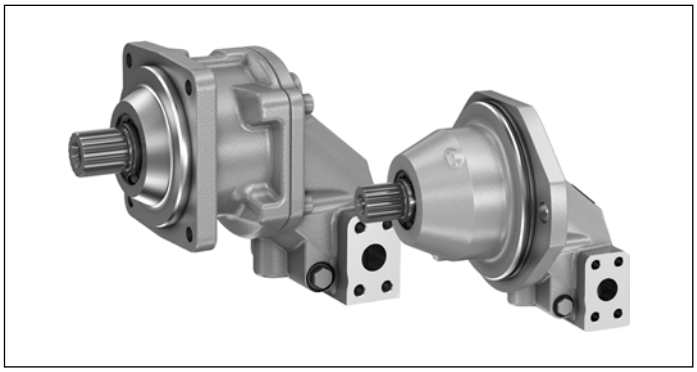
Axial piston fixed motor
A2FM Series 70
A2FE Series 70

RE 91071
Edition: 06.2018
Replaces 12.2015



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

Features

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

Contents

Type code

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

Axial piston unit

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

Operating mode

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

Pressure range		045	056	063	080	090	107	
03	Nominal pressure: 300 bar, maximum pressure: 350 bar	○	●	●	●	●	●	**N**
	Nominal pressure: 400 bar, maximum pressure: 450 bar	●	●	●	●	●	○	**M**
	Nominal pressure: 450 bar, maximum pressure: 500 bar	●	●	●	●	●	○	**H**

Size (NG)

04	Geometric displacement, see technical data on page 7	**045**	**056**	**063**	**080**	**090**	**107**	

Series

05	Series 7, Index 0	**70**

Design of ports and fastening threads

06	Volumetric ports according to DIN 3852 with profile seal, volumetric fastening thread according to DIN 13	**N**

Direction of rotation

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

Sealing material

08	FKM (fluoroelastomer)	**V**

Mounting flange			045	056	063	080	090	107	
09	ISO 3019-2 metric	125-4 (only available for A2FM)	●[3]	●	●	●[1]	–	–	**M4**
		140-4 (only available for A2FM)	–	–	–	●[3]	●	●[1]	**N4**
		160-4 (only available for A2FE)	●[3]	●	●	●[1]	–	–	**P2**
		190-2 (only available for A2FE)	–	–	–	●[3]	●	●[1]	**Y2**

Drive shaft			045	056	063	080	090	107	
10	Splined shaft DIN 5480	W30x2x14x9g	●	●[2]	–	–	–	–	**Z6**
		W35x2x16x9g	–	●	●	●	–	–	**Z8**
		W40x2x18x9g	–	–	–	●[3]	●	●	**Z9**
	Parallel keyed shaft DIN 6885	ø 30	●	●	–	–	–	–	**P6**
		ø 35	–	●	●	●	–	–	**P8**
		ø 40	–	–	–	●[3]	●	●	**P9**

Working port		045	056	063	080	090	107	
11	SAE flange ports A and B at bottom	●	●	●	●	●	●	**11**
	SAE flange ports A and B at side, opposite	●	●	●	●	●	●	**02**
	Threaded ports A and B at side, opposite	○	○	○	–	–	–	**05**
	Version with pressure relief valve for mounting a counter balance valve BVD[2)3)]	●	●	●	●	●	–	**07**
	Version with pressure relief valves[2)3)]	●	●	●	●	●	–	**09**

● = Available ○ = On request – = Not available

1) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)
2) not available for A2FMH, A2FEH (pressure range 450 to 500 bar)
3) not available for A2FMN, A2FEN (pressure range 300 to 350 bar)

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

Valves

			045	056	063	080	090	107	
12	Without valves		●	●	●	●	●	●	**0**
	Integrated flushing and boost pressure valve Flushing flow when: $\Delta p = p_{ND} - p_G = 25$ bar and $\nu = 10$ mm²/s	**Flushing flow [l/min] /** orifice ø [mm] **2.6** / 1.0	●	●	●	●	●	●	**C**
		6.0 / 1.5	●	●	●	●	●	●	**E**
		7.4 / 1.7	●	●	●	●	●	●	**F**
		8.5 / 1.8	●	●	●	●	●	●	**G**
		11.4 / 2.3	●	●	●	●	●	●	**I**
		12.5 / 3	●	●	●	●	●	●	**J**
	Pressure relief valves (without pressure sequencing stage)[2)3)]		●	●	●	●	●	–	**R**
	Pressure relief valves (with pressure sequencing stage)[2)3)]		●	●	●	●	●	–	**S**
	Counter balance valve BVD mounted[2)3)]		●	●	●	●	●	–	**W**

Speed sensor

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

Special version

14	Standard version	**0**
	Long-life bearing[4)]	**L**
	Special version for slew drives	**J**

Standard / special version

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

● = Available ○ = On request – = Not available

Notes

▶ Note the project planning notes on page 28.

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

Hydraulic fluids

The fixed motor A2FM/A2FE is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids

