times \Delta p \times \eta_{hm}}{24 \times \pi}$	[lb-ft]	$\left(\frac{V_g \times \Delta p \times \eta_{hm}}{20 \times \pi}\right)$ [Nm]
Power	$P = \frac{2 \pi \times M \times n}{33000} = \frac{q_v \times \Delta p \times \eta_t}{1714}$	[HP]	$\left(\frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p \times \eta_t}{600}\right)$ [kW]

Key

V_g	=	Displacement per revolution [in³ (cm³)]
Δp	=	Differential pressure [psi (bar)]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{hm}	=	Hydraulic-mechanical efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

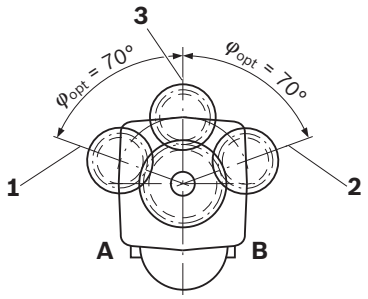
Note

- 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 the destruction of the axial piston unit.
- Technical data regarding torsional vibrations on request.
- 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 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**



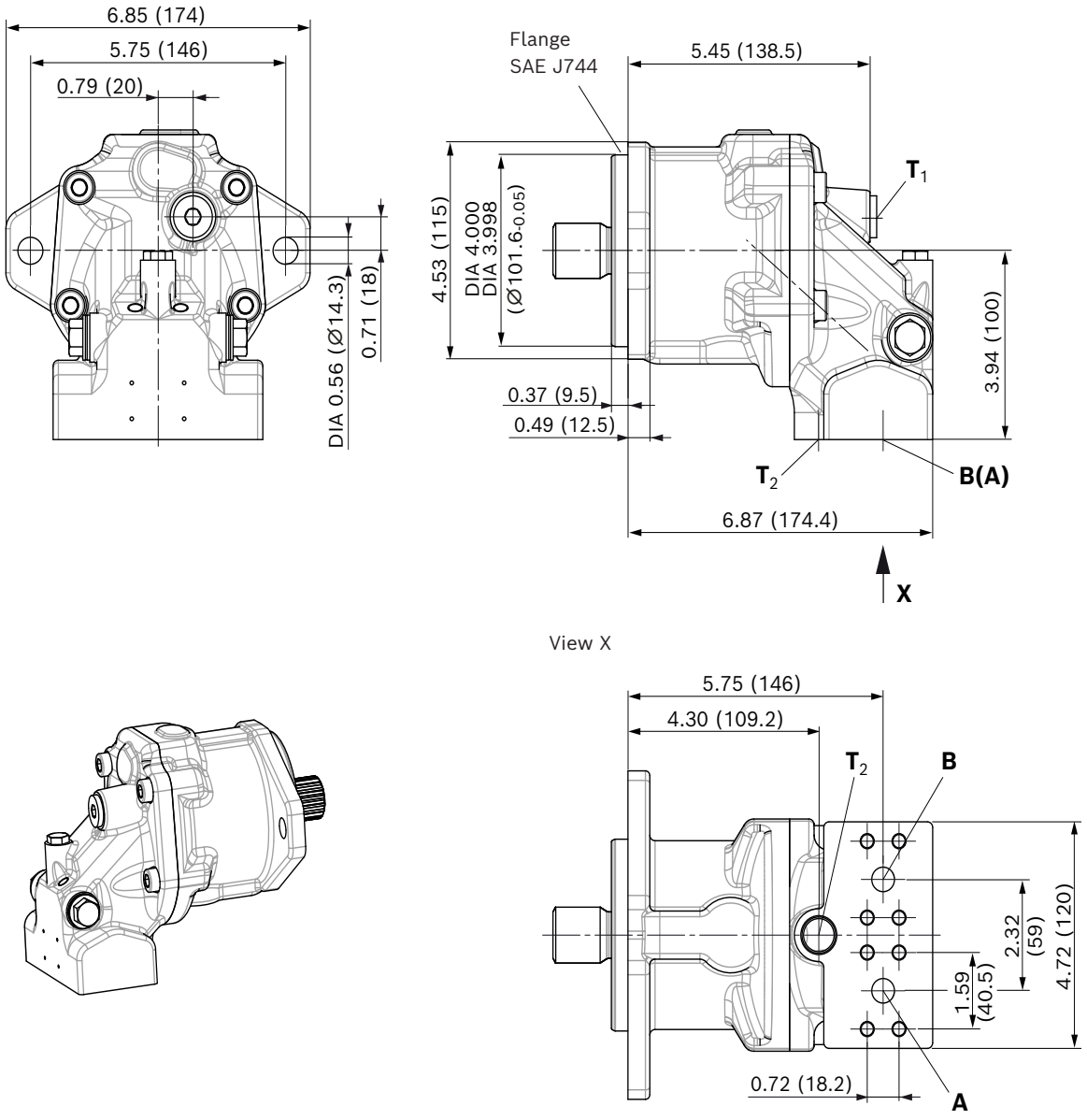
1 “Counter-clockwise” rotation. Pressure at port **B**

2 “Clockwise” rotation, Pressure at port **A**

3 “Bidirectional” direction of rotation

A2FMN sizes 28, 32, 37, 45 and A2FMM sizes 23, 28, 32

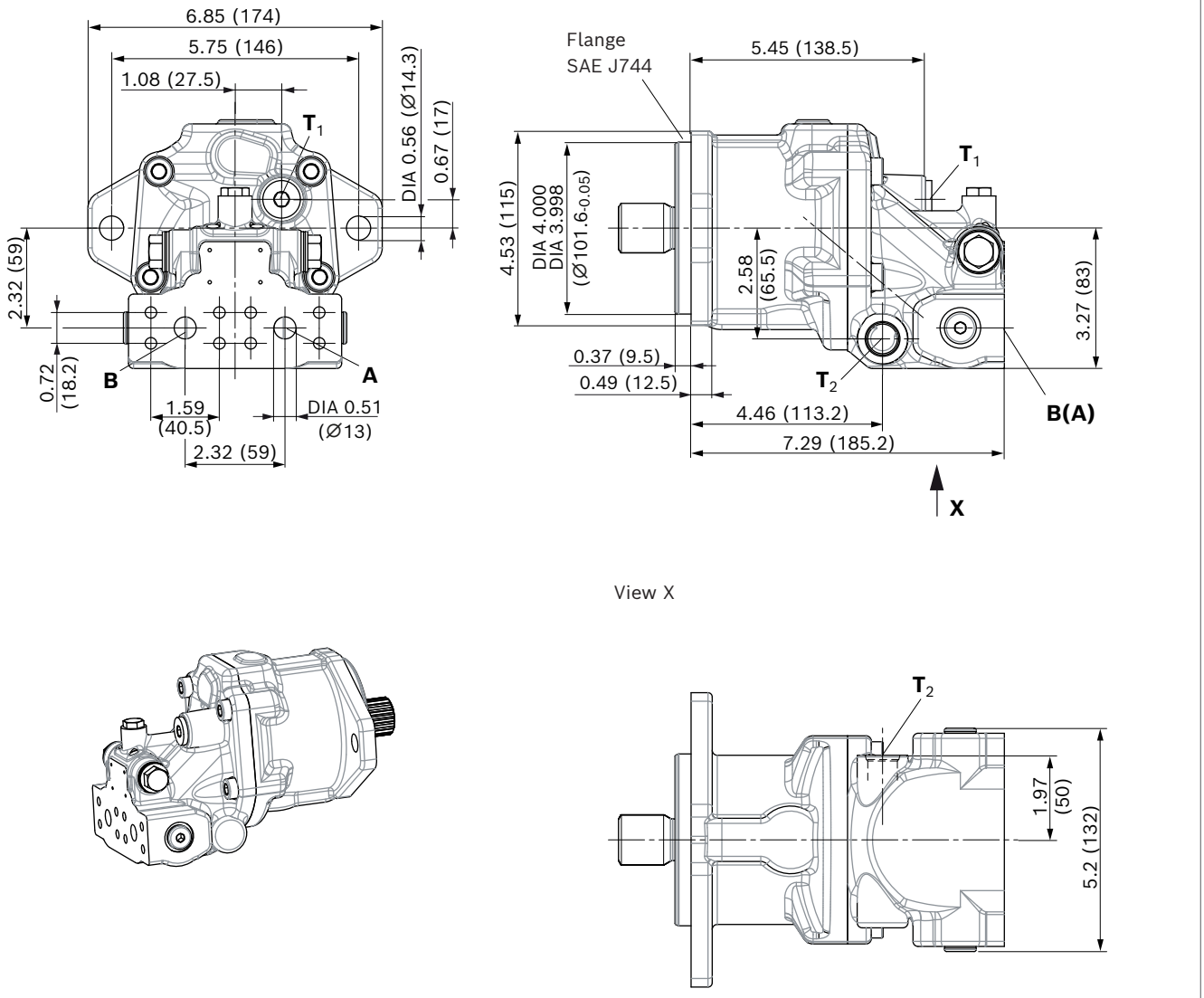
A2FM dimensions, B2 flange, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

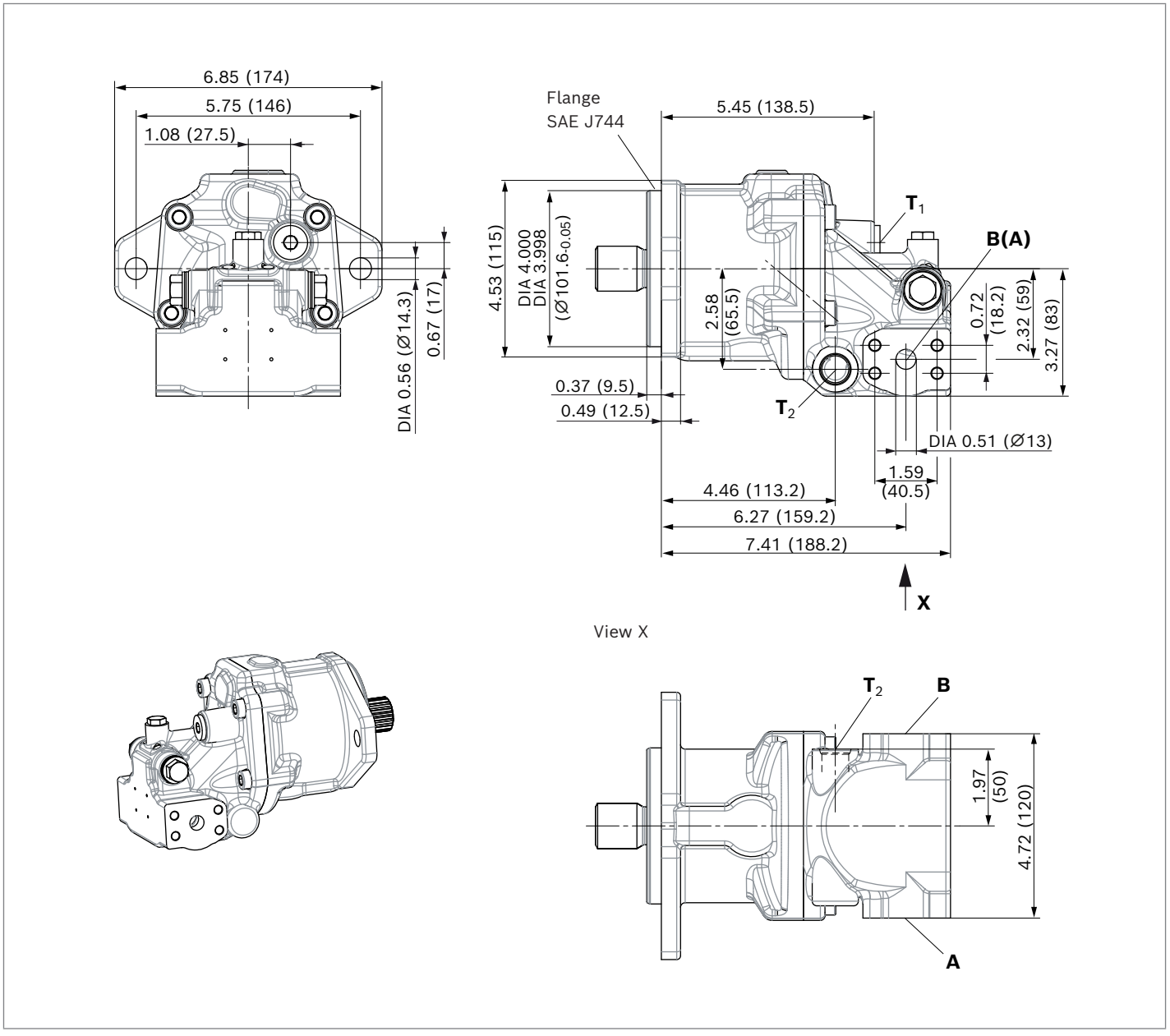
A2FM dimensions, flange B2, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

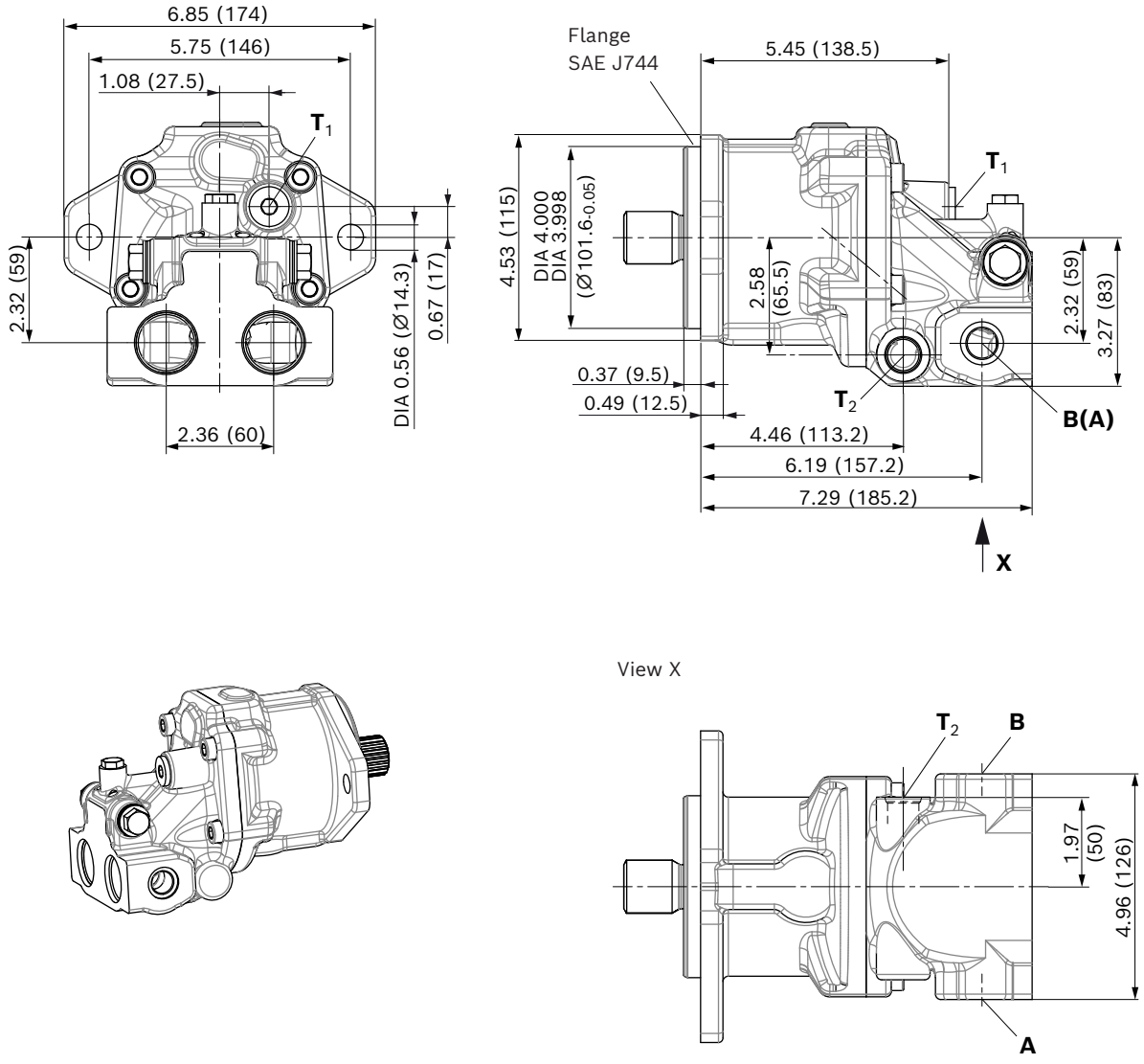
A2FM dimensions, flange B2, working ports A and B at side (02)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

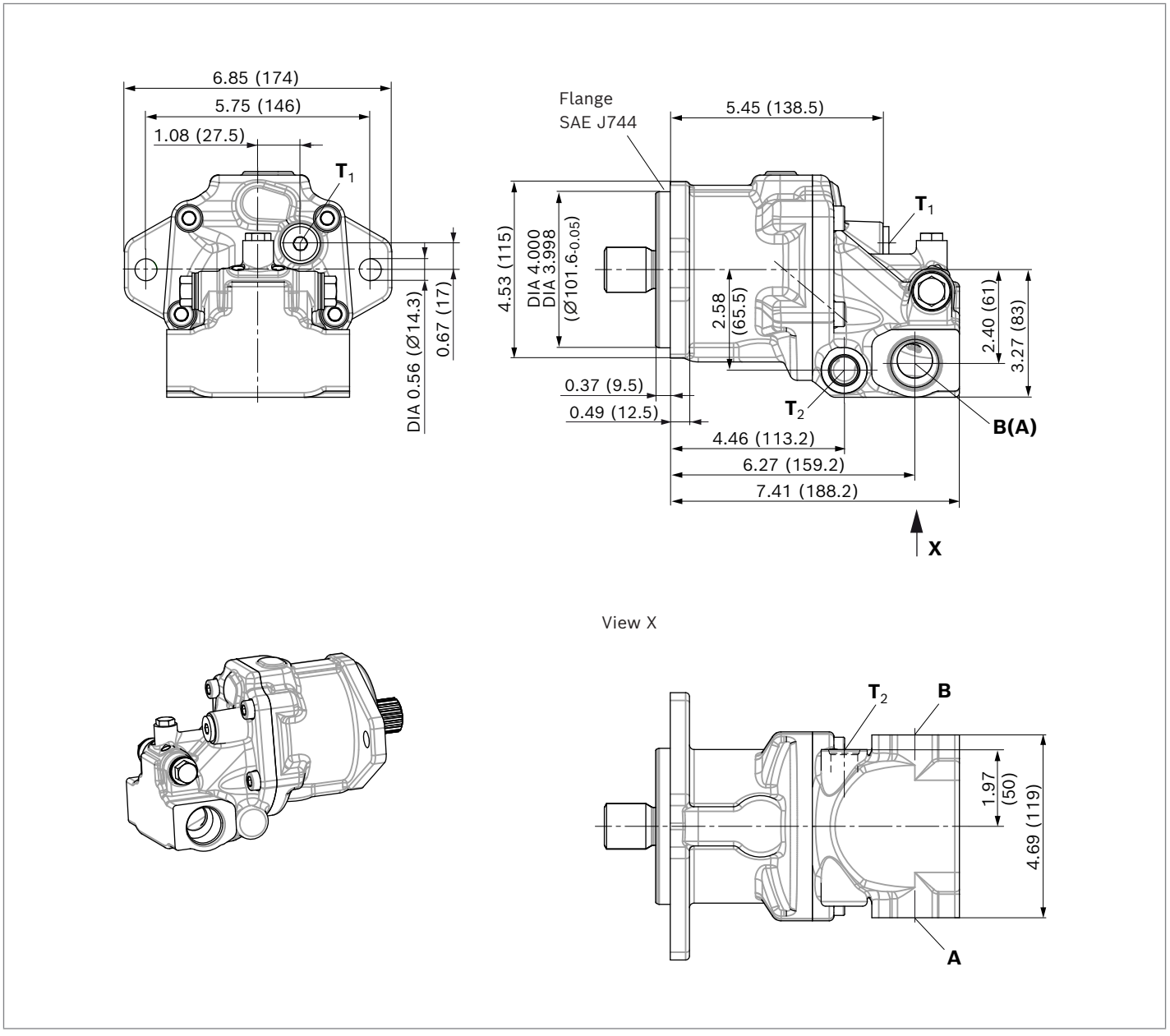
A2FM dimensions, flange B2, working ports A and B at side and at rear (03)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port at side	DIN 3852[3]	M18x1.5; 0.47 (12) deep	6500 (450)	O
	Working port at rear	ISO 11926[3]	1 5/16-12 UN-2B; 0.79 (20) deep		
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