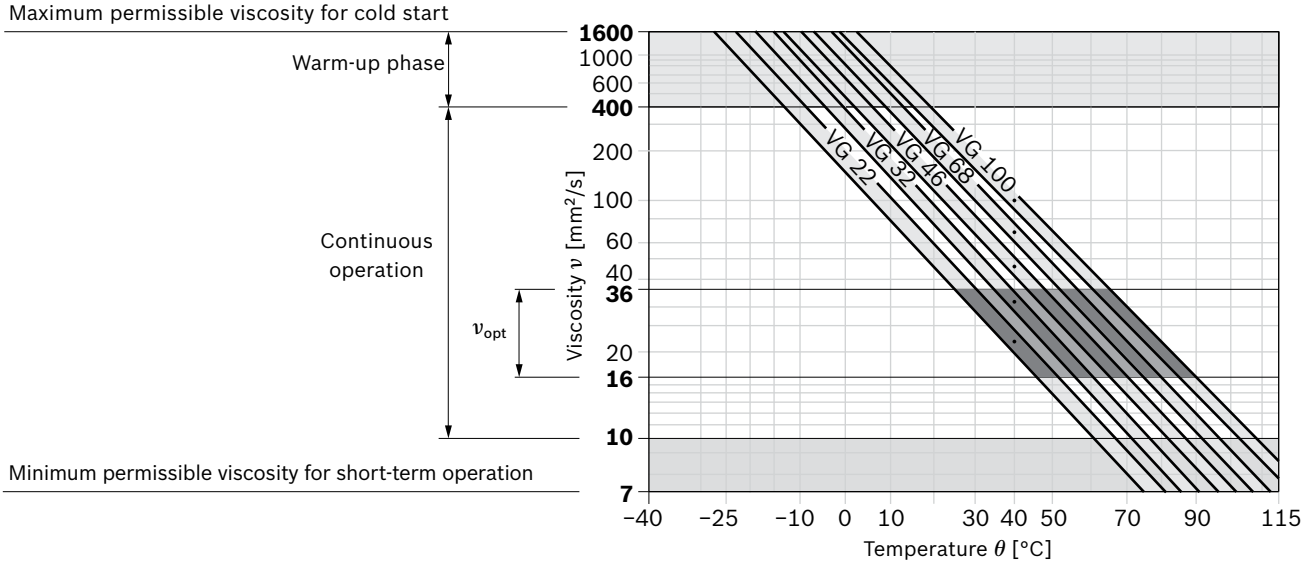
Details regarding the selection of hydraulic fluid
The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt}, see selection diagram).

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 mm²/s	NBR[2]	θ_{St} ≥ −40 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 min^{-1} Permissible temperature difference between axial piston unit and hydraulic fluid in the system 25 K maximum
		FKM	θ_{St} ≥ −25 °C	
Warm-up phase	v = 1600 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Continuous operation	v = 400 ... 10 mm²/s[1]	NBR[2]	θ ≤ +78 °C	measured at port **T**
		FKM	θ ≤ +103 °C	
	v_{opt} = 36 ... 16 mm²/s			range of optimum operating viscosity and efficiency
Short-term operation	v_{min} = 10 ... 7 mm²/s	NBR[2]	θ ≤ +78 °C	t ≤ 3 min, p ≤ 0.3 × p_{nom} , measured at port **T**
		FKM	θ ≤ +103 °C	

▼ **Selection diagram**



1) Corresponds e.g. for VG 46 to a temperature range of +4 °C to +85 °C (see selection diagram)
2) Special version, please contact us
3) If the temperature at extreme operating parameters cannot be adhered to, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit. A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

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

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

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

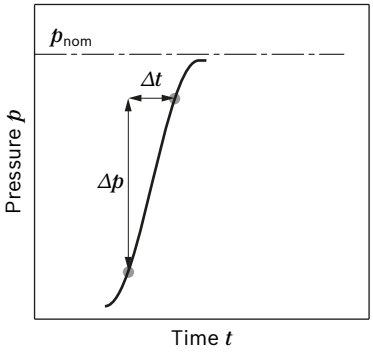
Flow direction

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

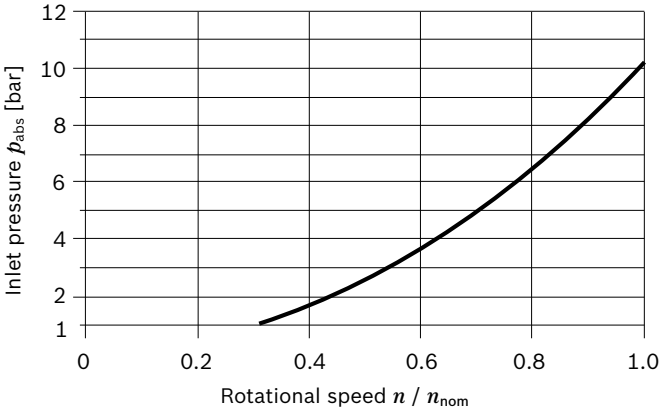
Working pressure range

Pressure at working port A or B			**Definition**
Nominal pressure p_{nom}	A2FMN, A2FEN	300 bar absolute	The nominal pressure corresponds to the maximum design pressure.
	A2FMM, A2FEM	400 bar absolute	
	A2FMH, A2FEH	450 bar absolute	
Maximum pressure p_{max}	A2FMN, A2FEN	350 bar absolute	The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
	A2FMM, A2FEM	450 bar absolute	
	A2FMH, A2FEH	500 bar absolute	
Single operating period		10 s	
Total operating period		300 h	
Minimum pressure (high-pressure side)		25 bar absolute	Minimum pressure at the high-pressure side (**A** or **B**) required to prevent damage to the axial piston unit.
Minimum pressure – pump operating mode (inlet)		see characteristic	To prevent damage to the axial piston motor in pump mode (change of high-pressure side with unchanged direction of rotation, e.g. when braking), a minimum pressure must be guaranteed at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Total pressure p_{Su} (pressure **A** + pressure **B**)		700 bar absolute	The summation pressure is the sum of the pressures at both work ports (**A** and **B**).
Rate of pressure change $R_{A\ max}$			Maximum permissible rate of pressure build-up and reduction during a pressure change across the entire pressure range.
with built-in pressure relief valve		9000 bar/s	
without pressure relief valve		16000 bar/s	
Case pressure at port T			
Continuous differential pressure $\Delta p_{L/T\ cont}$		2 bar	Maximum, averaged differential pressure at the shaft seal (case to ambient pressure)
Pressure peaks $p_{L/T\ peak}$		10 bar	t < 0.1 s

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



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



This diagram is only valid for the optimum viscosity range of ν_{opt} = 36 to 16 mm²/s.
Please contact us if these conditions cannot be satisfied.