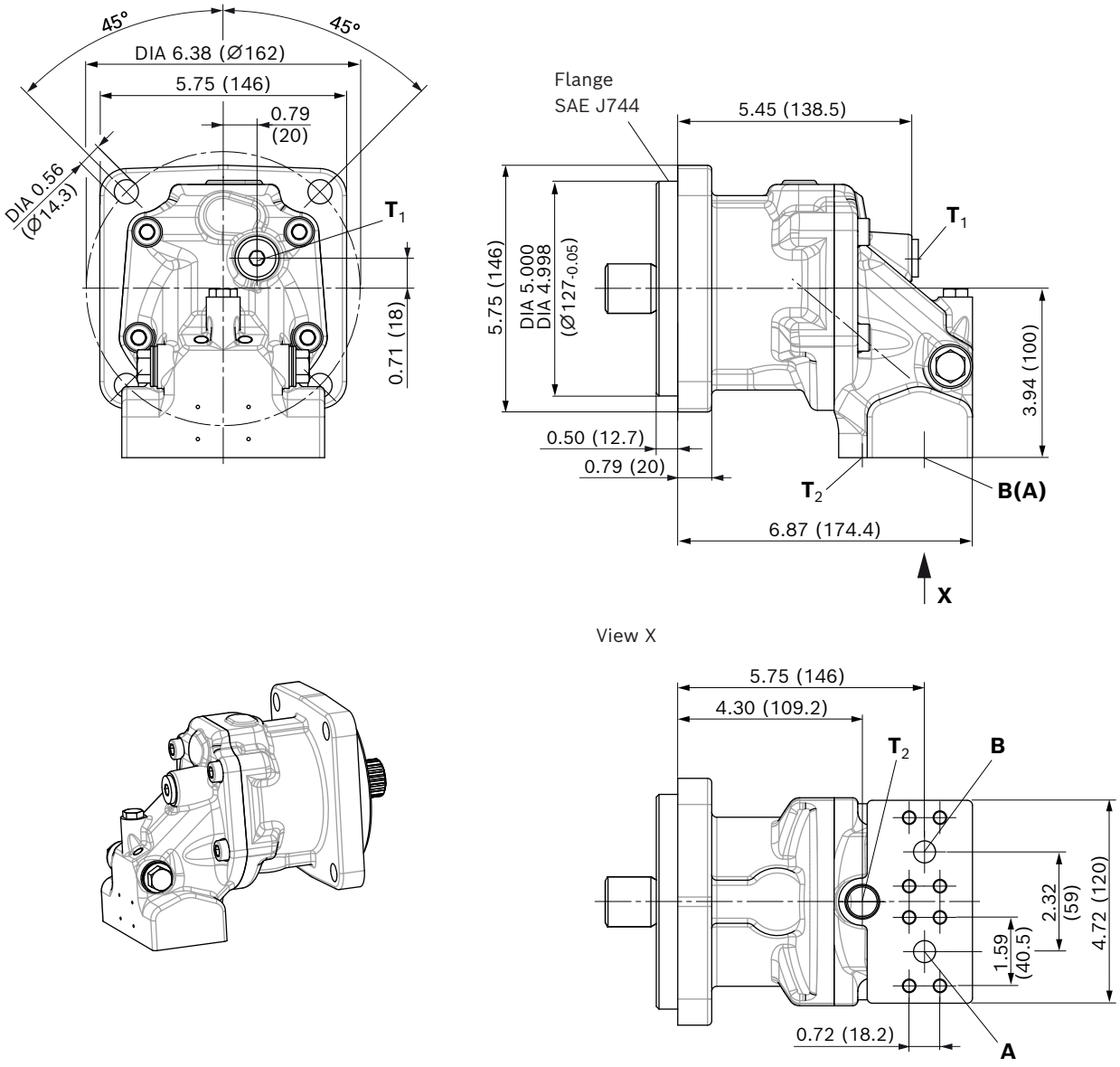
A2FM dimensions, flange B2, working ports A and B at side, opposite (05)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port	ISO 11926[3]	1 5/16-12 UN-2B; 0.79 (20) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

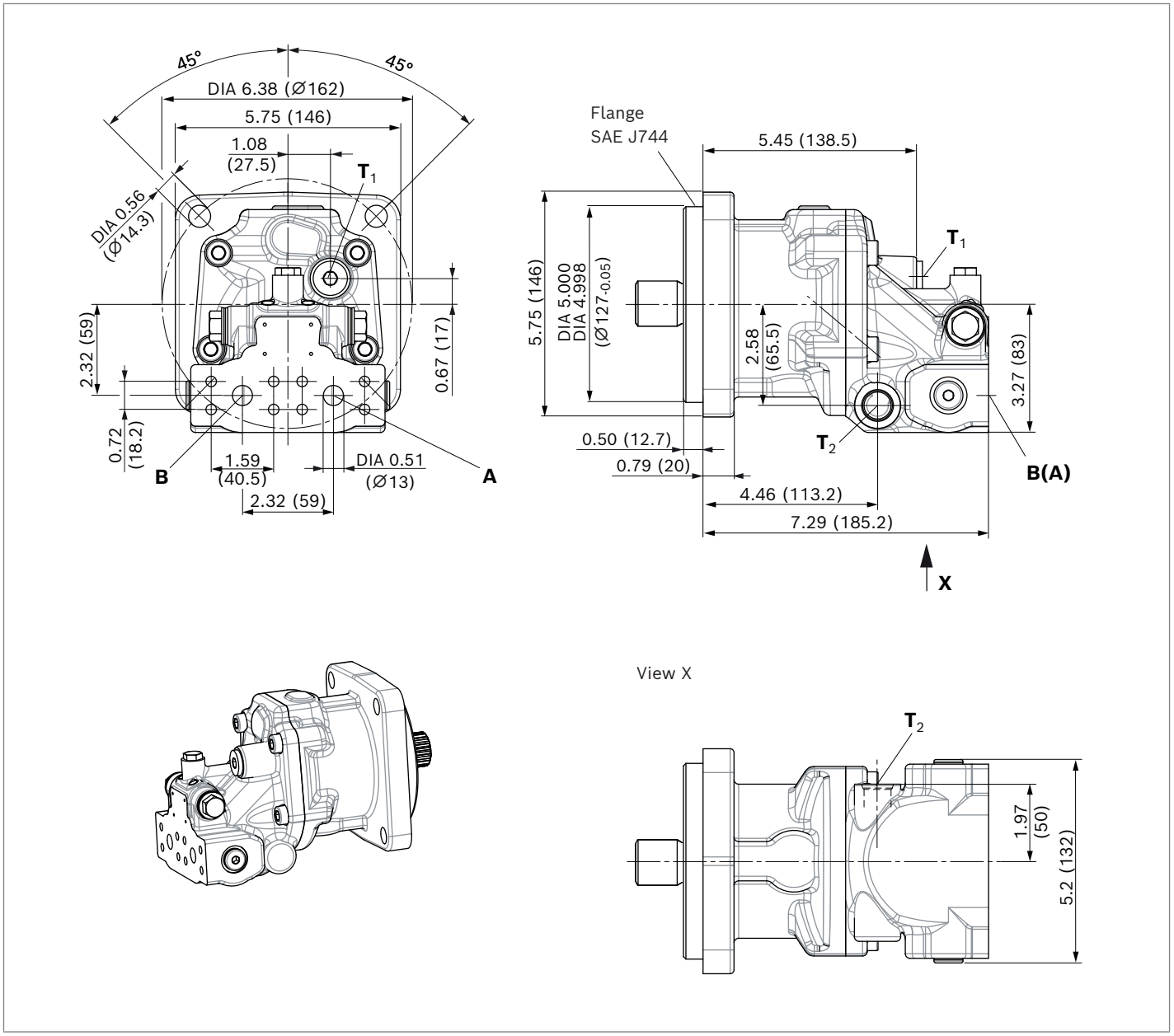
A2FM dimensions, flange C4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

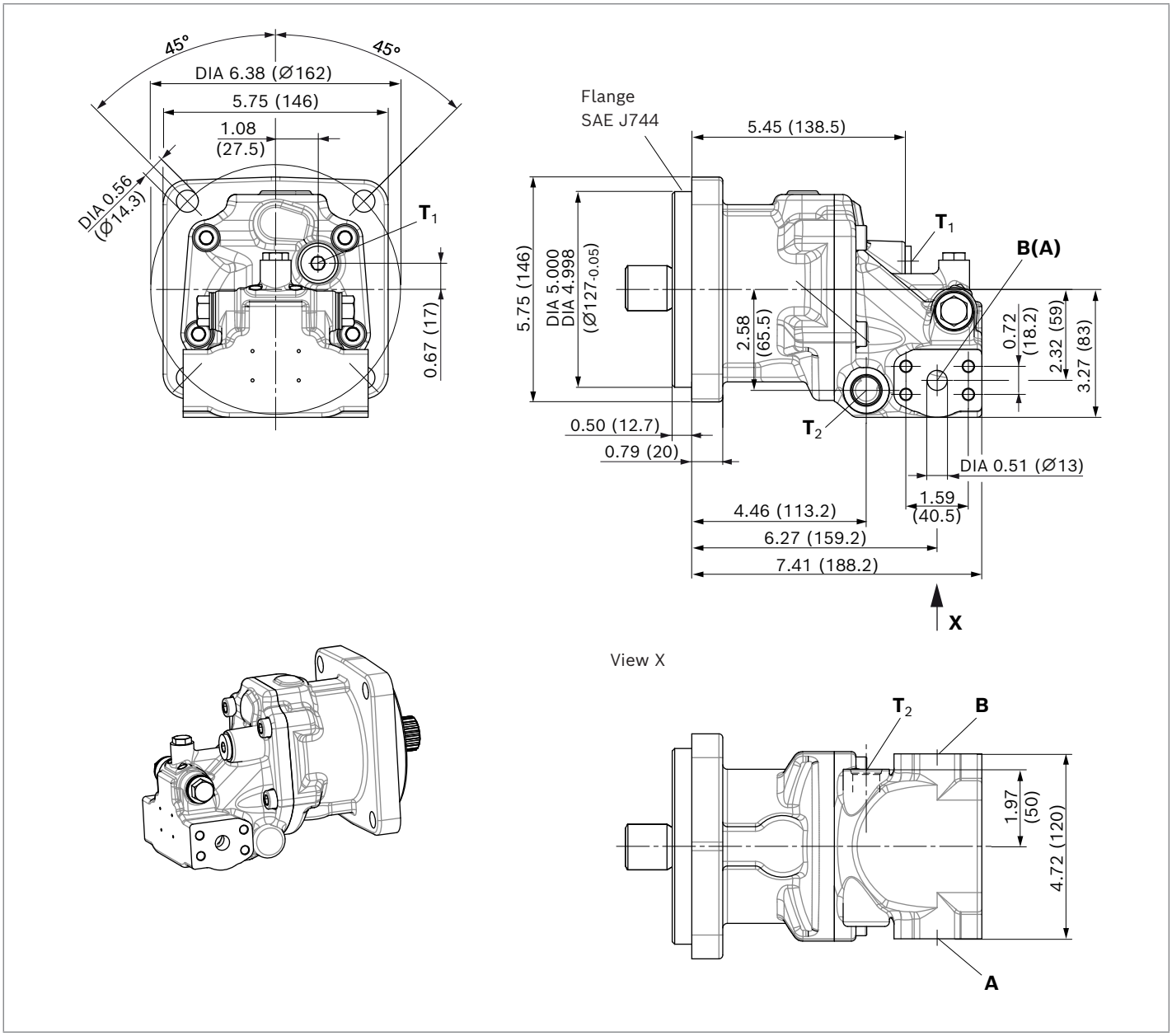
A2FM dimensions, flange C4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

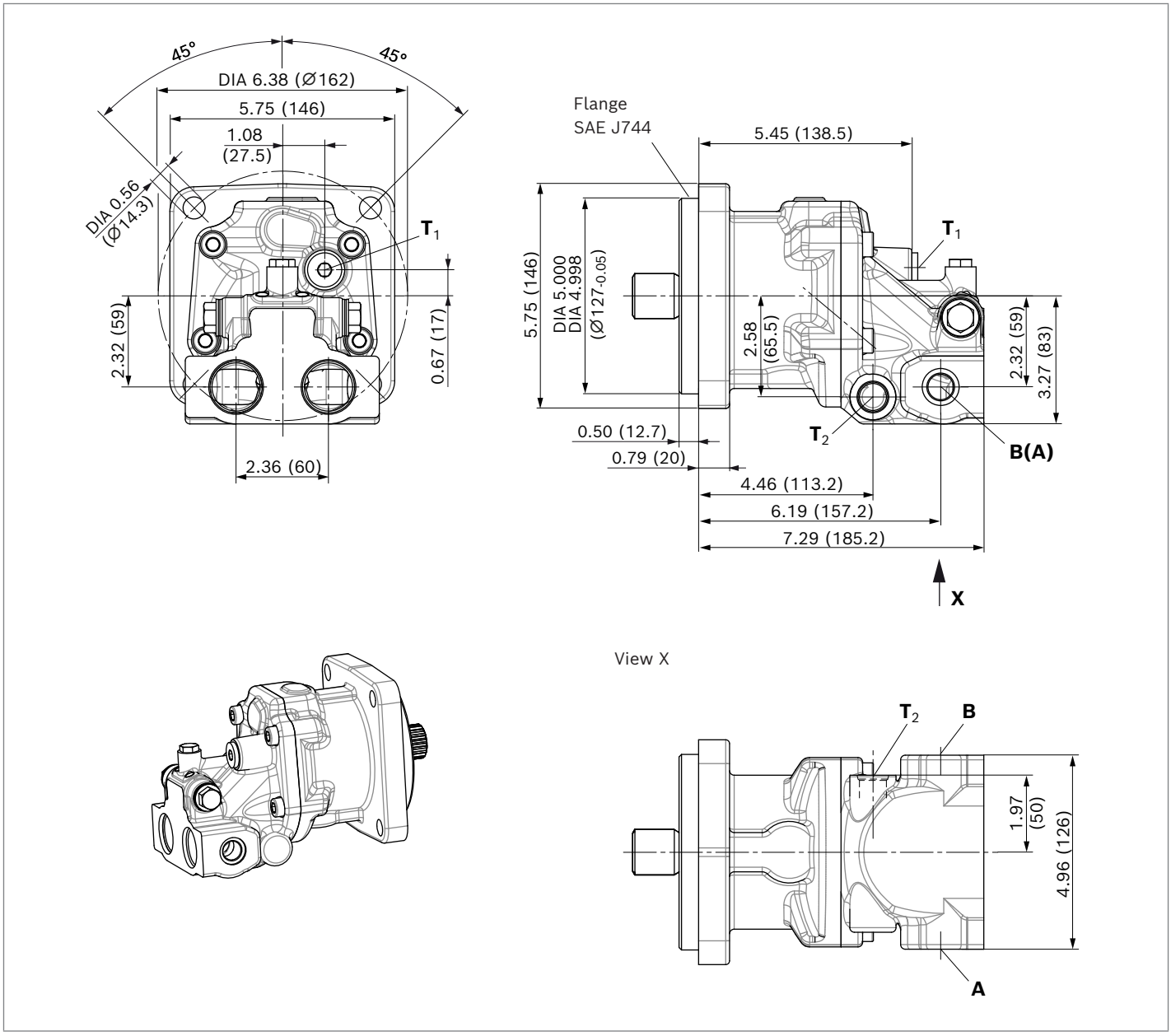
A2FM dimensions, flange C4, working ports A and B at side (02)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1/2 in M8 × 1,25; 0.63 (16) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

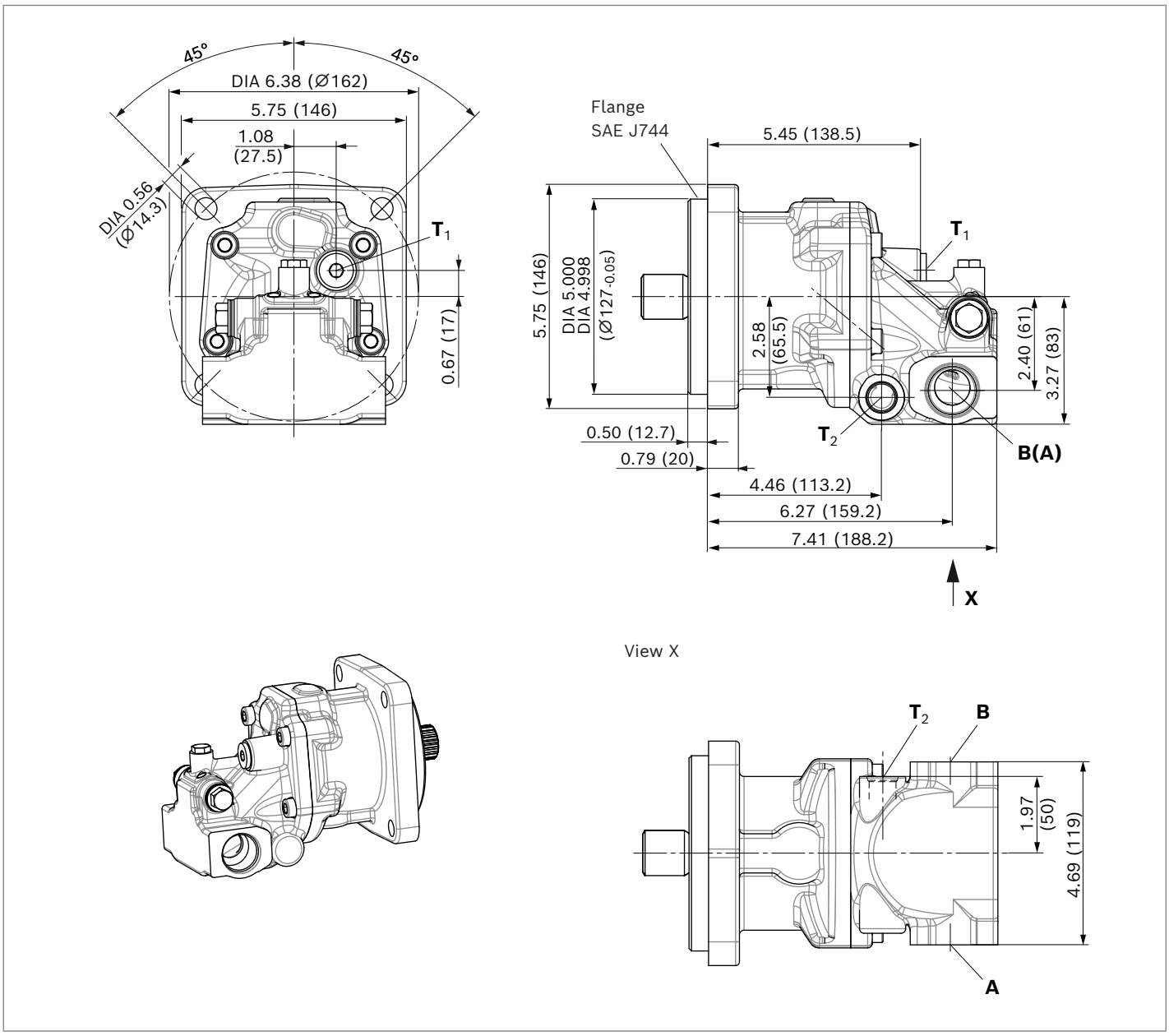
A2FM dimensions, flange C4, working ports A and B at side and at rear (03)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port at side	DIN 3852[3]	M18x1.5; 0.47 (12) deep	6500 (450)	O
	Working port at rear	ISO 11926[3]	1 5/16-12 UN-2B; 0.79 (20) deep		
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, flange C4, working ports A and B at side, opposite (05)