Note

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

Technical data

A2FMN, A2FEN

Size	NG		56	63	80	90	107
Displacement, geometric, per revolution	V_g	cm³	56.6	63.0	81.7	90.5	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	$q_{v\,max}$	l/min	212	236	270	304	326
Torque[3] at Δp = 300 bar	T	Nm	270	301	390	432	519
Rotary stiffness	c_{min}	kNm/rad	6.83	8.09	7.94	9.84	10.9
Moment of inertia for rotary group	J_{TW}	kgm²	0.0032	0.0032	0.0034	0.0054	0.0061
Maximum angular acceleration	α	rad/s²	10000	12200	19800	4500	6000
Case volume	V	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	m	kg	17	17	17	23	23

A2FMM, A2FEM

Size	NG		45	56	63	80	90
Displacement, geometric, per revolution	V_g	cm³	44.9	56.6	63.0	79.8	90.5
Maximum rotational speed[1]	n_{nom}	rpm	5000	5000	5000	4500	4500
	n_{max}[2]	rpm	5500	5500	5500	5000	5000
Inlet flow	$q_{v\,max}$	l/min	225	283	315	359	407
Torque[3] at Δp = 400 bar	T	Nm	286	360	401	508	576
Rotary stiffness	c_{min}	kNm/rad	4.52	6.83	8.09	9.09	9.84
Moment of inertia for rotary group	J_{TW}	kgm²	0.0032	0.0032	0.0032	0.0058	0.0054
Maximum angular acceleration	α	rad/s²	5400	9000	11100	7900	10100
Case volume	V	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	m	kg	17	17	17	23	23

A2FMH, A2FEH

Size	NG		45	56	63	80	90
Displacement, geometric, per revolution	V_g	cm³	44.9	56.6	63.0	79.8	90.5
Maximum rotational speed[1]	n_{nom}	rpm	5000	5000	5000	4500	4500
	n_{max}[2]	rpm	5500	5500	5500	5000	5000
Inlet flow	$q_{v\,max}$	l/min	225	283	315	359	407
Torque[3] at Δp = 450 bar	T	Nm	322	405	451	571	648
Rotary stiffness	c_{min}	kNm/rad	4.52	6.83	8.09	9.09	9.84
Moment of inertia for rotary group	J_{TW}	kgm²	0.0032	0.0032	0.0032	0.0058	0.0054
Maximum angular acceleration	α	rad/s²	5000	8550	10500	4500	4500
Case volume	V	l	0.6	0.6	0.6	0.65	0.65
Weight approx.	m	kg	17	17	17	23	23

Speed range

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

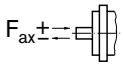
1) The valid values (observing the maximum permissible flow):
   – to the optimum viscosity range from v_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oil

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

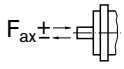
3) Torque without radial force, with radial force see page 8

Permissible radial and axial forces of the drive shafts

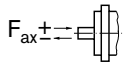
A2FMN, A2FEN

Size		NG		Z6/P6	Z8/P8	Z8/P8	Z8/P8	Z9/P9	Z9/P9
				56	56	63	80	90	107
Drive shaft	with splined shaft	ø	mm	30	35	35	35	40	40
	with parallel keyed shaft	ø	mm	30	35	35	35	40	40
Maximum radial force[1] at distance a (from shaft collar)		$F_{q\,max}$	kN	7.1	6.1	6.9	8.7	8.6	10.4
		a	mm	18	18	18	18	20	20
Maximum torque at $F_{q\,max}$		$T_{q\,max}$	Nm	267	267	301	382	430	519
Maximum differential pressure at $F_{q\,max}$		$\Delta p_{q\,max}$	bar	300	300	300	300	300	300
Maximum axial force at standstill or pressure-free operation		+ $F_{ax\,max}$	N	0	0	0	0	0	0
		– $F_{ax\,max}$	N	800	800	800	800	1000	1000
Permissible axial force per bar working pressure		+ $F_{ax\,perm}$/bar	N/bar	8.7	8.7	8.7	8.7	10.6	10.6

A2FMM, A2FEM

Size		NG		Z6/P6	Z6/P6	Z8/P8	Z8/P8	Z8/P8	Z9/P9	Z9/P9
				45	56	56	63	80	80	90
Drive shaft	with splined shaft	ø	mm	30	30	35	35	35	40	40
	with parallel keyed shaft	ø	mm	30	30	35	35	35	40	40
Maximum radial force[1] at distance a (from shaft collar)		$F_{q\,max}$	kN	7.6	9.5	8.1	9.2	11.6	10.2	11.5
		a	mm	18	18	18	18	20	20	20
Maximum torque at $F_{q\,max}$		$T_{q\,max}$	Nm	286	357	357	401	509	509	573
Maximum differential pressure at $F_{q\,max}$		$\Delta p_{q\,max}$	bar	400	400	400	400	400	400	400
Maximum axial force at standstill or pressure-free operation		+ $F_{ax\,max}$	N	0	0	0	0	0	0	0
		– $F_{ax\,max}$	N	800	800	800	800	1000	1000	1000
Permissible axial force per bar working pressure		+ $F_{ax\,perm}$/bar	N/bar	8.7	8.7	8.7	8.7	10.6	10.6	10.6

A2FMH, A2FEH

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

1) With intermittent operation

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

Key

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

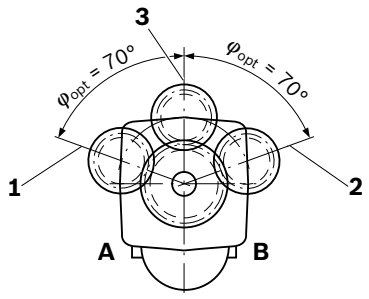
Notes

- Theoretical values, without efficiency and tolerances; values rounded.
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.
- The 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**