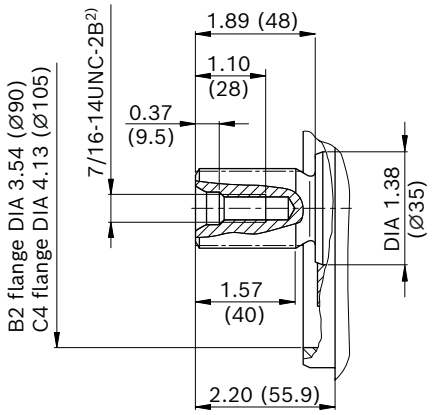


Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port	ISO 11926[3]	1 5/16-12 UN-2B; 0.79 (20) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

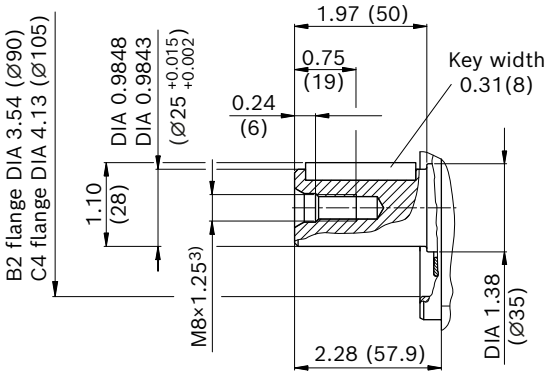
▼ **Splined shaft SAE J744,**
A2FMN: size 28, 32, 37, 45
A2FMM: size 23, 28, 32

S7 – 1 1/4 in 14T 12/24 DP[1)]



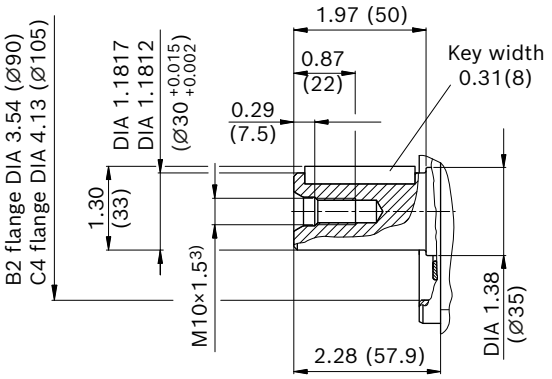
▼ **Parallel keyed shaft, DIN 6885,**
A2FMN: size 28, 32
A2FMM: size 23, 28, 32

P5 – AS8×7×40



▼ **Parallel keyed shaft, DIN 6885,**
A2FMN: size 28, 32, 37, 45
A2FMM: size 23, 28, 32

P6 – AS8×7×40



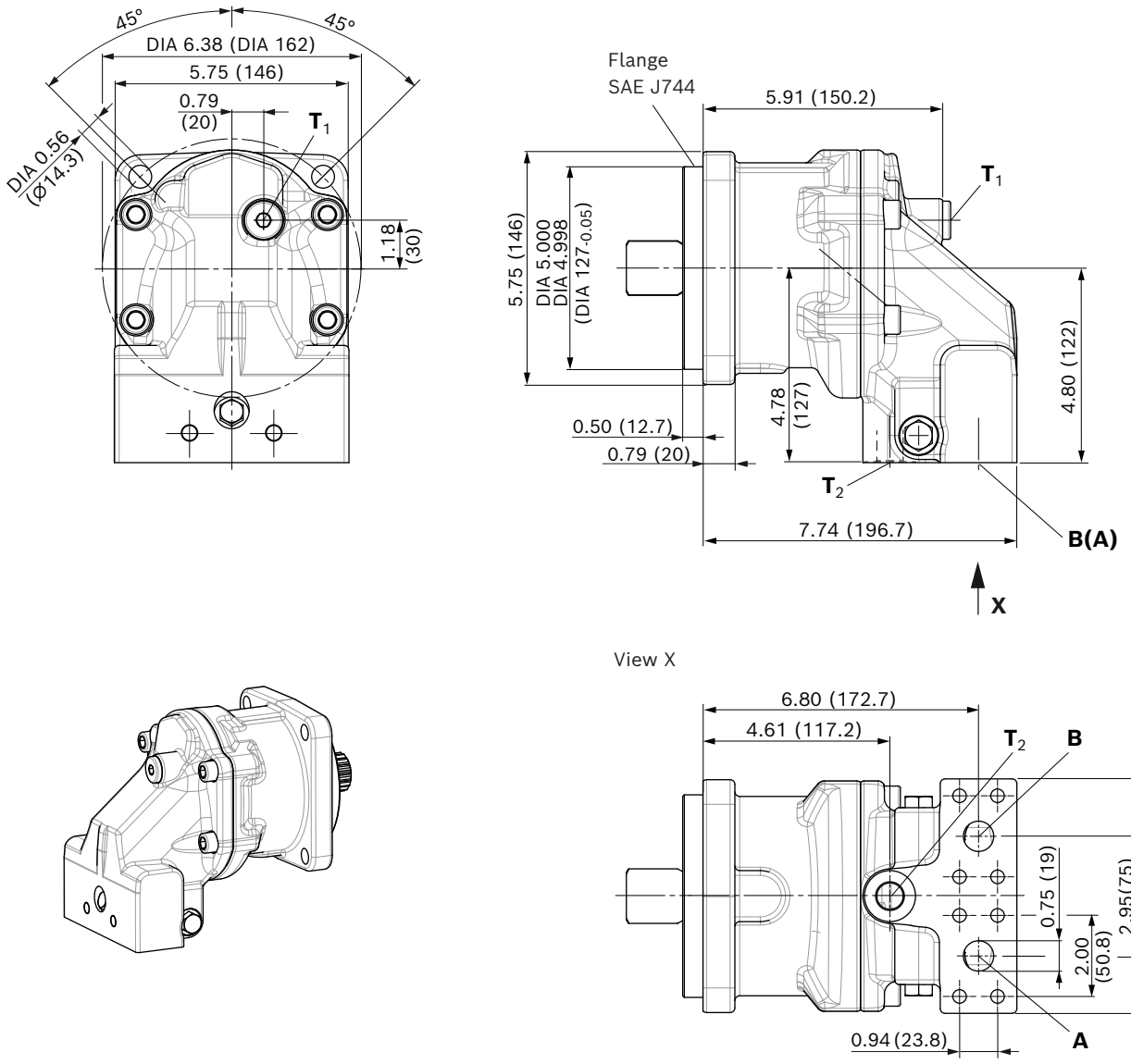
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

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

A2FMN sizes 56, 63 and 80, A2FMM sizes 45, 56 and 63, A2FMH sizes 45, 56 and 63

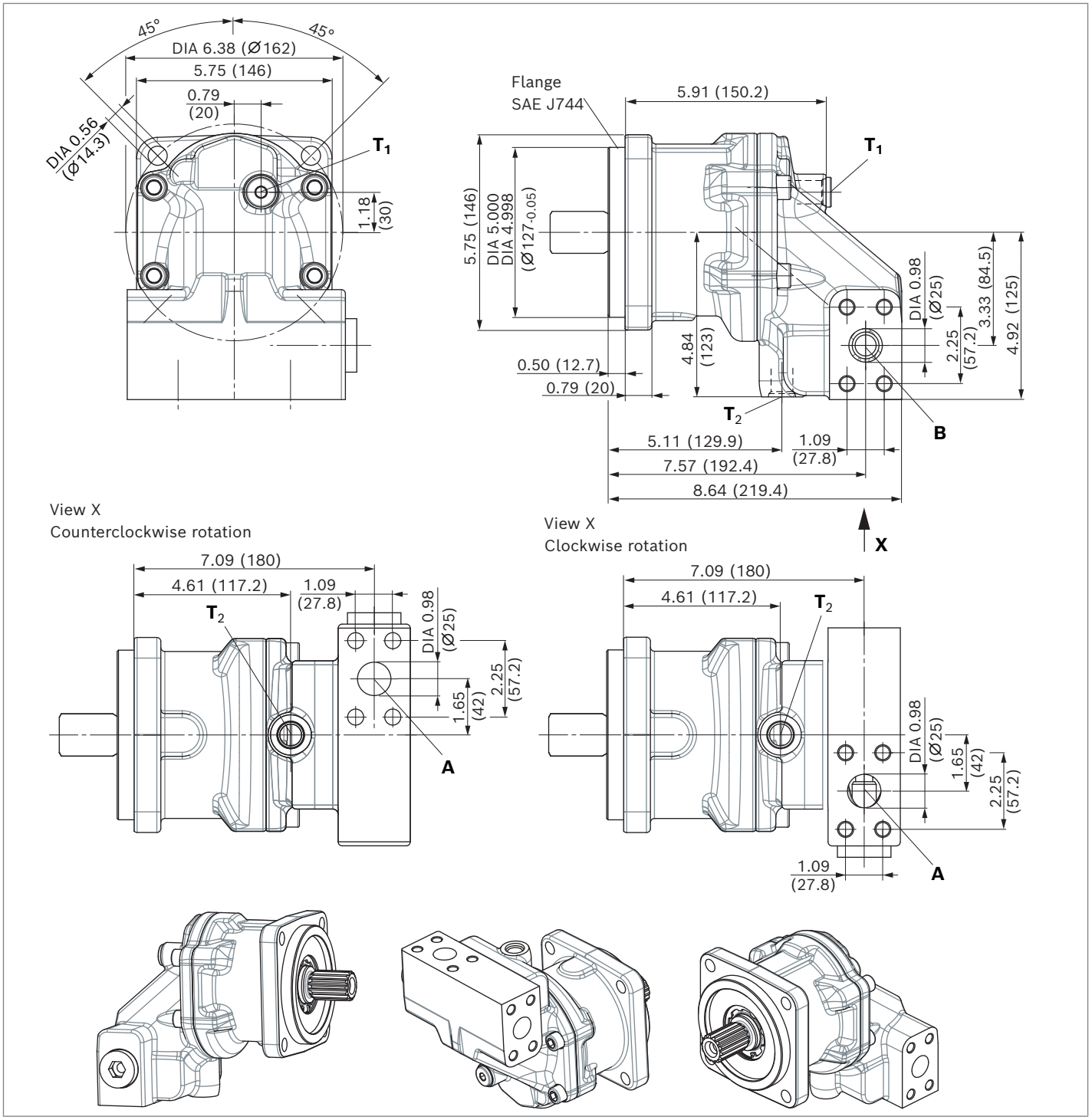
A2FM dimensions, flange C4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	3/4 in M10 × 1.5; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

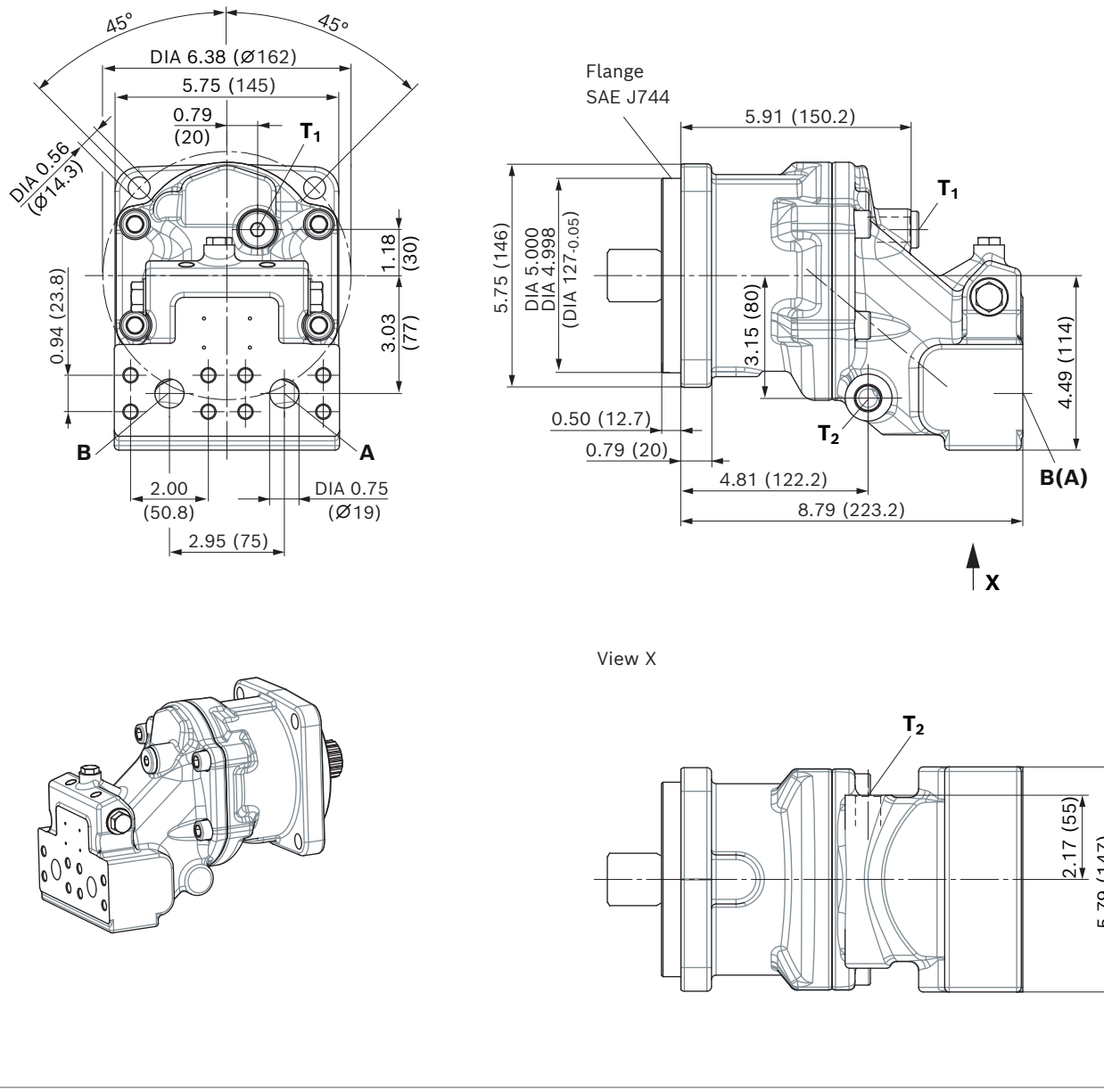
A2FM dimensions, flange C4, working ports A and B at side and at bottom (12)



Ports		Standard	Size	p_{max} [bar][2]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	1 in M12; 0.67 (17) deep	7250 (350)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

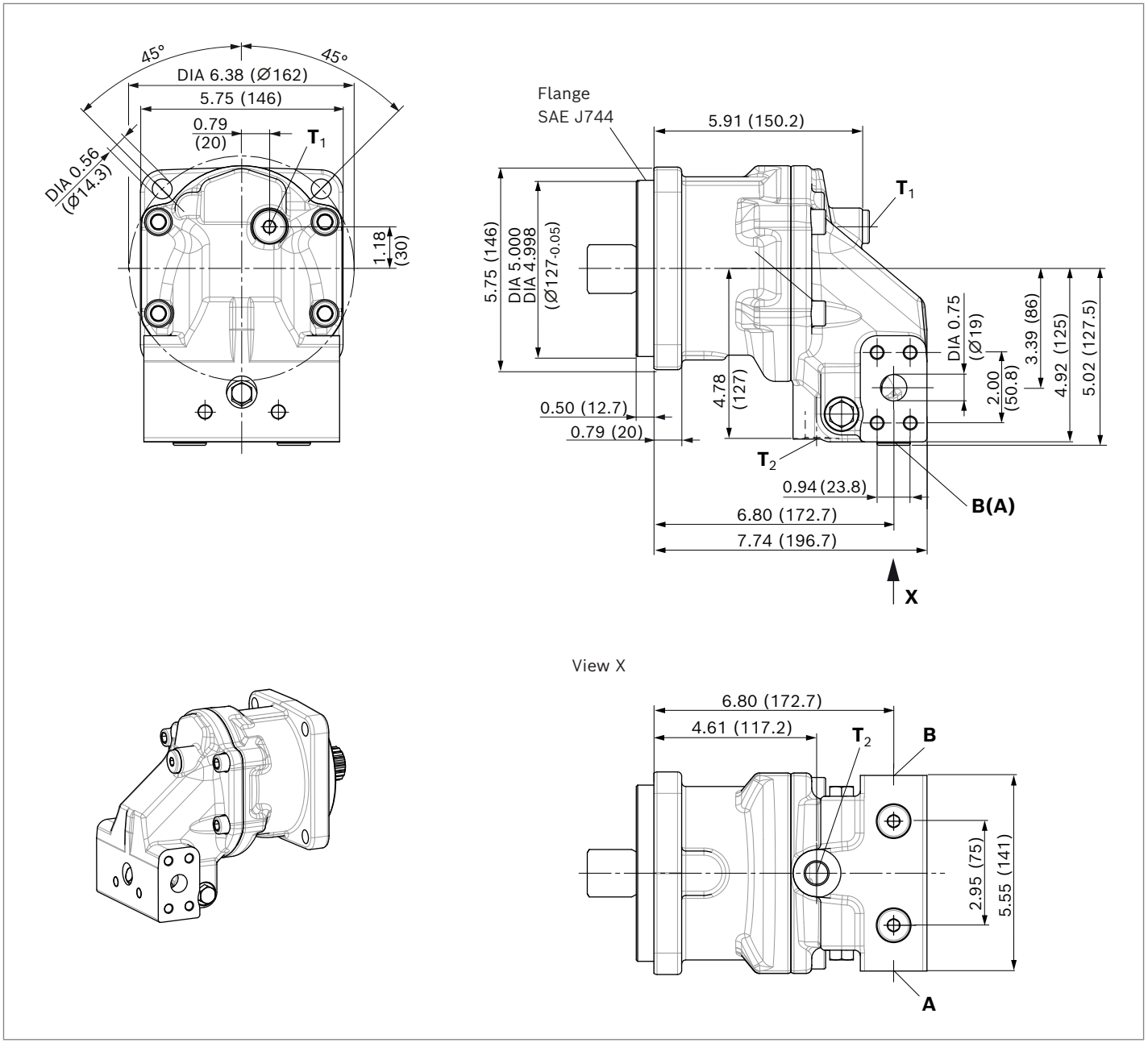
A2FM dimensions, flange C4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	3/4 in M10 × 1.5; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

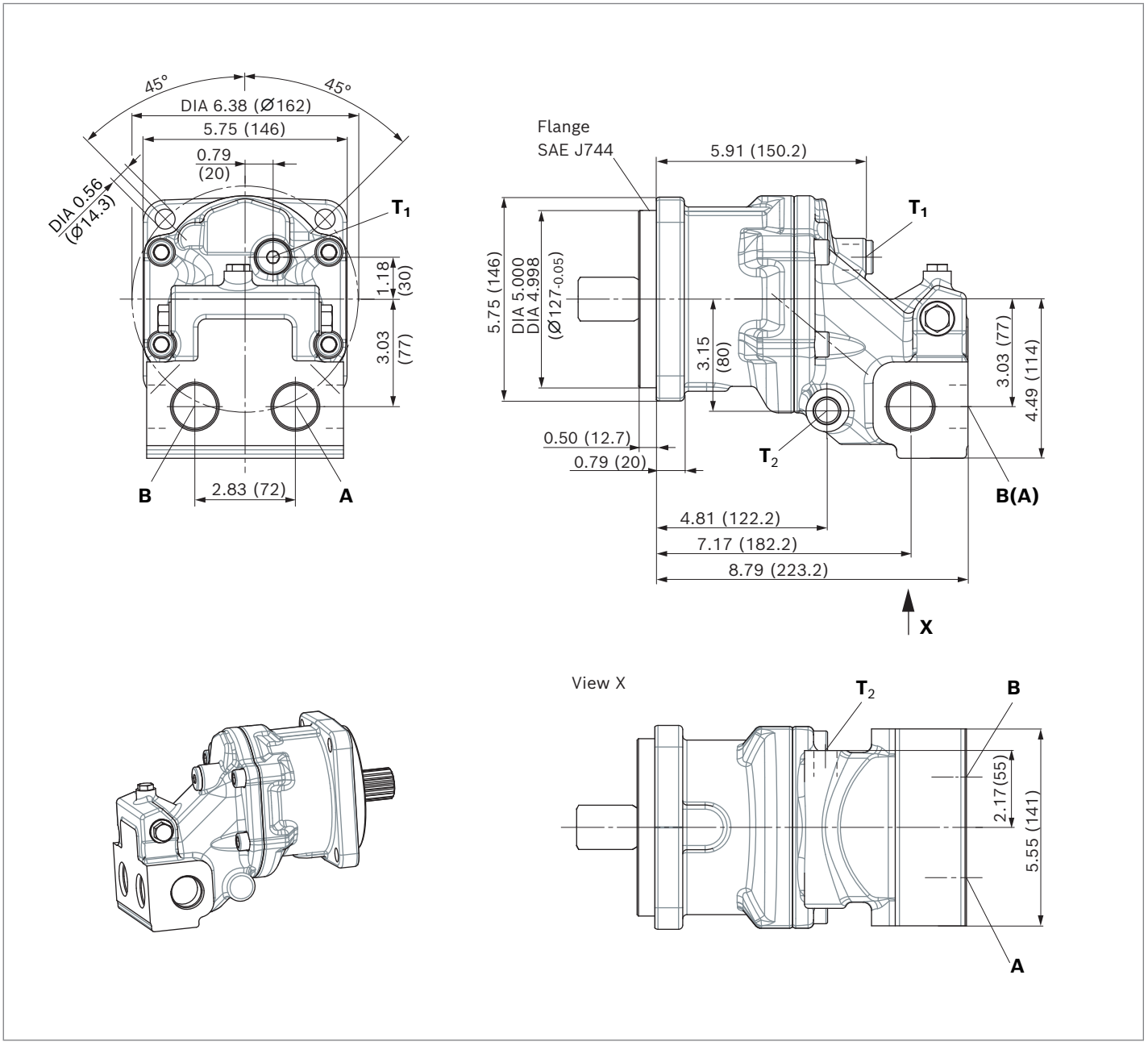
A2FM dimensions, flange C4, working ports A and B at side (02)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	3/4 in M10 × 1.5; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, flange C4, working ports A and B at side and at rear (03)

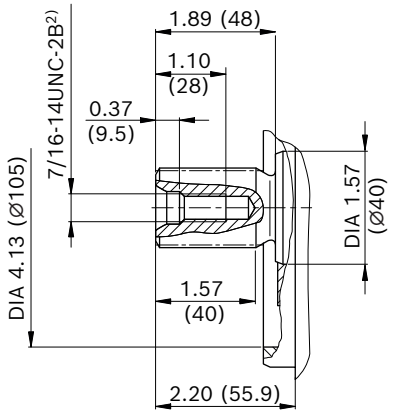


Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port	ISO 11926	1 5/16-16 UNF-2B; 20 deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	3/4-16 UNF-2B; 0.59 (15) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

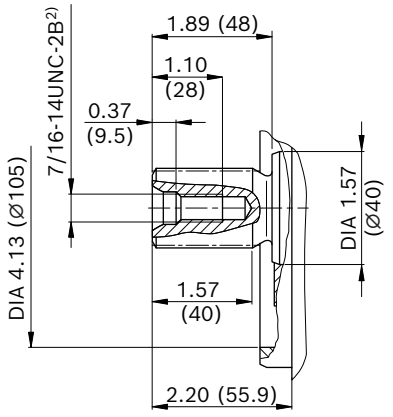
▼ **Splined shaft SAE J744,**
A2FMN: size 56, 63, 80
A2FMM: size 45, 56, 63
A2FMH: size 45

S7 – 1 1/4 in 14T 12/24 DP[1)]



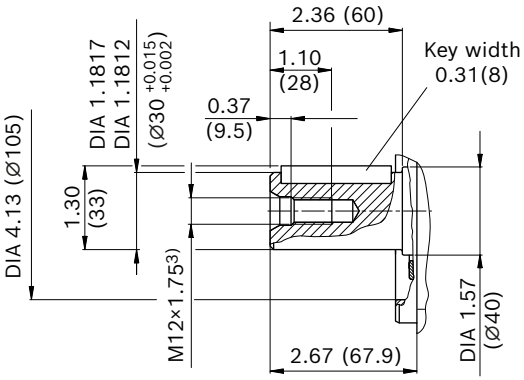
▼ **Splined shaft SAE J744,**
A2FMN: size 56, 63, 80
A2FMM: size 56, 63
A2FMH: size 56, 63

V8 – 1 3/8 in 21T 16/32 DP[1)]



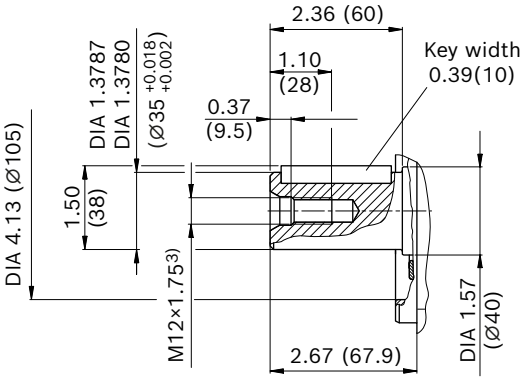
▼ **Parallel keyed shaft, DIN 6885,**
A2FMN: size 56
A2FMM: size 45, 56
A2FMH: size 45, 56

P6 – AS8×7×50



▼ **Parallel keyed shaft, DIN 6885,**
A2FMN: size 56, 63, 80
A2FMM: size 56, 63
A2FMH: size 56, 63

P8 – AS10×8×50



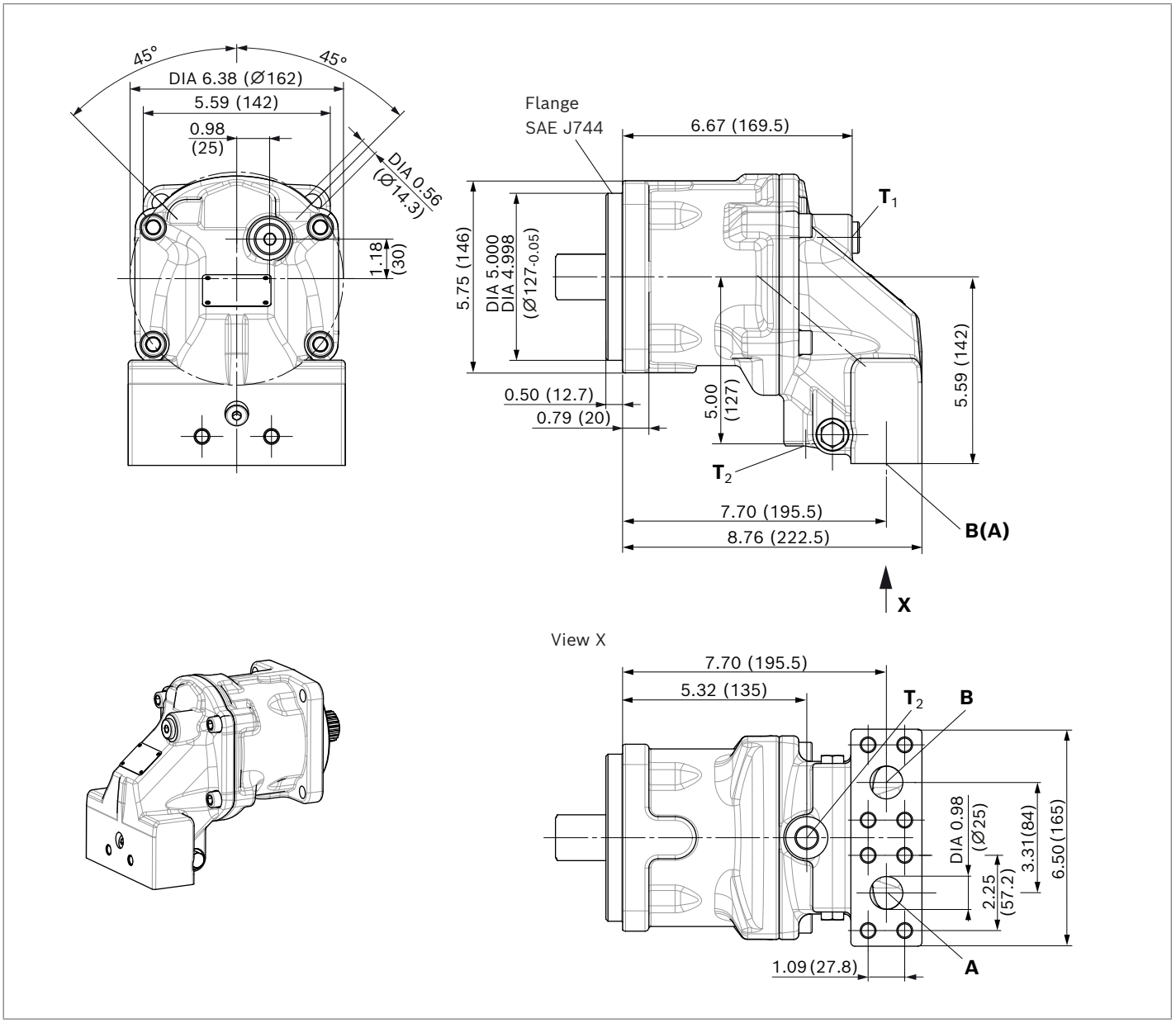
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

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

A2FMN sizes 90 and 107, A2FMM sizes 80 and 90, A2FMH sizes 80 and 90

A2FM dimensions, flange C4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	1 in M12 × 1.75; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

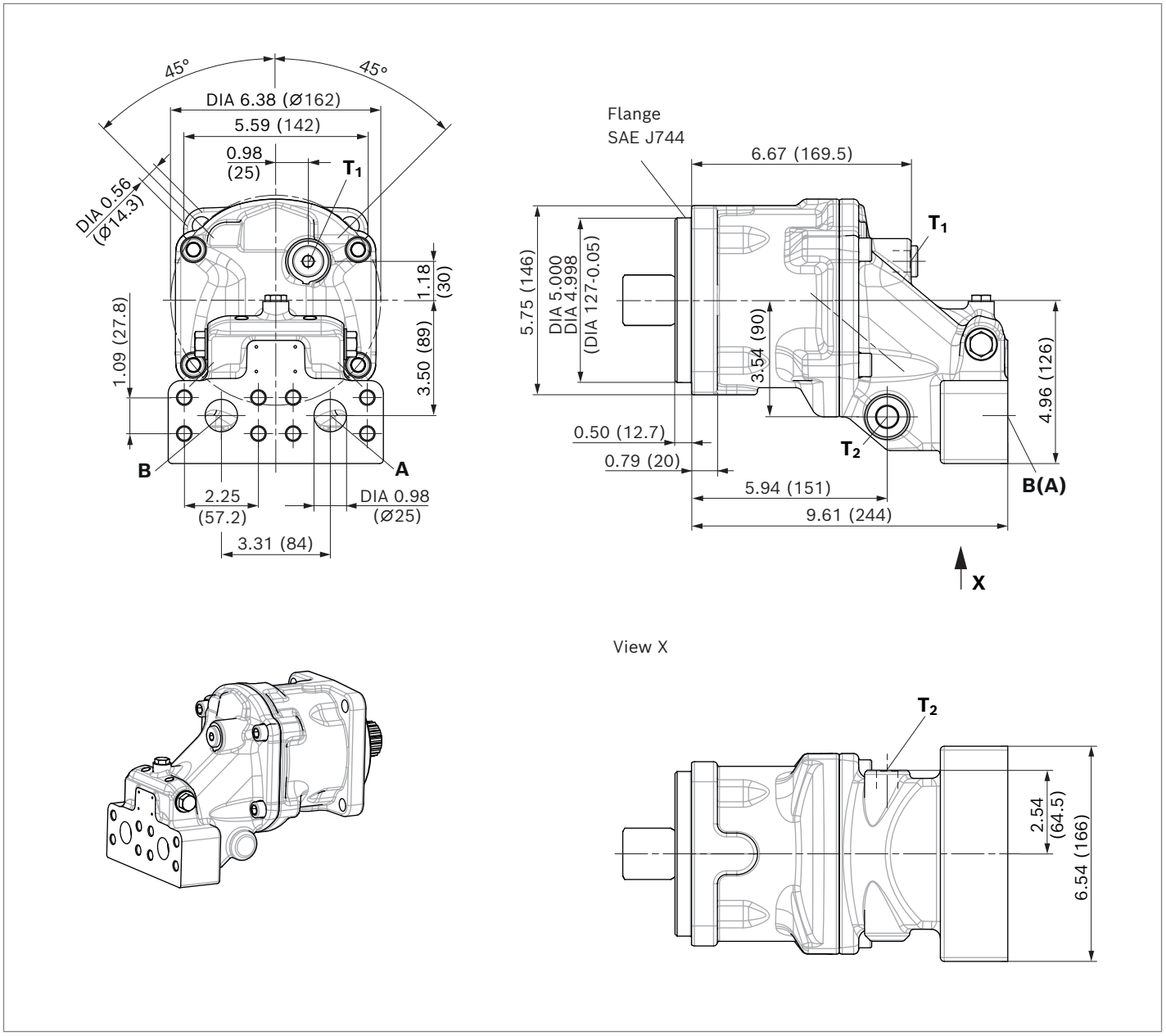
1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).

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

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

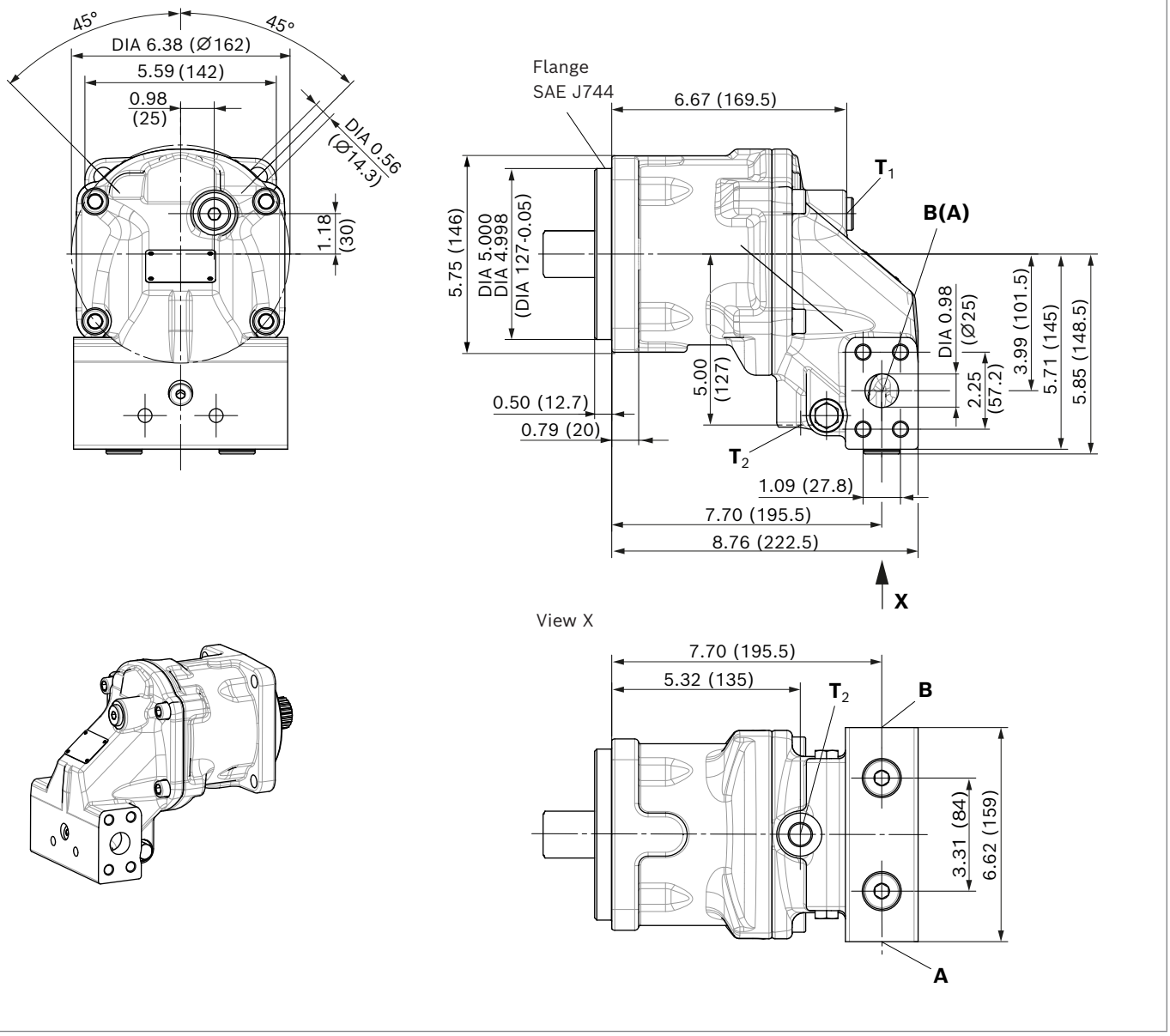
A2FM dimensions, flange C4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	1 in M12 × 1.75; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, flange C4, working ports A and B at side (02)

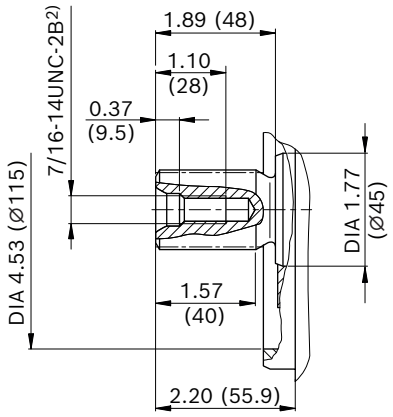


Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN 13	1 in M12 × 1.75; 0.67 (17) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