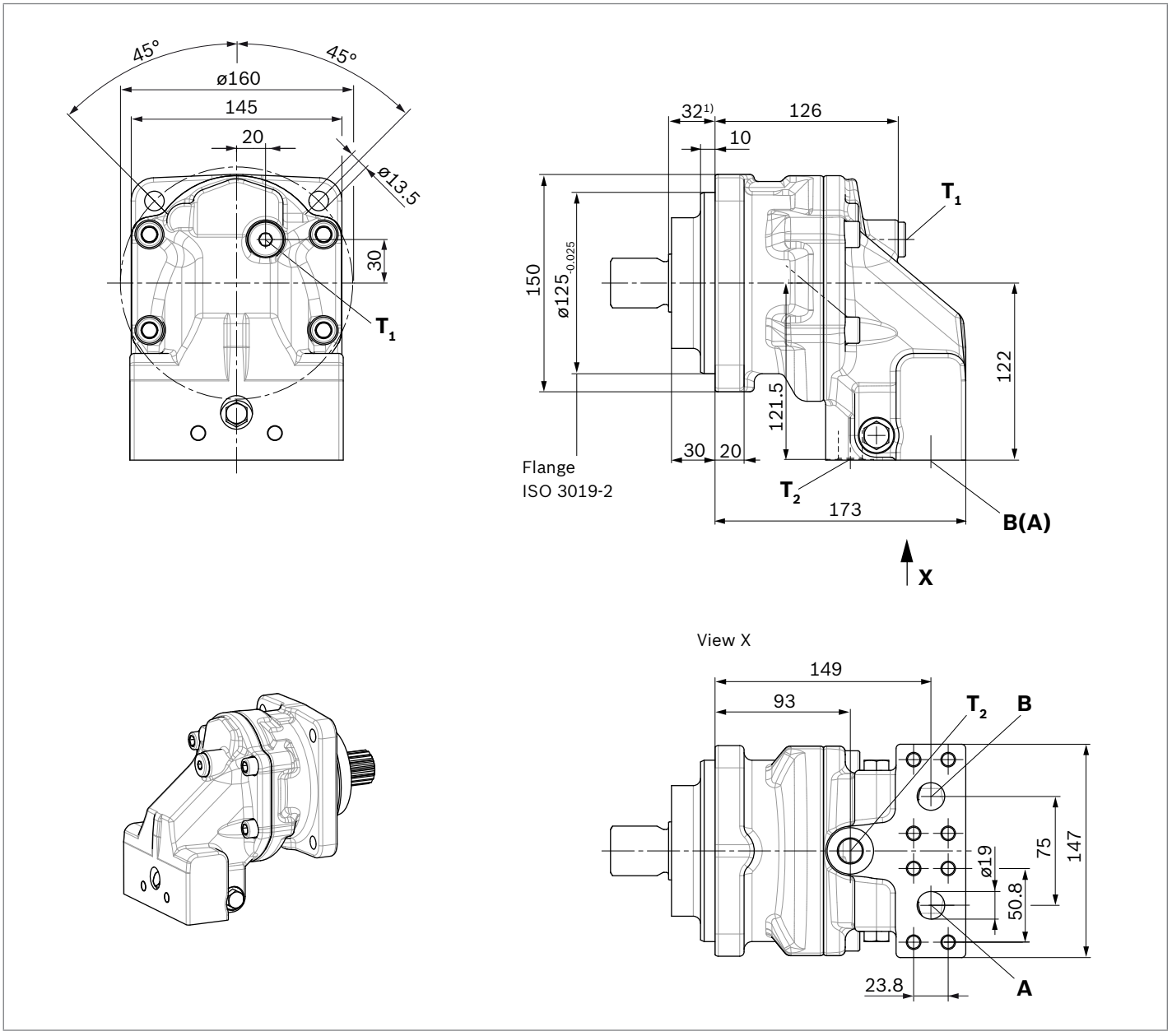
1 “Counter-clockwise” rotationPressure at port **B**