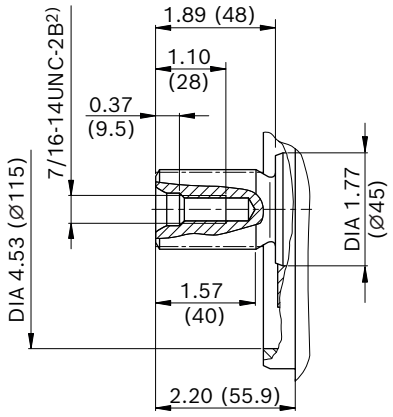
▼ **Splined shaft SAE J744,**
A2FMN: size 90, 107
A2FMM: size 80, 90

S7 – 1 1/4 in 14T 12/24 DP[1)]



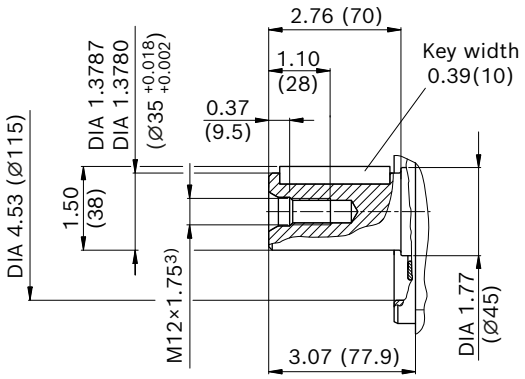
▼ **Splined shaft SAE J744,**
A2FMN: size 90, 107
A2FMM: size 80, 90
A2FMH: size 80

V8 – 1 3/8 in 21T 16/32 DP[1)]



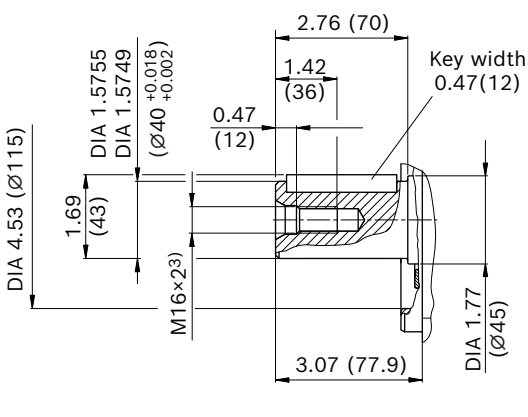
▼ **Parallel keyed shaft, DIN 6885,**
A2FMM: size 80
A2FMH: size 80

P8 – AS10×8×56



▼ **Parallel keyed shaft, DIN 6885,**
A2FMN: size 90, 107
A2FMM: size 80, 90
A2FMH: size 80, 90

P9 – AS12×8×56



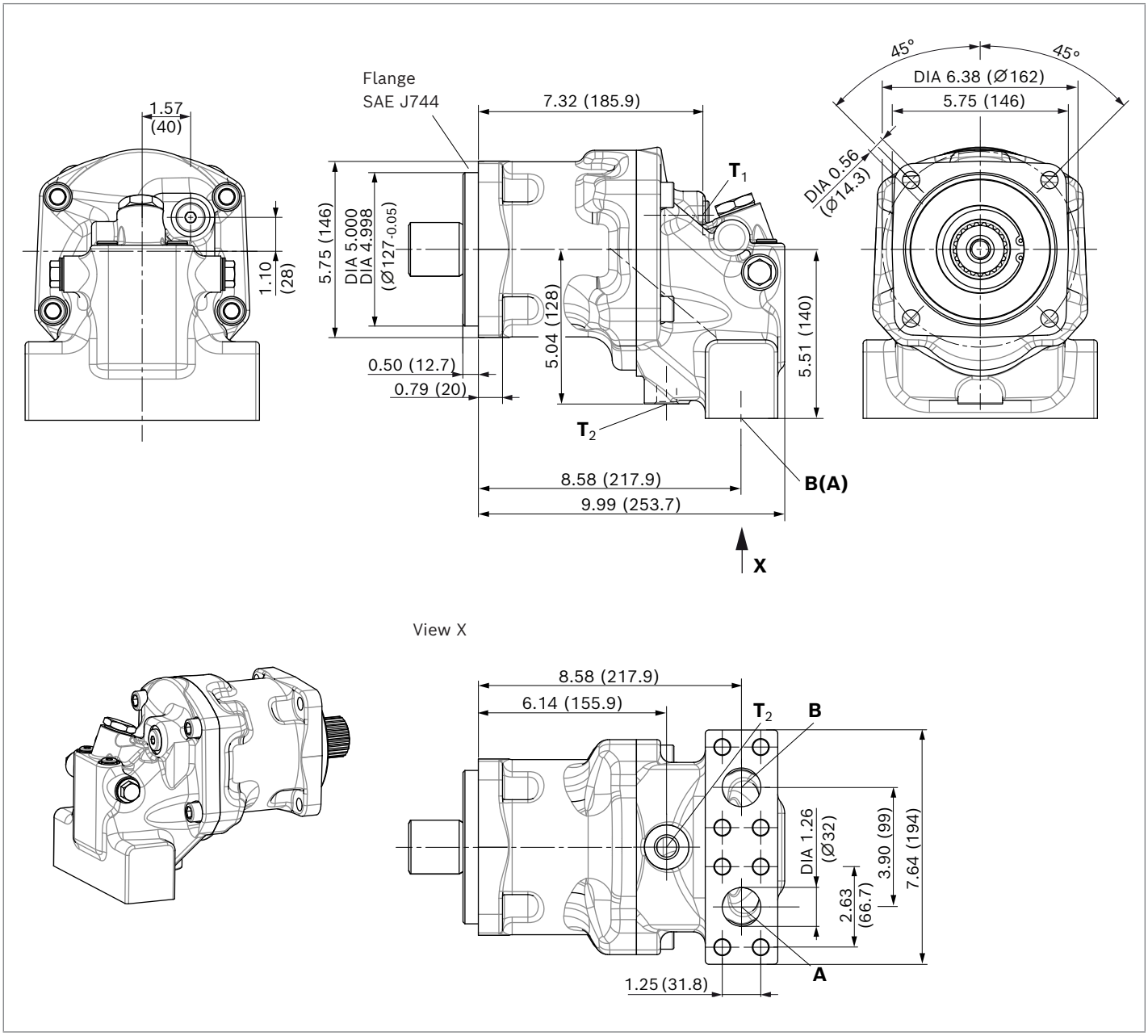
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

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

A2FMM sizes 107 and 125 and A2FMH sizes 107 and 125

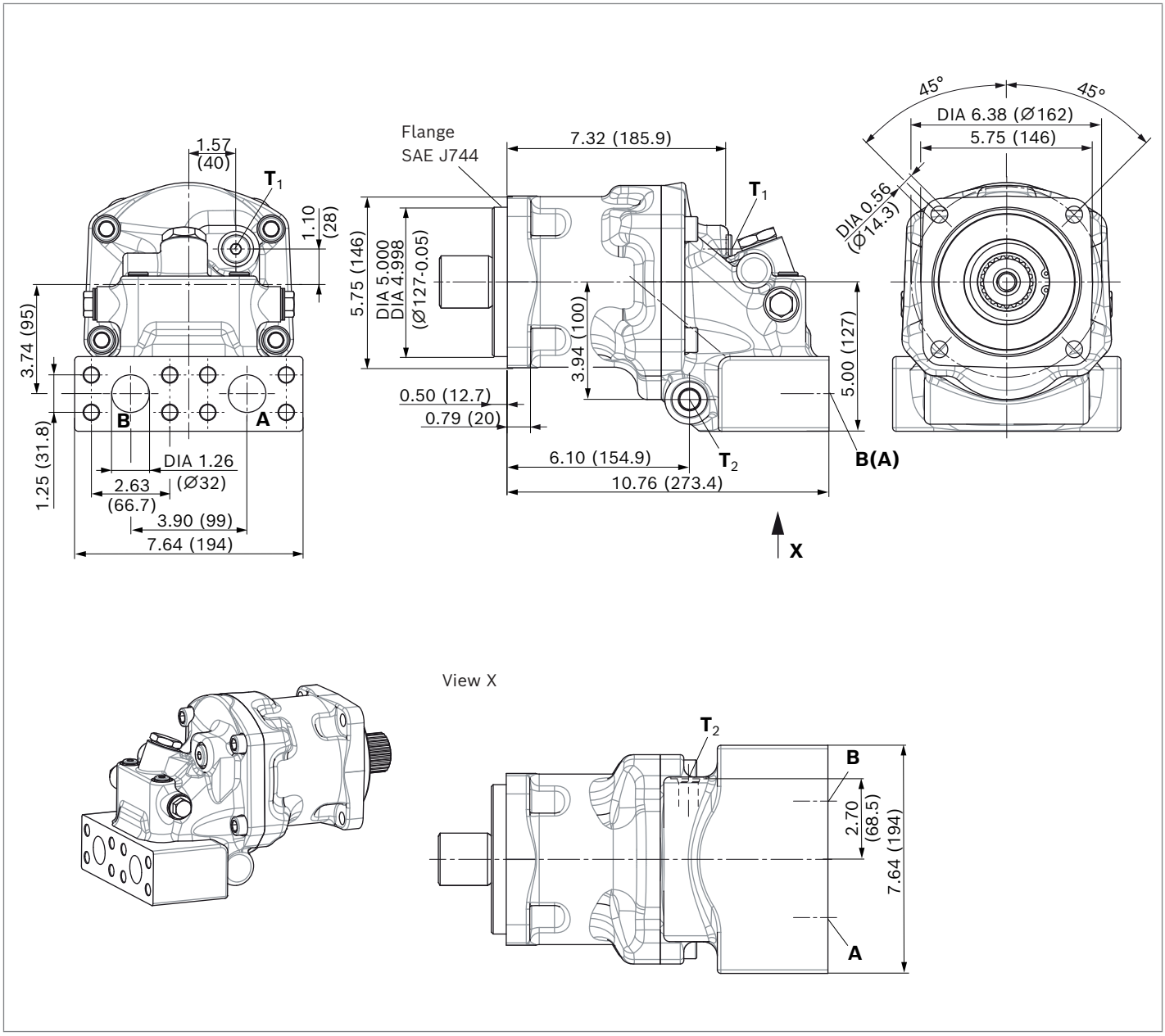
A2FM dimensions, flange C4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 x 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

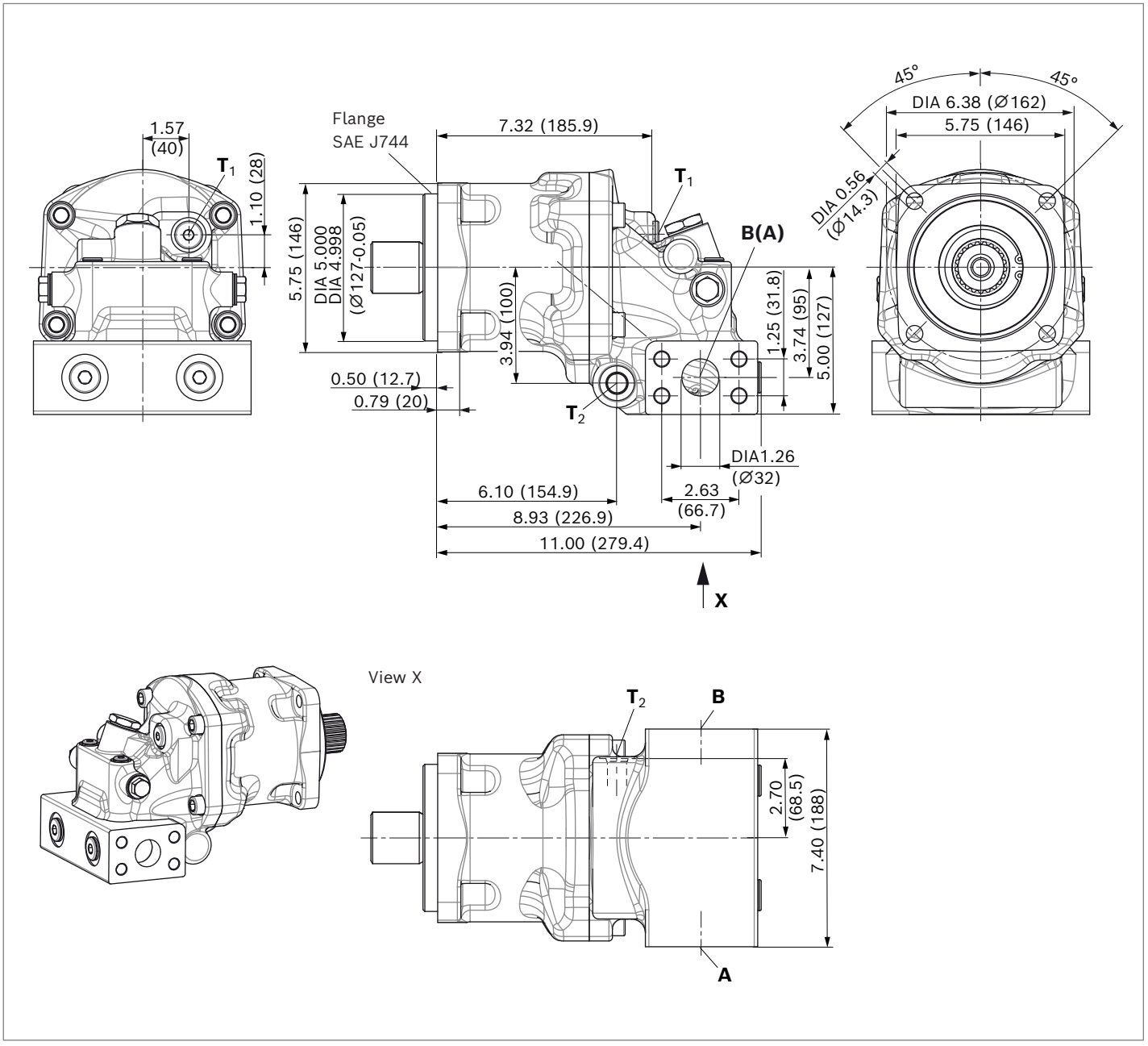
A2FM dimensions, flange C4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 x 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

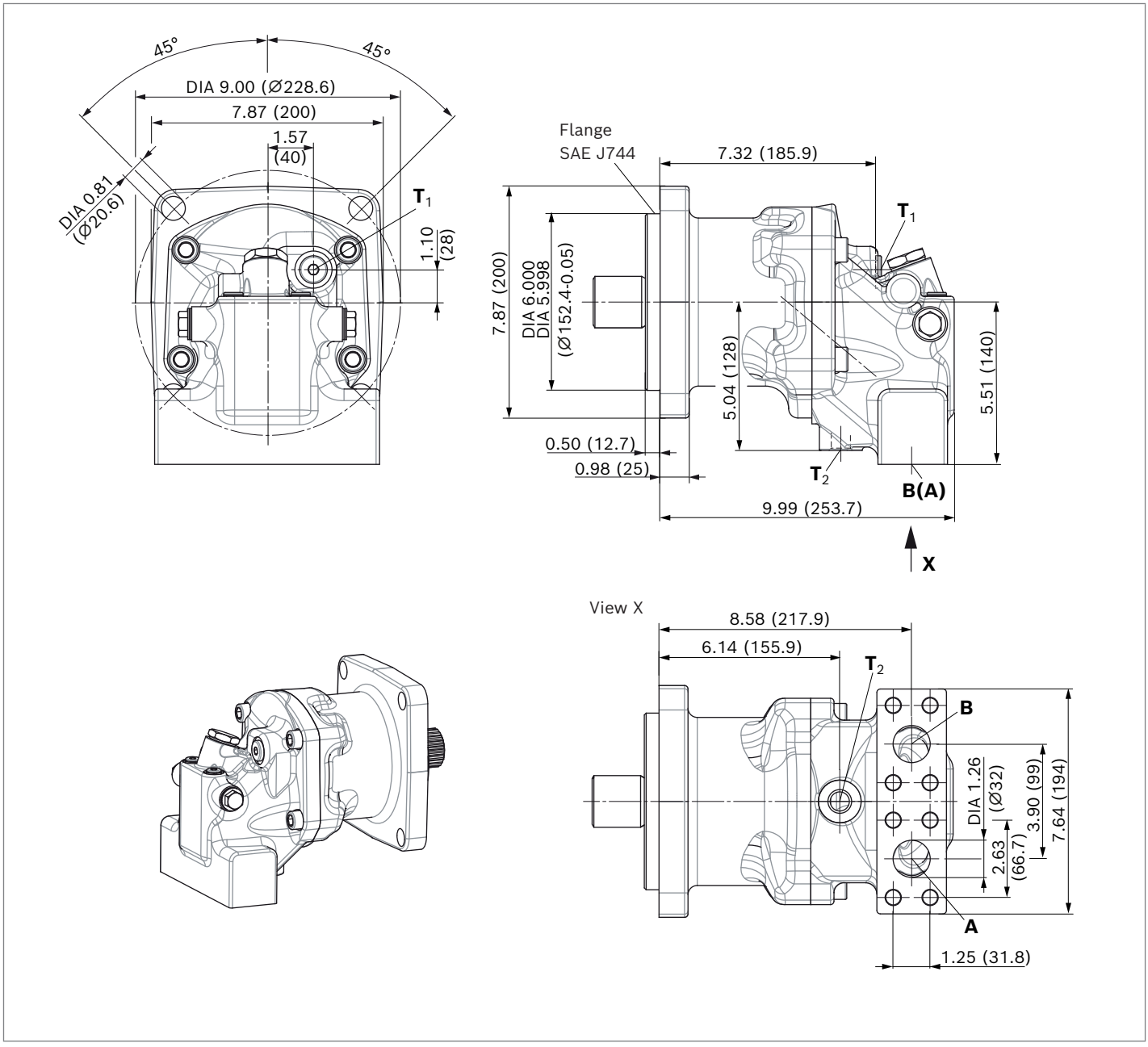
A2FM dimensions, flange C4, working ports A and B at side, opposite (02)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 x 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

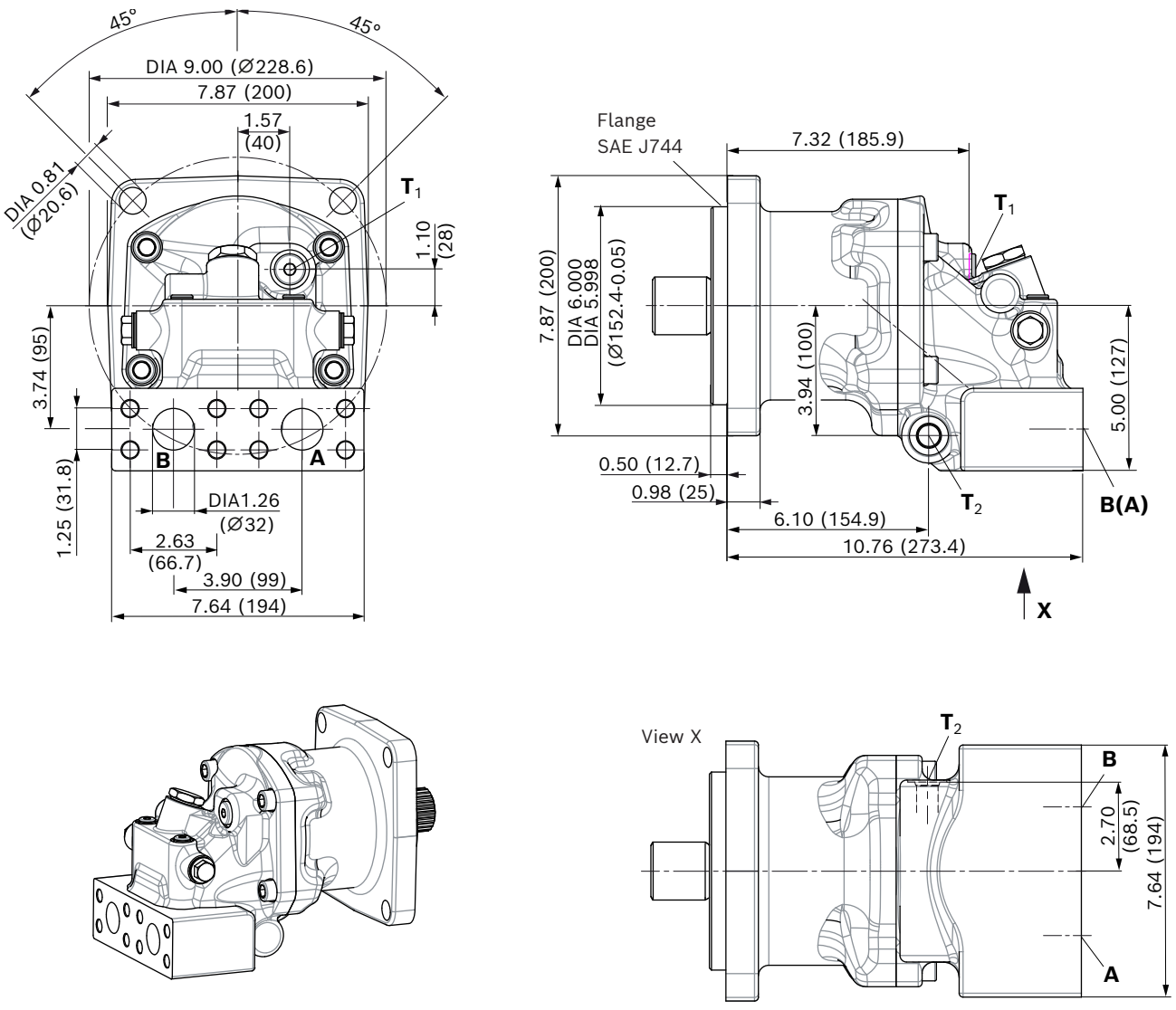
A2FM dimensions, flange D4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 x 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

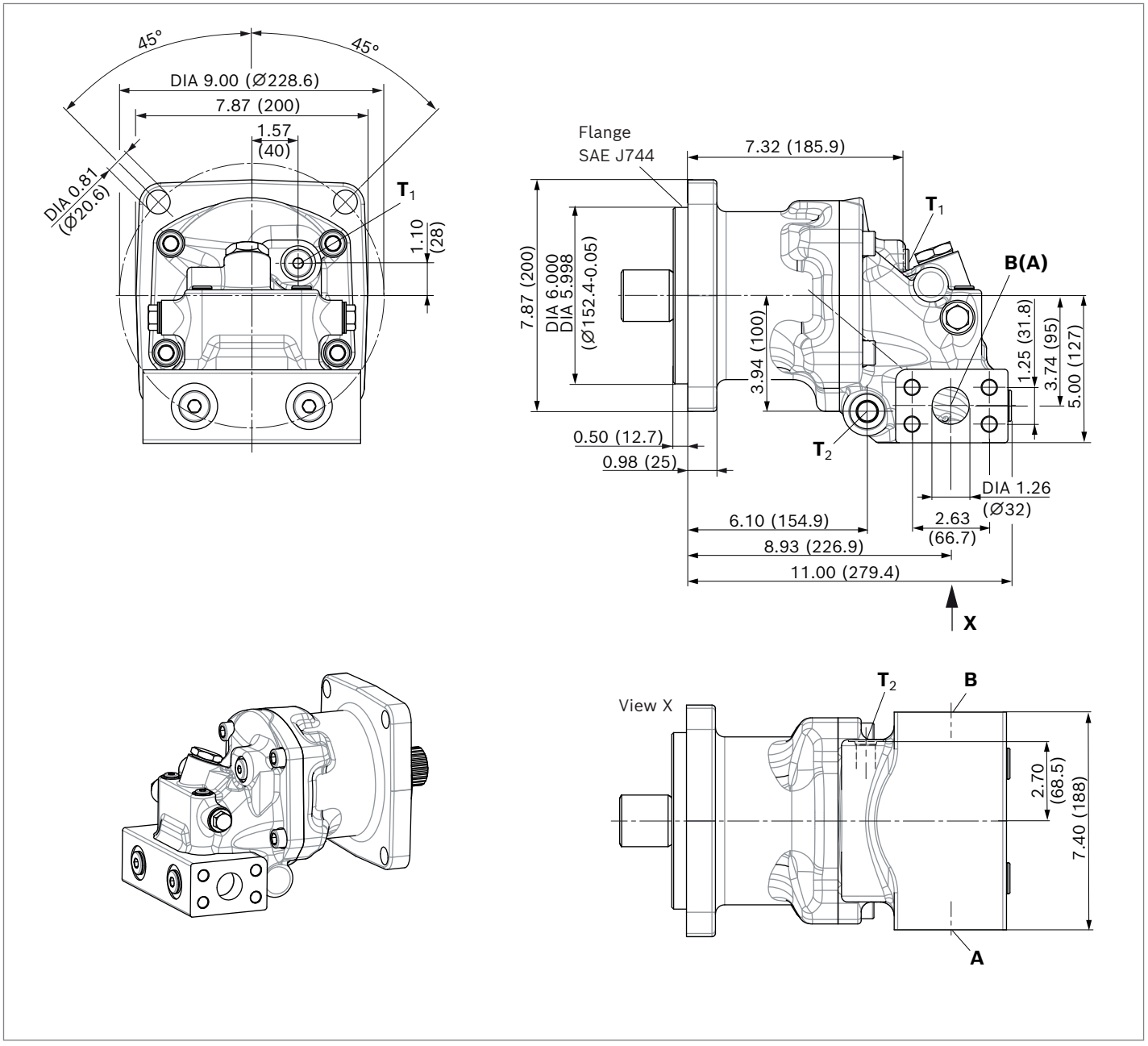
A2FM dimensions, flange D4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 x 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, flange D4, working ports A and B at side (02)

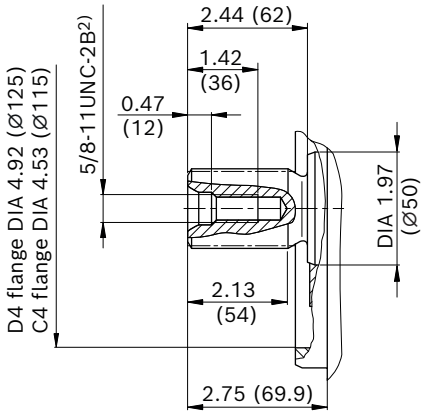


Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 × 2; 0.91 (23) deep	7250 (500)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

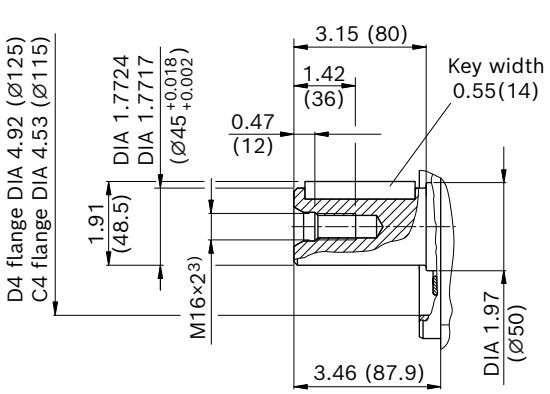
▼ **Splined shaft SAE J744,**
A2FMM: size 107, 125
A2FMH: size 107

V9 – 1 1/2 in 23T 16/32 DP



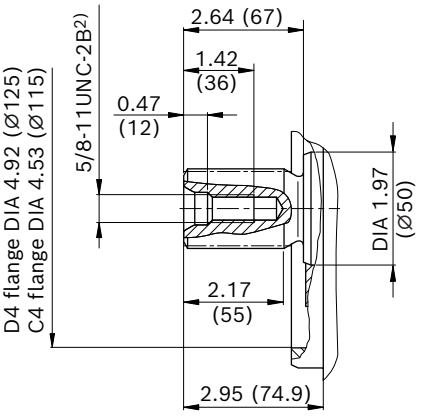
▼ **Parallel keyed shaft, DIN 6885,**
A2FMM: size 107, 125
A2FMH: size 107, 125

B1 – AS14×9×63



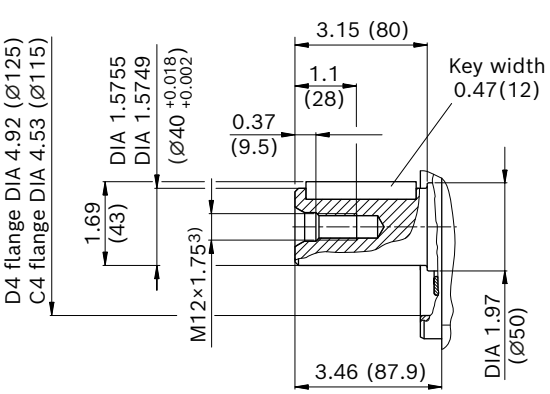
▼ **Splined shaft SAE J744,**
A2FMM: size 107, 125
A2FMH: size 107, 125

T1 – 1 3/4 in 13T 8/16 DP



▼ **Parallel keyed shaft, DIN 6885,**
A2FMM: size 107
A2FMH: size 107

P9 – AS12×8×63



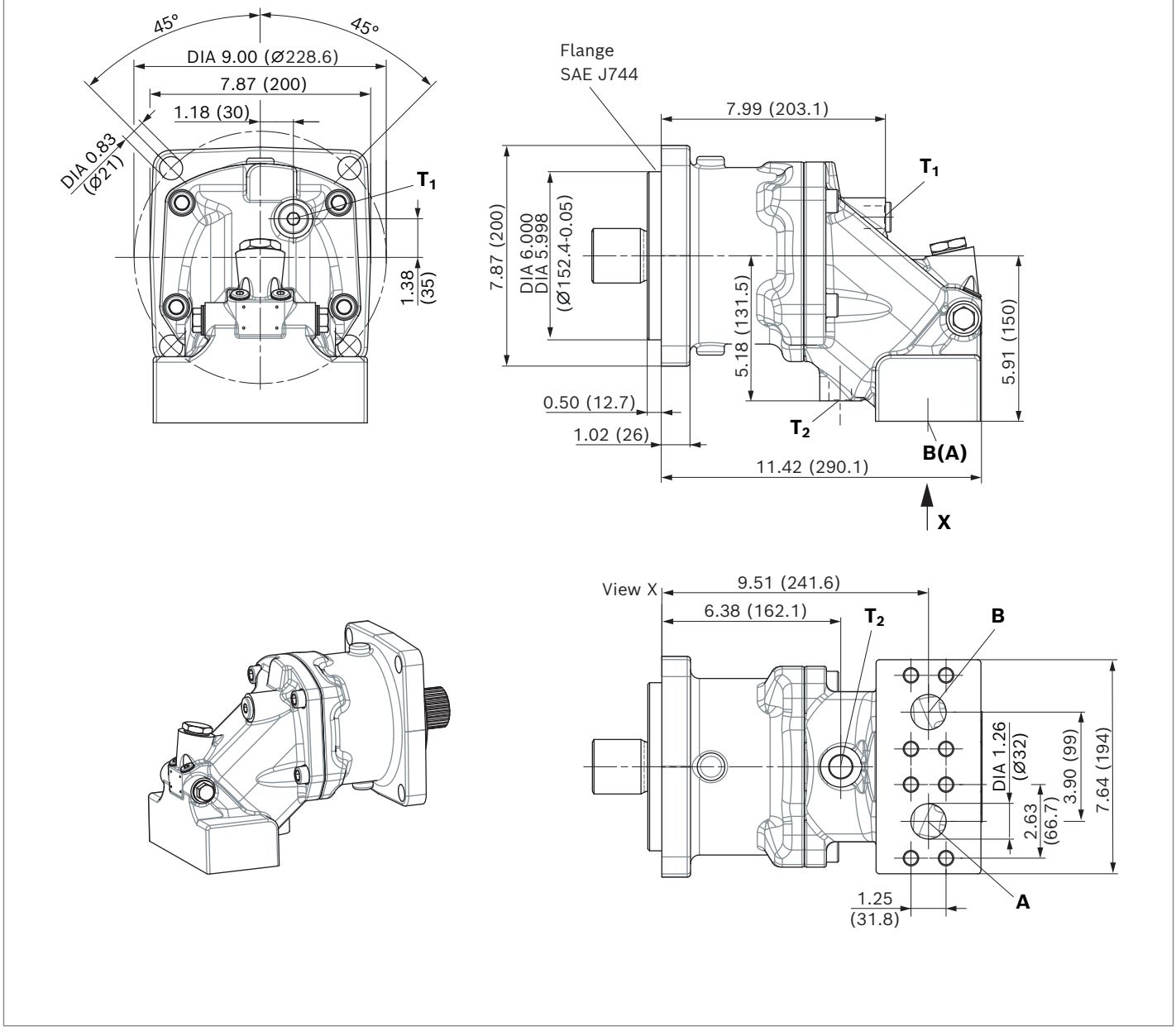
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

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

A2FMM sizes 160 and 180

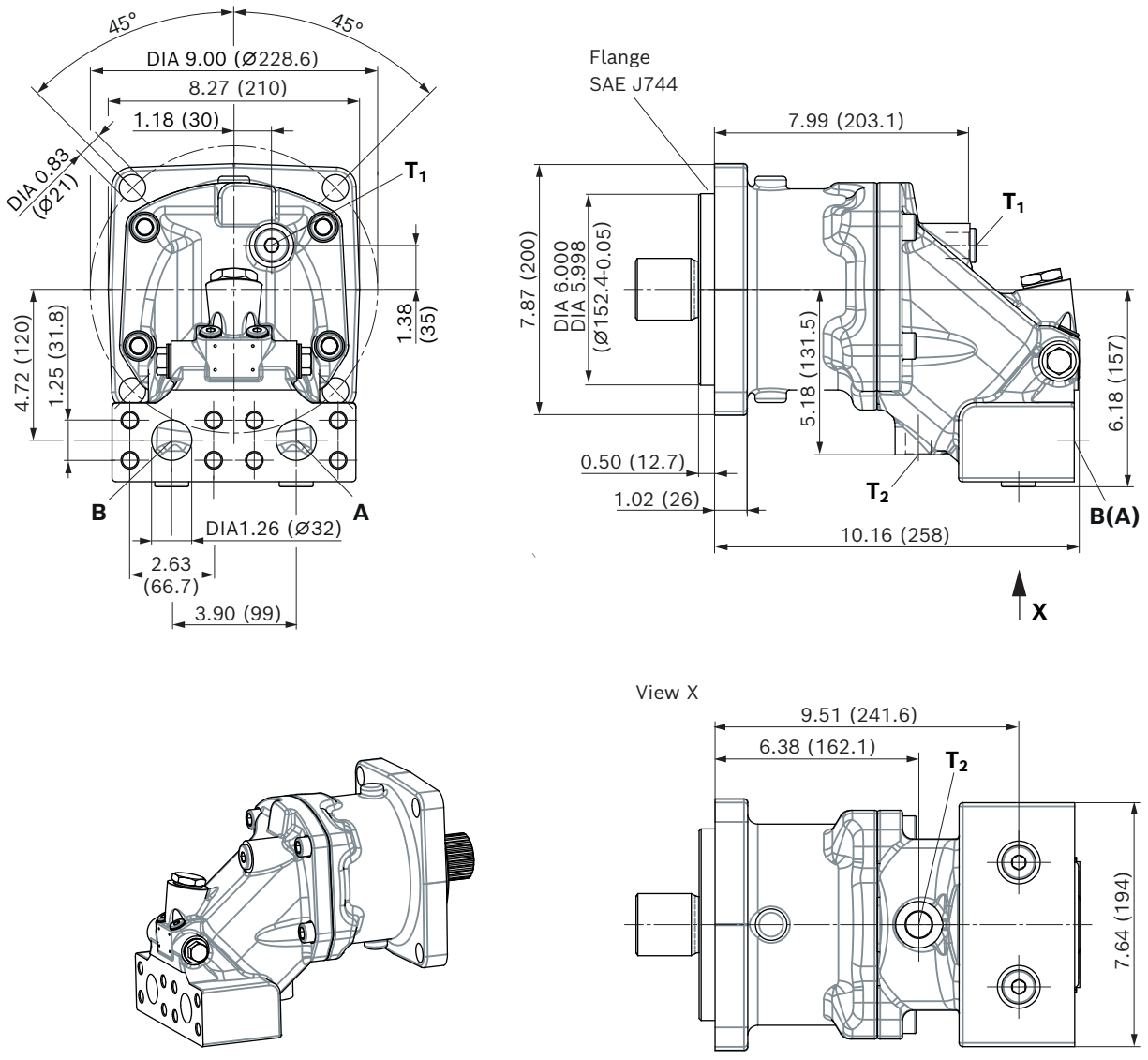
A2FM dimensions, flange D4, working ports A and B at bottom (11)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port	SAE J518	1 1/4 in	6500 (450)	O
	Fastening thread	DIN13	M14 × 2; 0.91 (23) deep		
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