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

3 “Alternating” direction of rotation

A2FM dimensions, SAE flange ports at bottom

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

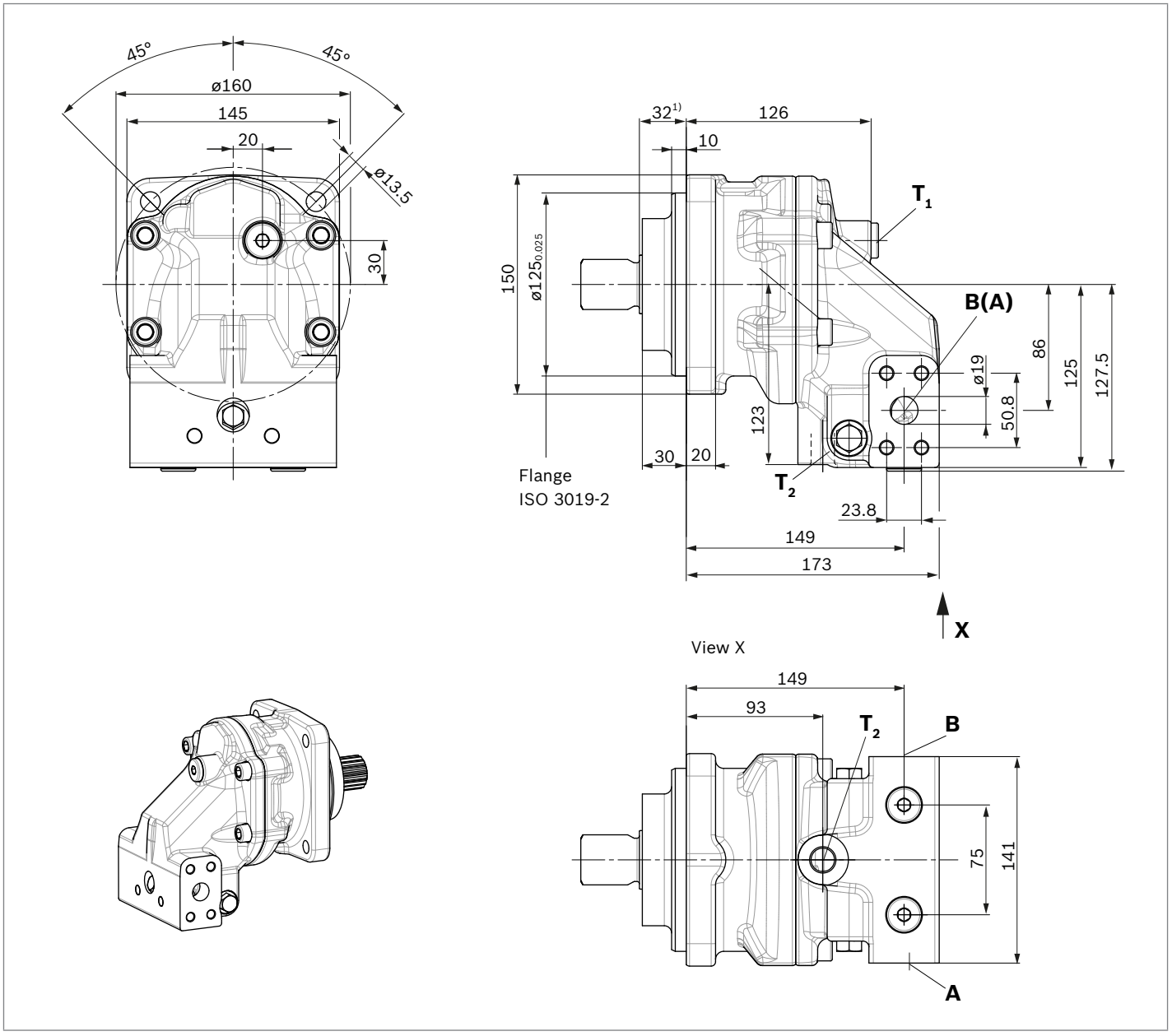


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status[6)]
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
T_1	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	X[4)]
T_2	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	O[4)]

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, SAE flange ports at side

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

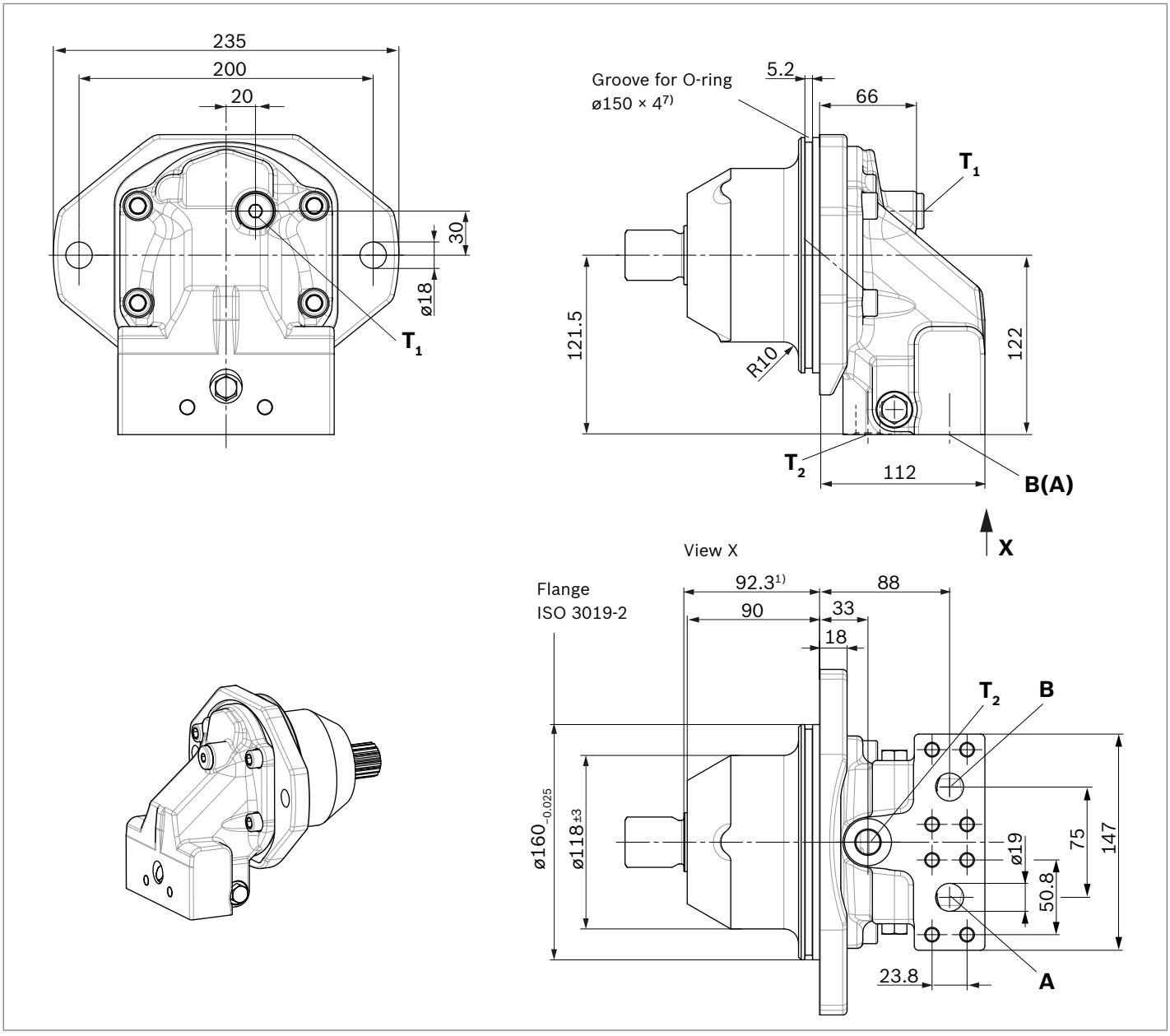


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status[6)]
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
T_1	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	X[4)]
T_2	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	O[4)]

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FE dimensions, SAE flange ports at bottom