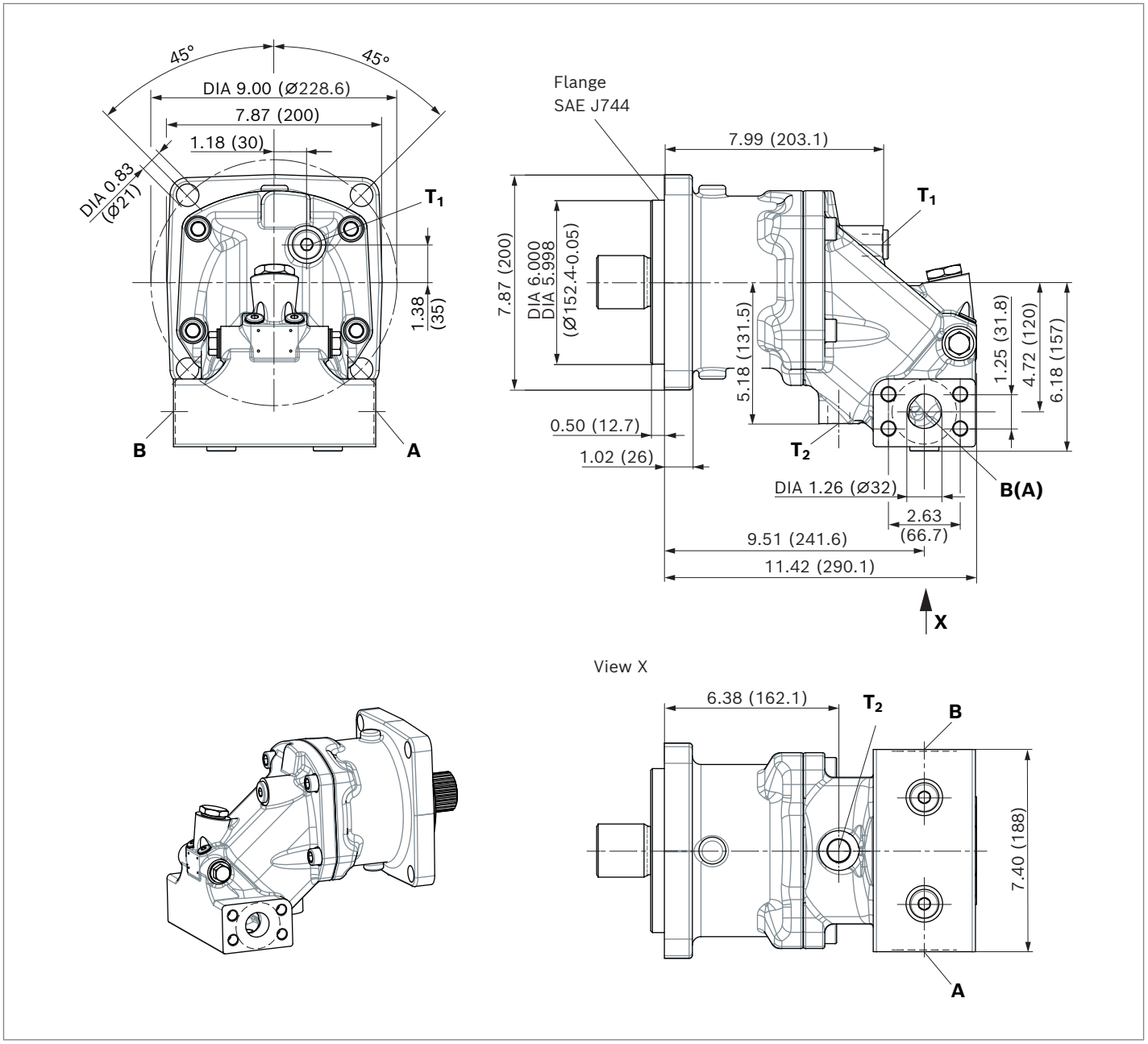
A2FM dimensions, flange D4, working ports A and B at rear (01)



Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 × 2; 0.91 (23) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, flange D4, working ports A and B at side (02)

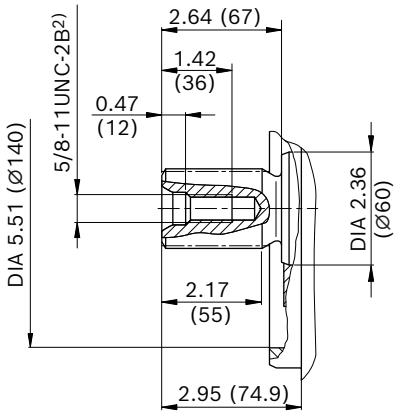


Ports		Standard	Size	p_{max} [bar][1]	Status[4]
A, B	Working port Fastening thread	SAE J518 DIN13	1 1/4 in M14 × 2; 0.91 (23) deep	6500 (450)	O
T_1	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	X[2]
T_2	Drain port	ISO 11926[3]	7/8-14 UNF-2B; 0.67 (17) deep	45 (3)	O[2]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 57).
3) The spot face can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

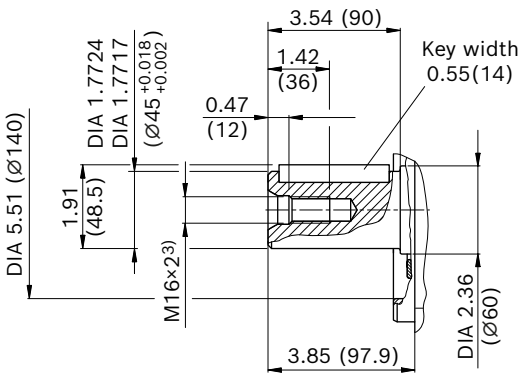
▼ **Splined shaft SAE J744, A2FMM: size 160, 180**

T1 – 1 3/4 in 13T 8/16 DP



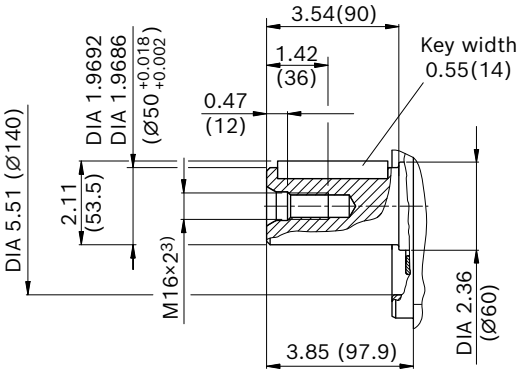
▼ **Parallel keyed shaft, DIN 6885, A2FMM: size 160**

B1 – AS14×9×70



▼ **Parallel keyed shaft, DIN 6885, A2FMM: size 160, 180**

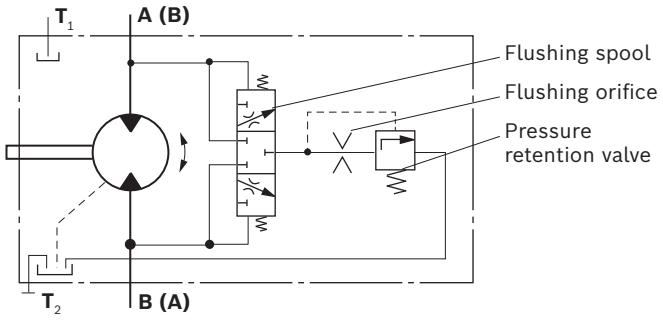
B2 – AS14×9×70



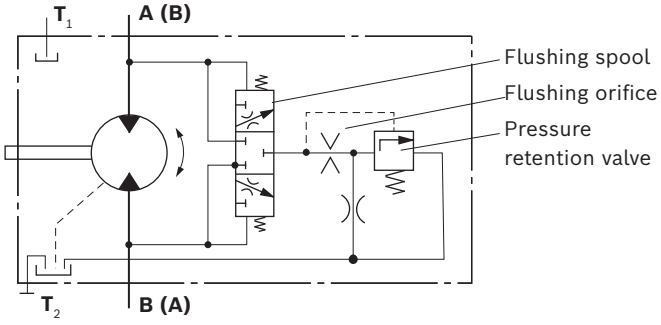
Flushing and boost pressure valve, integrated

The flushing and boost pressure valve is used to remove heat from the hydraulic circuit.
In the closed circuit it is used for the case flushing and for ensuring of 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, sizes 23 to 107(N)**



▼ **Circuit diagram, sizes 107 to 180**



Cracking pressure of pressure retention valve
(observe when setting the primary valve)

- Sizes 23 to 180, fixed setting 230 psi (16 bar)

Switching pressure of flushing spool

- Sizes 23 to 107(N)
  Δp = 115 ±15 psi (8 ±1 bar)
- Sizes 107 to 180
  Δp = 255 ±22.5 psi (17.5 ±1.5 bar)

Flushing flow
Orifices can be used to adjust the flushing flows as required. The following information is based on:
$\Delta p_{ND} = p_{ND} - p_G$ = 365 psi (25 bar) and
ν = 10 cSt
(p_{ND} = low pressure, p_G = case pressure)

Size	Code	Orifice dia. [inch (mm)]	Flushing flow q_v [gpm (l/min)]
23, 28, 32, 37, 45, 56, 63, 80, 90, 107(N)	**C**	0.04 (1.0)	0.69 (2.6)
	D	0.051 (1.3)	1.06 (4)
	E	0.06 (1.5)	1.58 (6)
	F	0.067 (1.7)	1.95 (7.4)
	G	0.071 (1.8)	2.25 (8.5)
	H	0.078 (2.0)	2.64 (10)
	I	0.09 (2.3)	3.01 (11.4)
	J	0.12 (3)	3.30 (12.5)
107, 125, 160, 180	**D**	0.047 (1.2)	1.06 (4)
	E	0.055 (1.4)	1.58 (6)
	F	0.063 (1.6)	1.95 (7.4)
	G	0.071 (1.8)	2.25 (8.5)
	H	0.078 (2.0)	2.64 (10)
	K	0.098 (2.5)	3.96 (15)
	L	0.11 (2.8)	4.75 (18)
	M	0.122 (3.1)	5.55 (21)
	N	0.149 (3.8)	7.13 (27)
	O	0.157 (4.0)	8.19 (31)
	P	0.196 (5.0)	9.77 (37)

Pressure relief valve

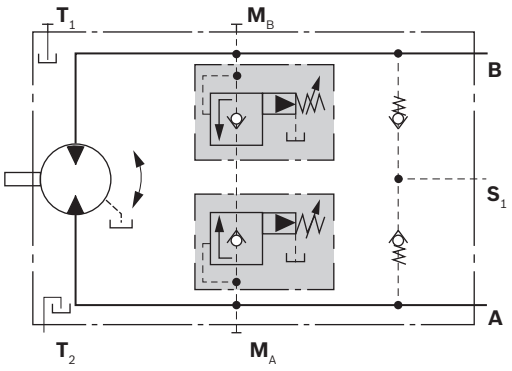
The VMR respectively VBB pressure relief valves (see data sheets 18318-42, 18318-43, 18319-14 and 18319-15) protect the hydraulic motor from overload. As soon as the set cracking pressure is reached, the hydraulic fluid flows from the high-pressure side to the low-pressure side.
The pressure relief valves are only available in conjunction with the working ports 07, 08 and 09 (for the counterbalance valve for mounting to working ports 07 and 08 see next page).

Cracking pressure setting range 725 to 6100 psi (50 to 420 bar)

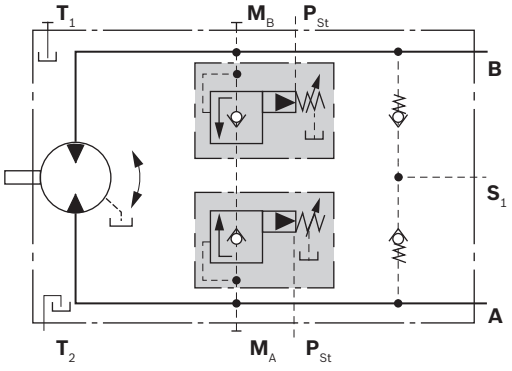
For versions “with pressure sequencing stage” 09S, a higher pressure setting can be implemented by connecting an external pilot pressure of 365 up to 435 psi (25 up to 30 bar) at port P_{St}.
When ordering, state in plain text:

- 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**



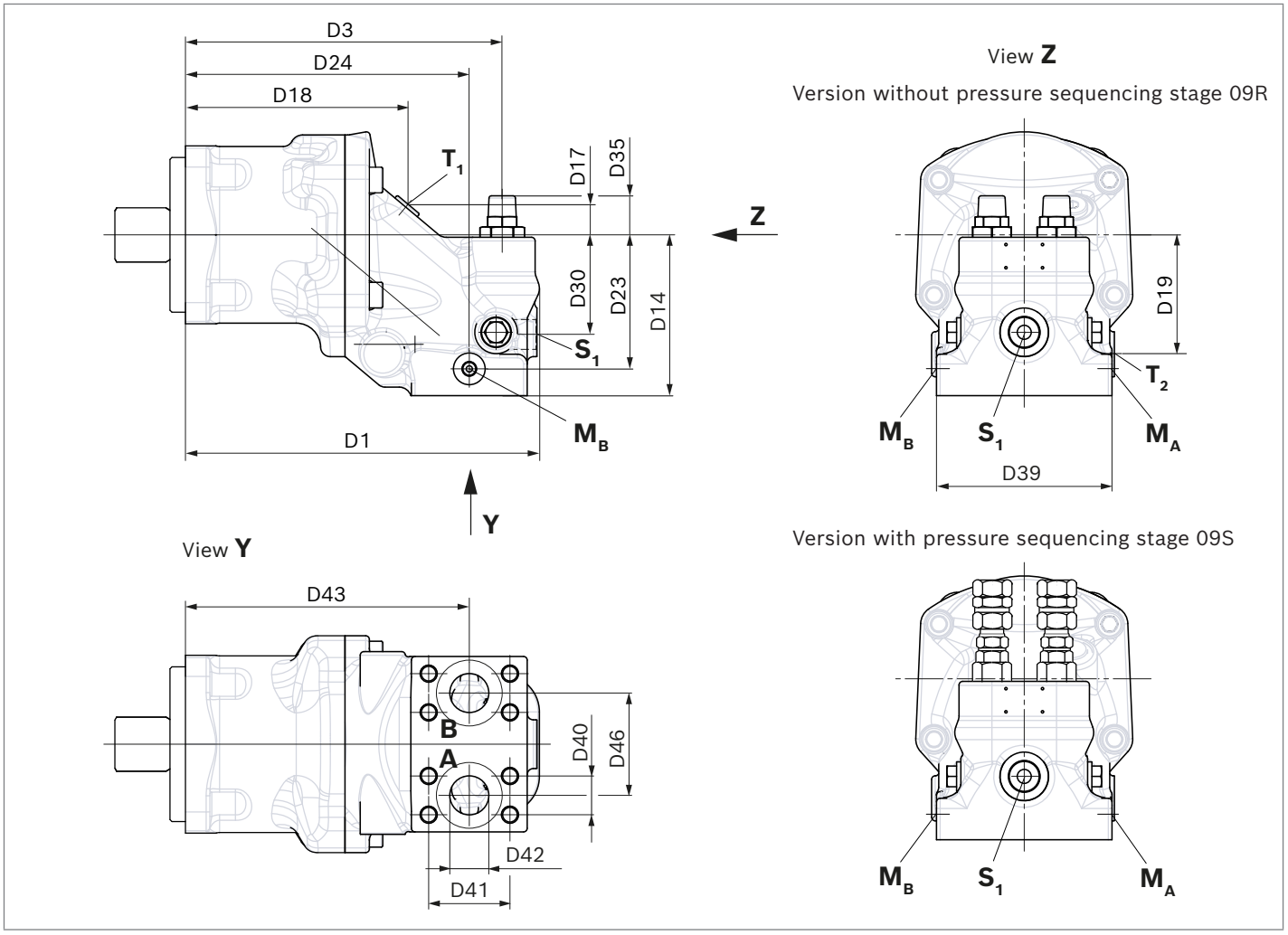
▼ **Circuit diagram version with pressure boost facility 09S**



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

Motor NG	Without valve		Limited values when using pressure relief valves		
			Pressure relief valve		
	p_{nom}/p_{max} [psi (bar)]	$q_{V\,max}$ [gpm (l/min)]	p_{nom}/p_{max} [psi (bar)]	q_V [gpm (l/min)]	Code
45	5800/6500 (400/450)	59.31 (225)	5100/6100 (350/420)	63.40 (240)	09R, 09S
56		74.76 (283)			
63		83.21 (315)			
80		94.86 (359)			
90		107.58 (407)			
107		112.80 (427)		105.67 (400)	
125		132.09 (500)			

Dimensions



Size		D1	D3	D14	D17	D18	D19	D23	D24
45, 56, 63	VMR**2** / VBB**2**	9.1 (230)	8.1 (206)	4.7 (120)	0.87 (22)	5.4 (138)	2.7 (70)	4.1 (105)	7.4 (187)
80, 90	VMR**2** / VBB**2**	9.8 (249.5)	8.9 (227)	5.0 (128)	0.84 (21.3)	6.1 (155.5)	3.1 (79)	4.3 (110)	8.2 (208.5)
107, 125	VMR**3** / VBB**3**	11.4 (290.4)	9.8 (248)	5.2 (132)	0.83 (21)	5.8 (147.7)	3.9 (98)	4.3 (110)	7.9 (200.8)

Size		D30	D35	D39	D40	D41	D42	D43	D46
45, 56, 63	VMR**2** / VBB**2**	2.95 (75)	1.28 (32.5)	5.1 (130)	0.94 (23.8)	2.00 (50.8)	DIA 0.75 (Ø19)	7.4 (187)	2.95 (75)
80, 90	VMR**2** / VBB**2**	3.15 (80)	1.24 (31.5)	5.7 (145)	1.09 (27.8)	2.25 (57.2)	DIA 0.98 (Ø25)	8.2 (208.5)	2.95 (75)
107, 125	VMR**3** / VBB**3**	3.15 (80)	1.26 (32)	5.6 (144)	1.25 (31.8)	2.62 (66.7)	DIA 1.26 (Ø32)	9.2 (232.9)	3.30 (84)

Size		A, B	S_1	M_A, M_B	P_{St}
45, 56, 63	VMR**2** / VBB**2**	3/4 in	M22 × 1.5; 0.55 (14) deep	M12 × 1.5; 0.47 (12) deep	G 1/4
80, 90	VMR**2** / VBB**2**	1 in	M26 × 1.5; 0.63 (16) deep	M12 × 1.5; 0.47 (12) deep	G 1/4
107, 125	VMR**3** / VBB**3**	1 1/4 in	M26 × 1.5; 0.63 (16) deep	M12 × 1.5; 0.47 (12) deep	G 1/4

Ports		Standard	Size	p_{max} [bar][1]	State[3]
A, B	Working port	SAE J518	see table above	420	O
S_1	Boost port (for working ports 09R/09S only)	DIN 3852[2]	see table above	5	O
M_A, M_B	Measuring port pressure A/B	DIN 3852[2]	see table above	420	X
P_{St}	Pilot pressure port (for working ports 09S only)	DIN ISO 228	see table above	30	O

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

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

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

Counterbalance valve BVD/BVE

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 125 and BVE available for sizes 107 and 125.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
  Order example:
  A2FMM90/70NWVC4S707W000 +
  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 and BVE in data sheet 95526
- 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 305 psi (21 bar))
  - the required closing time for a warm device (oil viscosity approx. 15 cSt)

Permissible input flow or pressure for version with counterbalance valve

Motor	Without valve		Limited values when using BVD/BVE			
			BVD/BVE			
NG	p_{nom}/p_{max} [psi (bar)]	$q_{V\,max}$ [gpm (l/min)]	NG	p_{nom}/p_{max} [psi (bar)]	q_V[1] [gpm (l/min)]	Code
45	5800/6500 (400/450)	59.31 (225)	20	5100/6100 (350/420)	58.12 (220)	07W
56		74.76 (283)				
63		83.21 (315)				
80		94.86 (359)				
90		107.58 (407)				
107		112.80 (427)				
125		132.09 (500)				
107		112.80 (427)	25		84.54 (320)	08W
125		132.09 (500)				

BVD = Counterbalance valve, double-acting
BVE = Counterbalance v alve, single-acting

1) Restriction of input flow with counterbalance valve

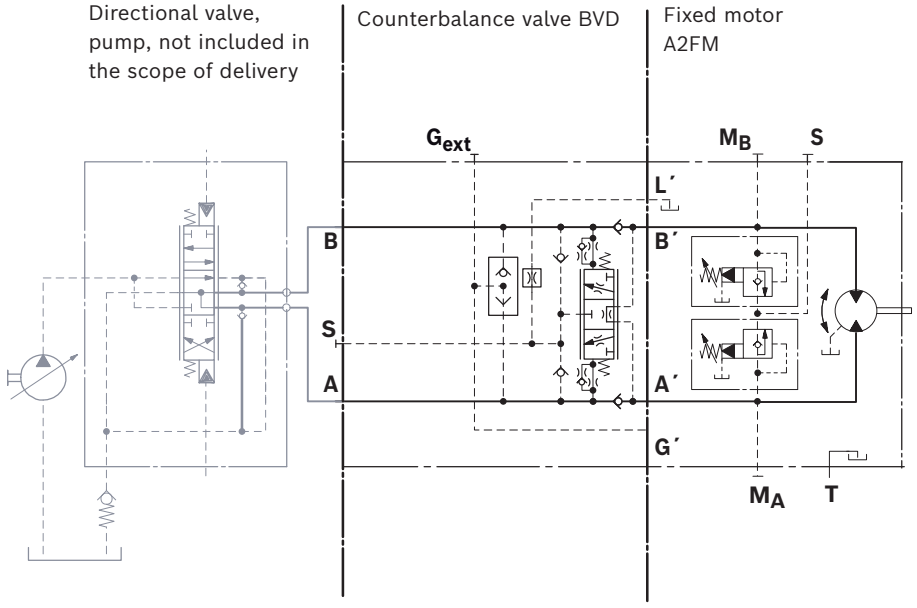
Counterbalance valve for travel drives BVD...F