A2FEN sizes 56, 63 and 80
A2FEM sizes 45, 56 and 63
A2FEH sizes 45, 56 and 63

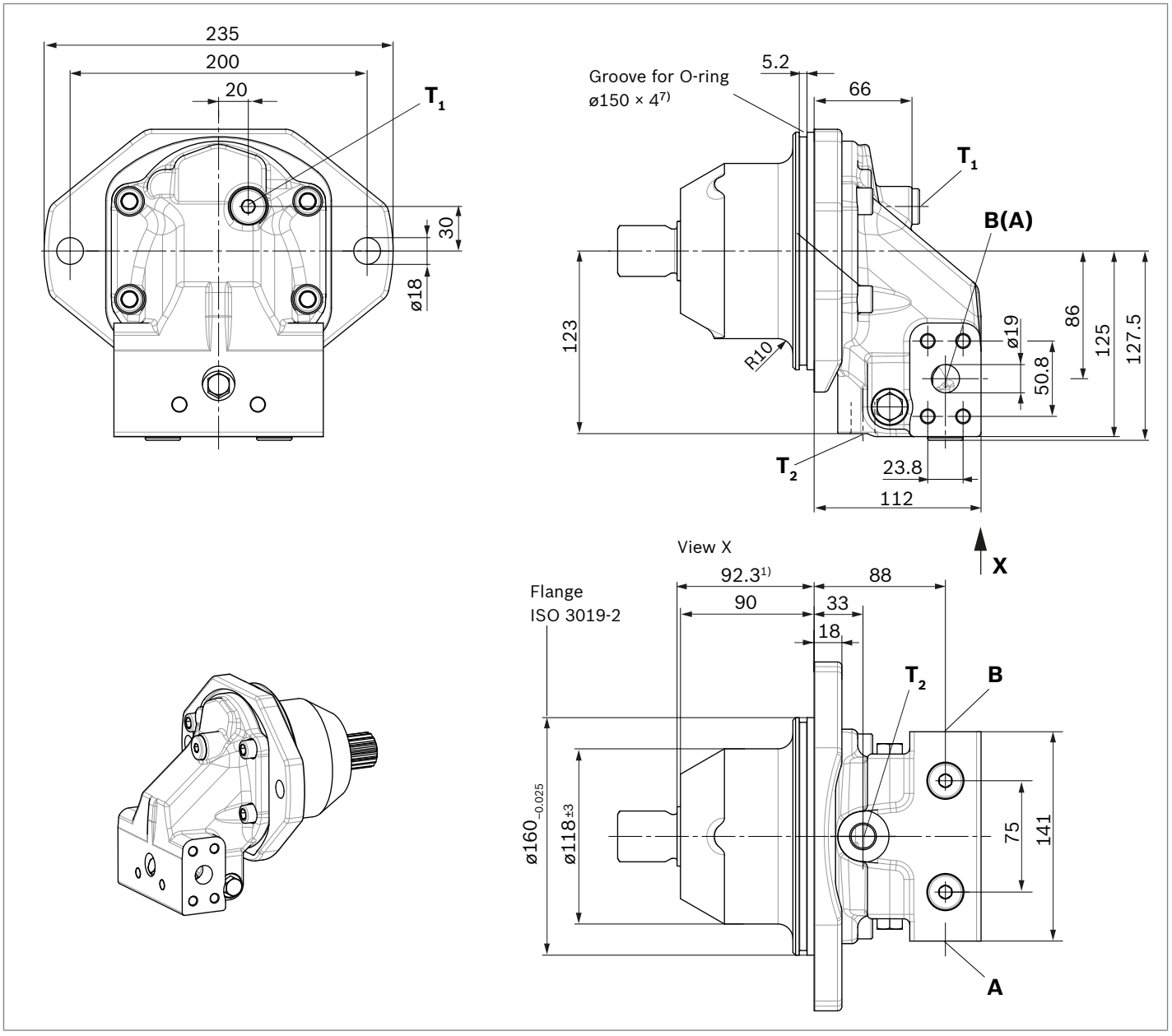


Ports		Standard	Size 2)	$p_{max\ abs}$ [bar] 3)	Status 6)
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
T_1	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	X 4)
T_2	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	O 4)

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601553.

A2FE dimensions, SAE flange ports at side

A2FEN sizes 56, 63 and 80
A2FEM sizes 45, 56 and 63
A2FEH sizes 45, 56 and 63

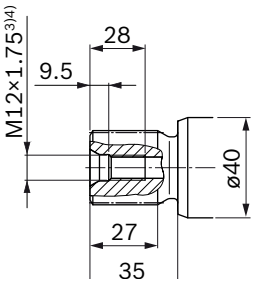


Ports		Standard	Size 2)	$p_{max\ abs}$ [bar] 3)	Status 6)
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	3/4 in M10 × 1.5; 17 deep	500	O
T_1	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	X 4)
T_2	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	O 4)

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601553.

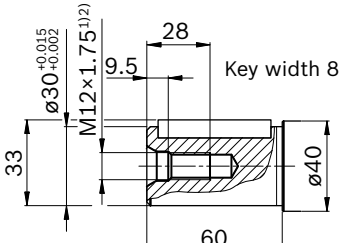
▼ **Splined shaft DIN 5480, sizes 45 and 56**

Z6 – W30×2×14×9g



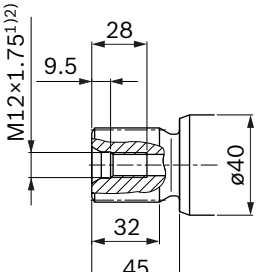
▼ **Parallel keyed shaft, DIN 6885, sizes 45 and 56**

P6 – AS8×7×50



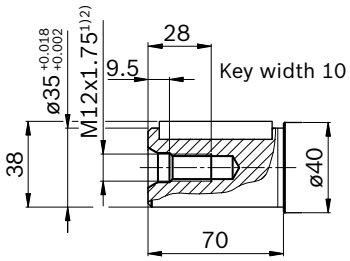
▼ **Splined shaft DIN 5480, sizes 56, 63 and 80**