Application option

- Travel drive for wheeled excavators

Example circuit diagram for travel drive in wheeled excavators

A2FMM90/70NWVC4S707W000 + BVD20F27S/41B–V03K16D0400S12



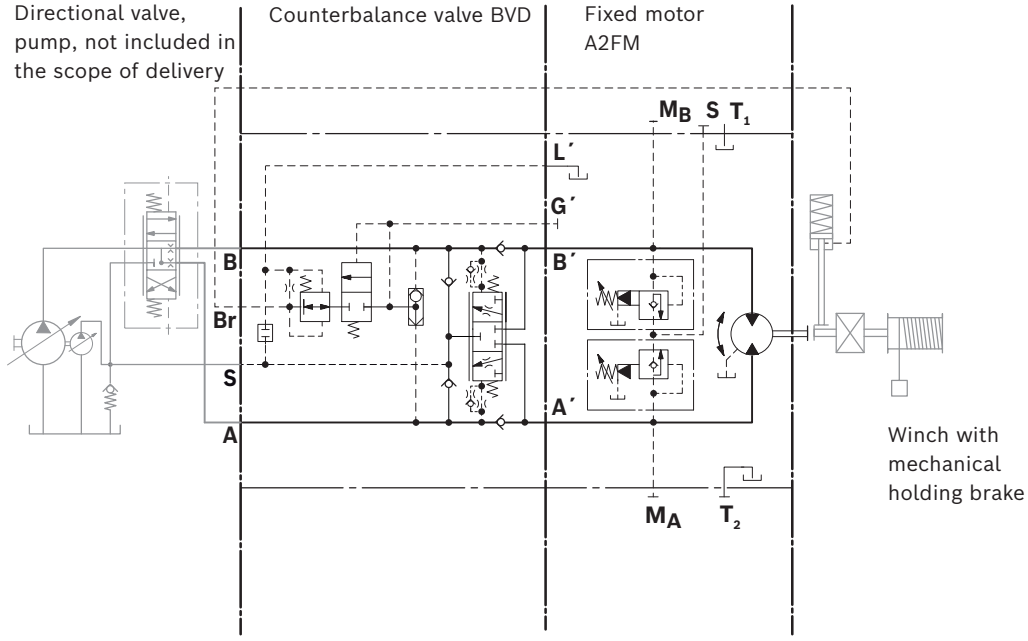
Counterbalance valve for winch drives BVD..W and BVE

Application options

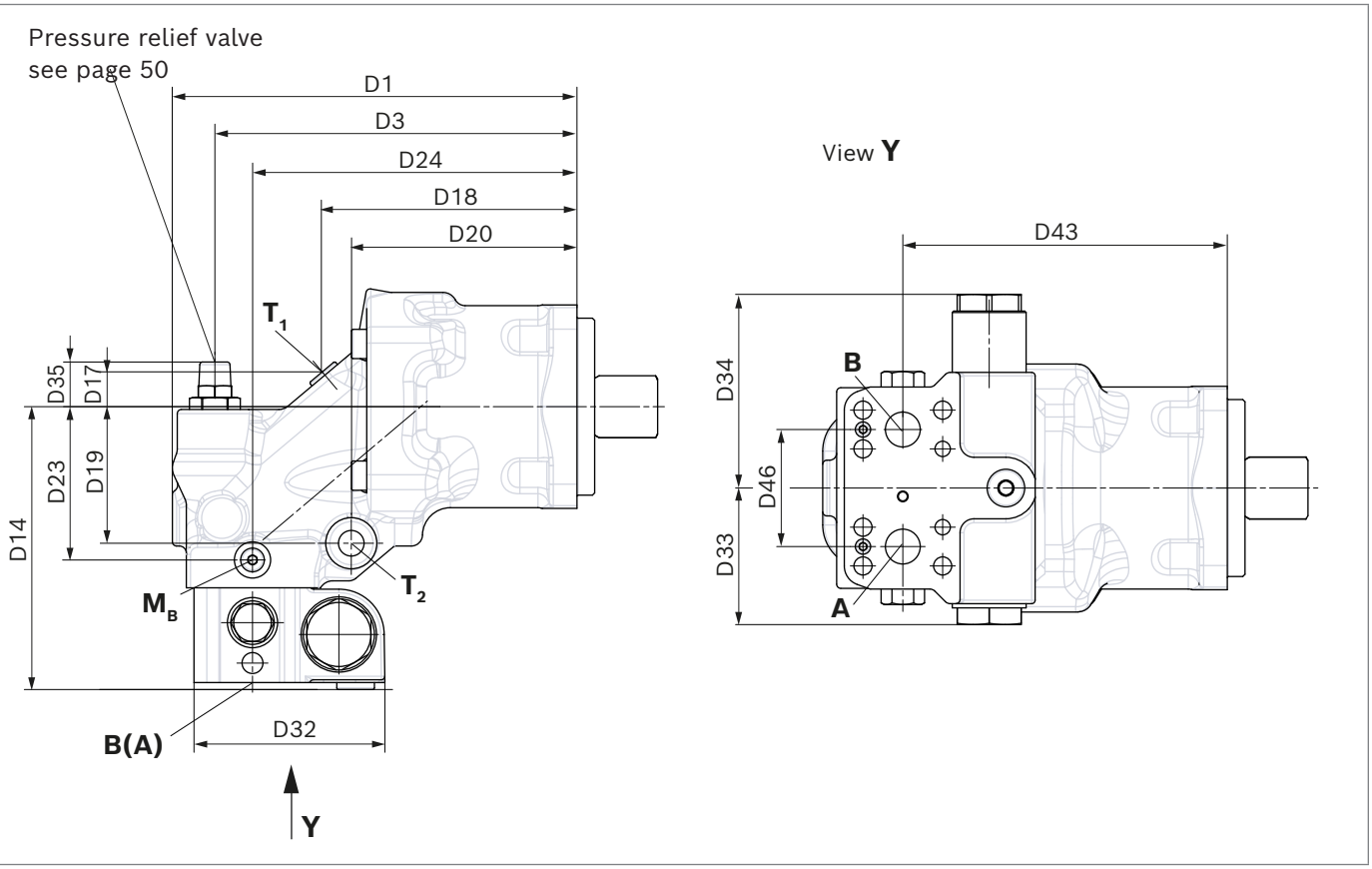
- Winch drives in cranes (BVD and BVE)
- Track drive in excavator crawlers (BVD)

Example circuit diagram for winch drive in cranes

A2FMM90/70NWVC4S707W000 + BVD20W27L/41B–V01K00D0600S00



Dimensions



Size		D1	D3	D14	D17	D18	D19	D20	D23
45, 56, 63	BVD**20**..17	9.1 (232)	8.1 (206)	7.6 (193)	0.87 (22)	5.4 (138)	2.7 (70)	5.3 (137)	4.1 (105)
80, 90	BVD**20**..27	9.9 (251.5)	8.9 (227)	7.9 (200.8)	0.84 (21.3)	6.1 (155.5)	3.1 (79)	6.3 (161.5)	4.3 (110)
107, 125	BVD**20**..28	11.4 (290.4)	9.8 (248)	8.1 (205.3)	0.83 (21)	5.8 (147.7)	3.9 (98)	5.1 (129.8)	4.3 (110)
	BVD**25**..38	11.4 (290.4)	9.8 (248)	8.7(222.3)	0.83 (21)	5.8 (147.7)	3.9 (98)	5.1 (129.8)	4.3 (110)
	BVE**25**..38	11.4 (290.4)	9.8 (248)	8.8 (223)	0.83 (21)	5.8 (147.7)	3.9 (98)	5.1 (129.8)	4.3 (110)

Size		D24	D32	D33	D34	D35	D43	D46	A, B
45, 56, 63	BVD**20**..17	7.4 (187)	5.4 (137)	3.9 (98)	5.5 (139)	1.28 (32.5)	7.4 (187)	2.95 (75)	3/4 in
80, 90	BVD**20**..27	8.2 (208.5)	5.4 (137)	3.9 (98)	5.5 (139)	1.24 (31.5)	8.2 (208.5)	2.95 (75)	1 in
107, 125	BVD**20**..28	7.9 (200.8)	6.0 (151.5)	3.9 (98)	5.5 (139)	1.26 (32)	9.2 (232.9)	3.30 (84)	1 1/4 in
	BVD**25**..38	7.9 (200.8)	6.0 (151.5)	4.7 (120.5)	6.9 (175)	1.26 (32)	9.2 (232.9)	3.30 (84)	1 1/4 in
	BVE**25**..38	7.9 (200.8)	6.0 (151.5)	5.4 (137)	8.4 (214)	1.26 (32)	9.2 (232.9)	3.30 (84)	1 1/4 in

Ports		Version	Standard	Size	p_{max} [bar][1]	State[3]
A, B	Working port		SAE J518	see table above	420	O
S	Boost port	BVD20	DIN 3852[2]	M22 × 1.5; 14 deep	30	X
		BVD25, BVE25	DIN 3852[2]	M27 × 2; 16 deep	30	X
Br	Brake release port, reduced high pressure	L	DIN 3852[2]	M12 × 1.5; 12.5 deep	30	O
G_{ext}	Brake release port, high pressure	S	DIN 3852[2]	M12 × 1.5; 12.5 deep	420	X
M_A, M_B	Measuring port pressure A/B		DIN 3852[2]	M12 × 1.5; 12 deep	420	X
T_1, T_2	Drain port		DIN 3852[2]	M18 × 1.5; 12 deep	3	X, O[4]

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring instruments and fittings.
2) The countersink may be deeper than specified in the standard.
3) O = Must be connected (condition on delivery: plugged)
X = Plugged (in normal operation)
4) Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 57).

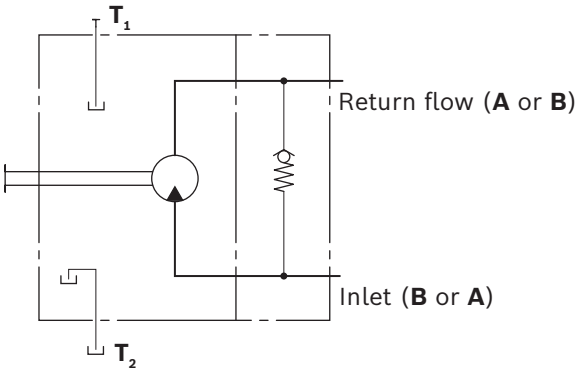
Mounting the counterbalance valve
When delivered, the counterbalance valve is fastened to the motor with two tacking screws (transport lock). The tacking screws may not be removed while mounting the working lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve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

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 DST

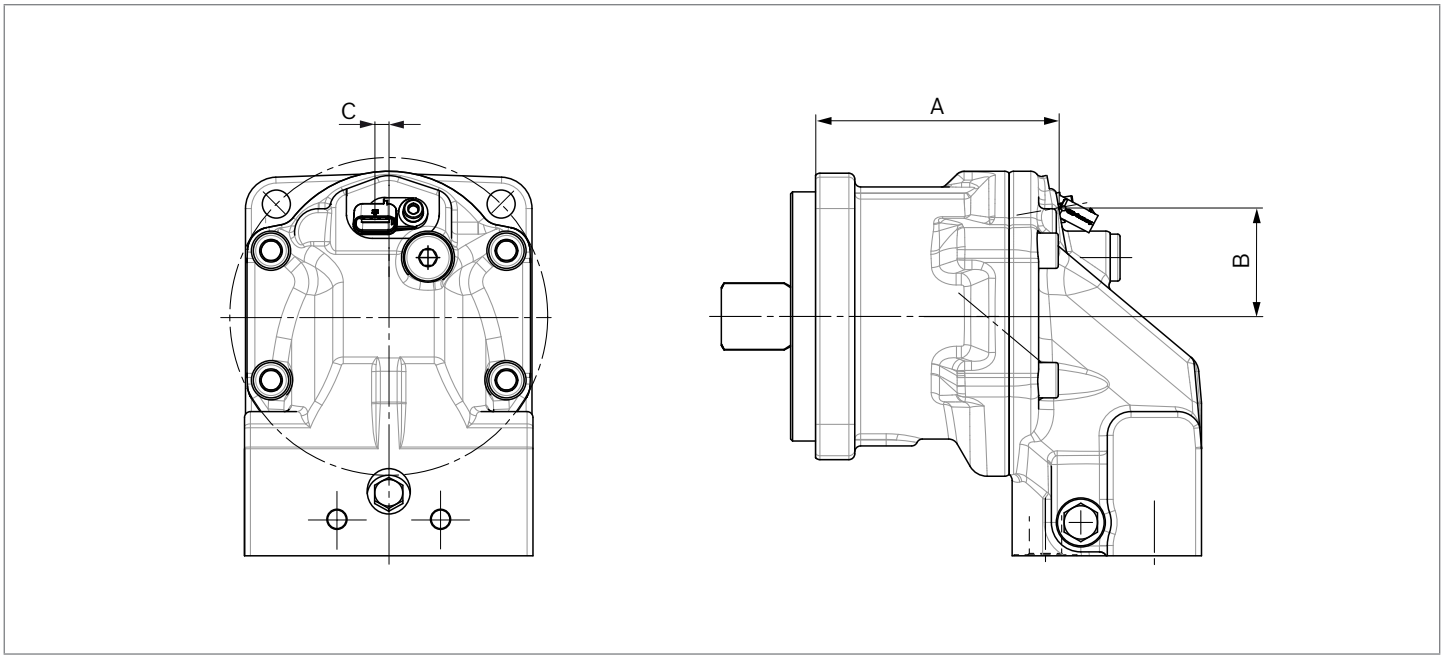
The motor speed can be recorded by the fitted DST and DSA speed sensor. The frequency signal required is generated by splines at the rotary group.
In addition to the rotational speed, the DST and DSA sensor will record the direction of rotation of the motor and the temperature at the installation location.
Type code, technical data, dimensions and details on the plug, plus safety instructions about the sensor can be found in the relevant data sheet DST (95131) respectively DSA/20 (95126).
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/20 speed sensor: Code C
- with mounted DST speed sensor: Code E
- prepared for DST and DSA/20 speed sensor (delivery without sensor): Code W

Size	**A2FMN**	**28, 32, 37, 45**	**56, 63, 80**	**90, 107**	**–**	**–**
	A2FMM	**23, 28, 32**	**45, 56, 63**	**80, 90**	**107, 125**	**160, 180**
	A2FMH	**–**	**45, 56, 63**	**80, 90**	**107, 125**	**–**
Number of teeth		38	47	53	59	67
Dimensions	A	4.25 (108)	4,75 (120.6)	5,21 (132.2)	5.69 (144.7)	6.16 (156.6)
	B	1.75 (44.5)	2.15 (54.6)	2.32 (58.8)	2.44 (62)	2.72 (69)
	C	0.078 (2)	0.078 (2)	0.078 (2)	0.157 (4)	0

Dimensions

▼ **Version "E"**
A2FM with speed sensor DST 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 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_1**, **T_2**).
If a shared drain line is used for several units, make sure that the relevant 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 under any operational circumstances, particularly during 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 (state in plain text when ordering, special version).

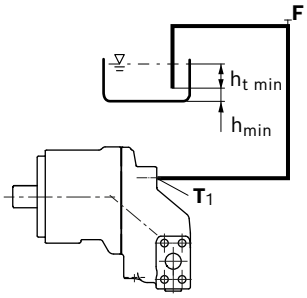
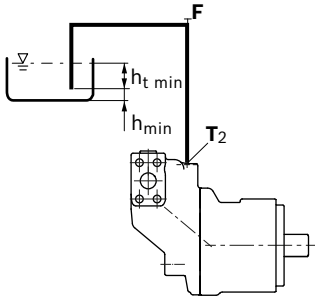
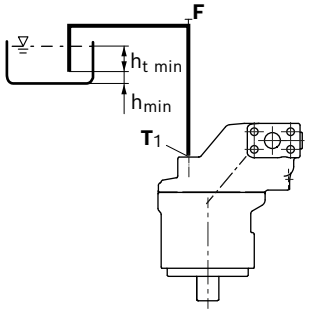
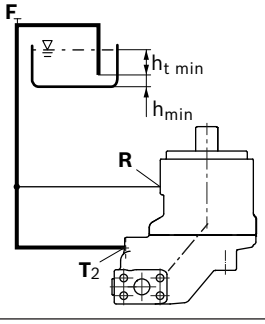
Key	
F	Filling / air bleeding Note: F is part of the external piping
R	Air bleed port (special version)
T_1, T_2	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir base (100 mm)

Installation position

See the following examples **1** to **8**.
Additional installation positions are available 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 below the minimum fluid level.

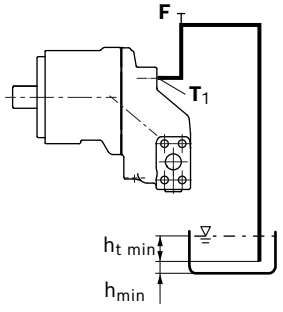
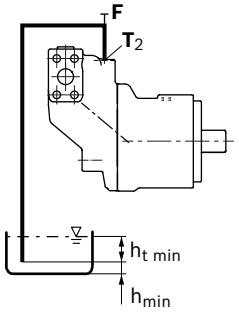
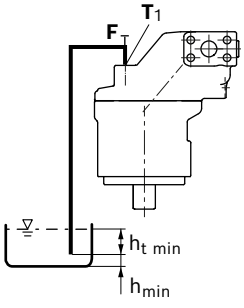
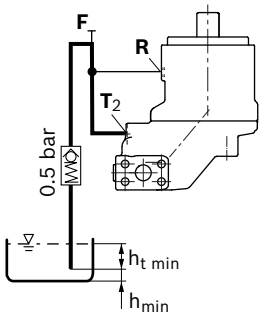
Installation position	Air bleeding	Filling
1 	–	**T_1 (F)**
2 	–	**T_2 (F)**
3 	–	**T_1 (F)**
4 	R	**T_2 (F)**

Above-reservoir installation

Above-reservoir installation means 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 (opening pressure 0.5 bar) can prevent draining of the housing area.

Note

Port **F** is not part of the motor and can be provided by the customer to make filling and air bleeding easier.

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

Project planning notes

- The motor A2FM is designed to be used in open and closed circuits.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- 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, request a binding installation drawing.
- The specified data and notices contained herein must be observed.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection 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.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- Be sure to add a pressure relief valve to the hydraulic system.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the excitation of the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the port tables. The machine or system manufacturer must ensure that the connecting 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.
- Note that series connection of motors and operation under summation pressure have an effect on the efficiency of the units.

Safety instructions

- During and shortly after operation, there is a risk of getting burnt 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 position as a result of contamination (e.g. contaminated 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 properly 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.
  The machine/system manufacturer must check whether additional measures are required on the machine for the relevant application in order to keep the load in a safe position and ensure they are properly implemented.

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