Z8 – W35×2×16×9g



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

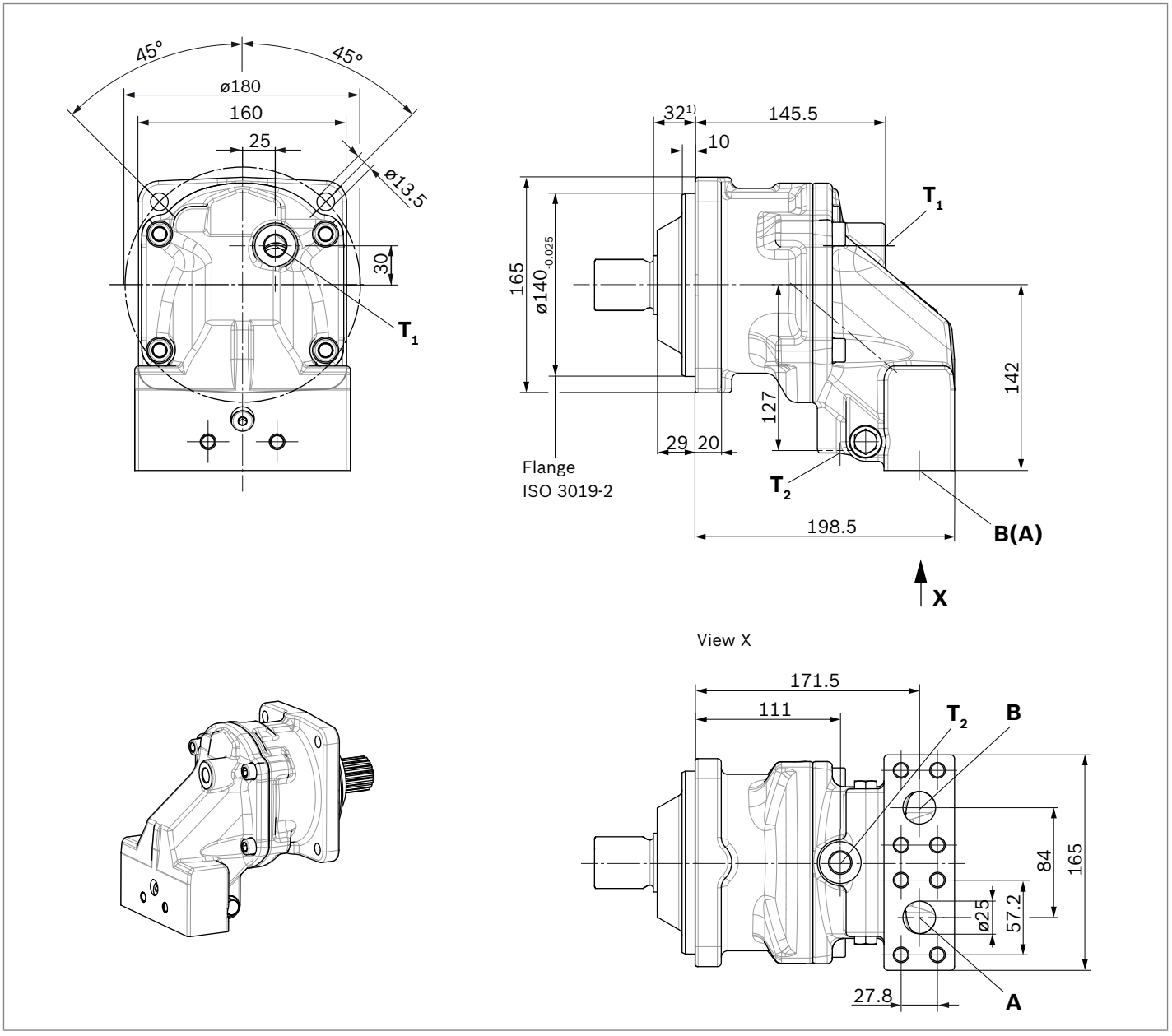
P8 – AS10×8×56



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

A2FM dimensions, SAE flange ports at bottom

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

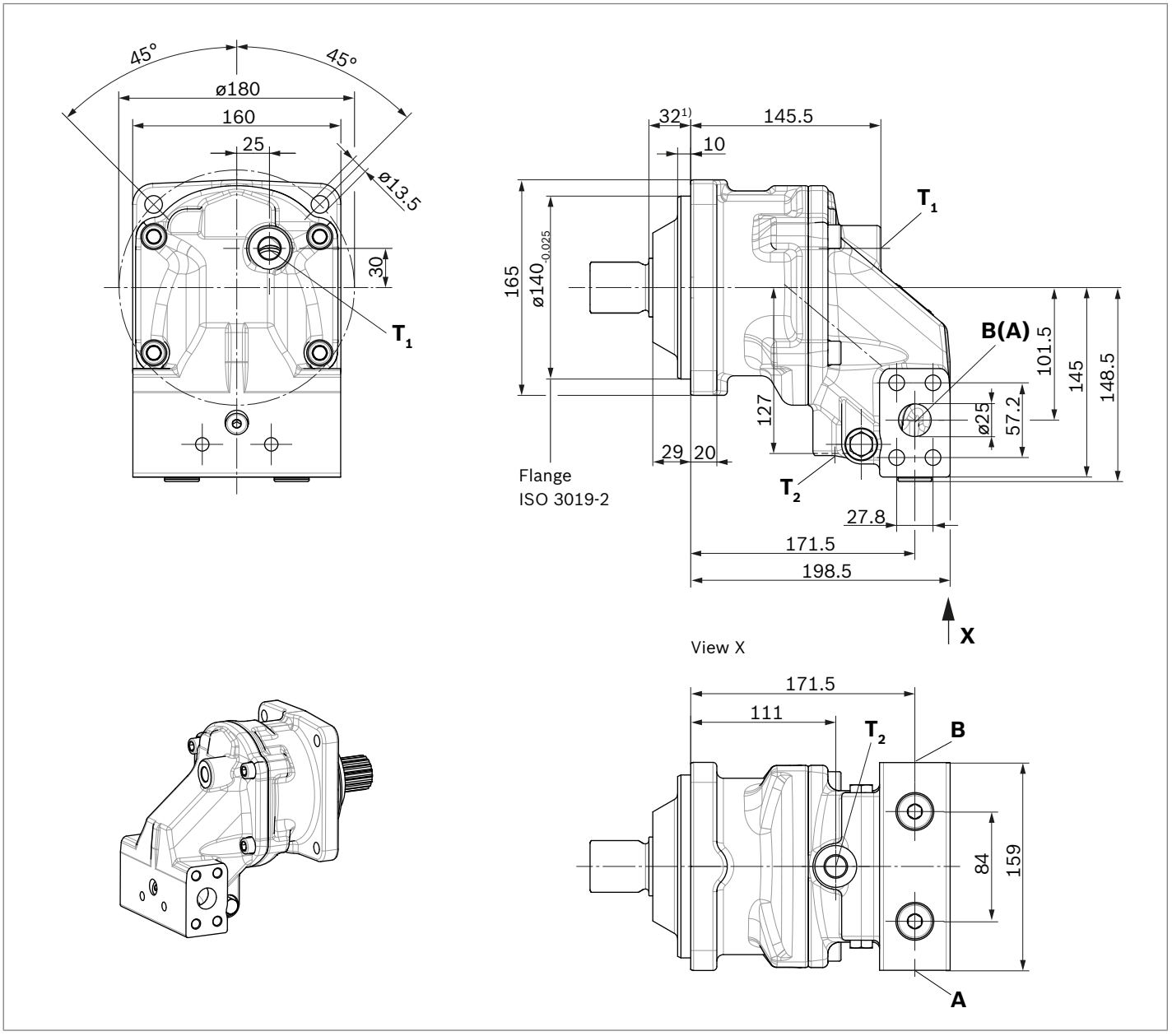


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status[6)]
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
T_1	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	X[4)]
T_2	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	O[4)]

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FM dimensions, SAE flange ports at side

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

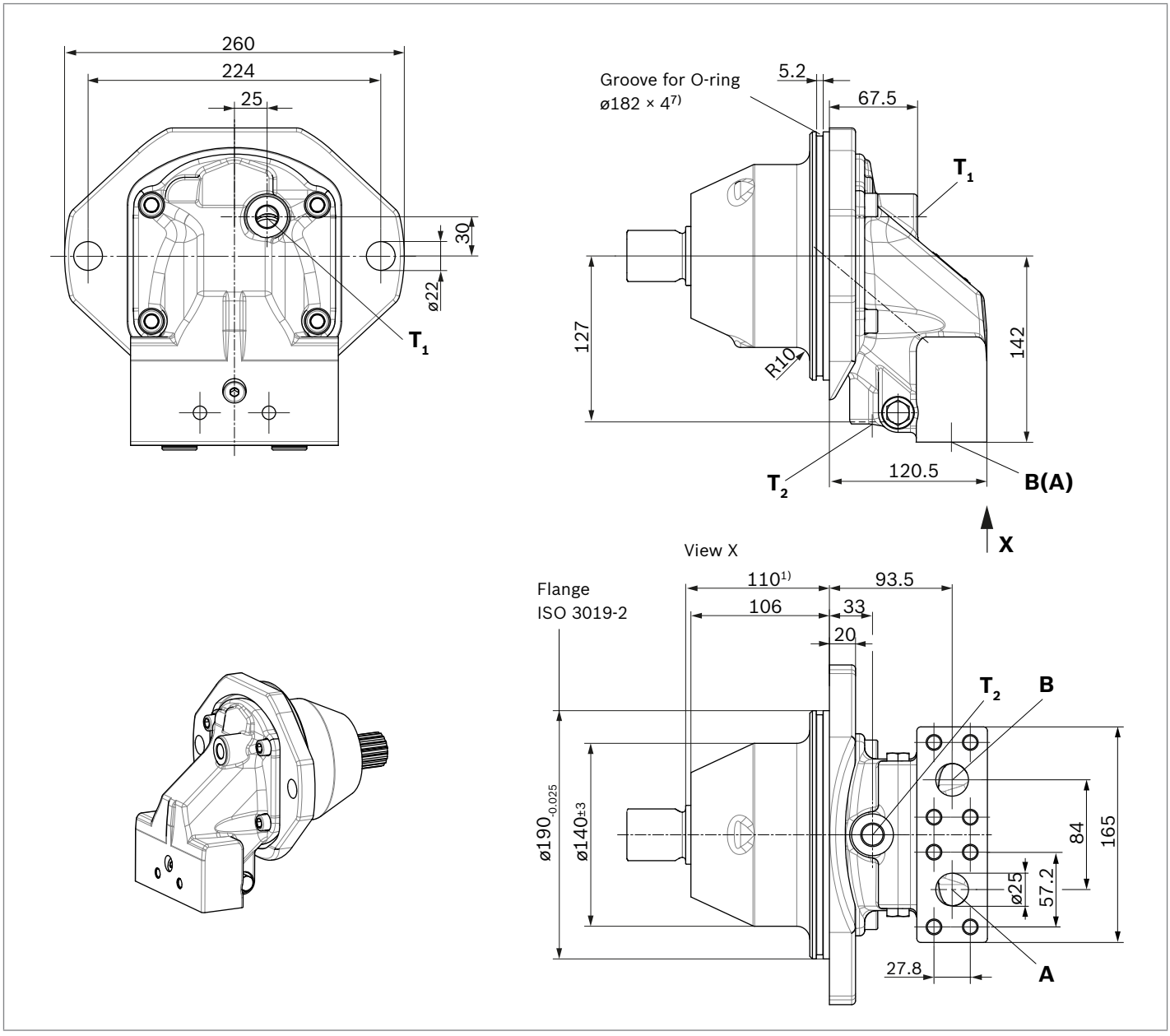


Ports		Standard	Size[2)]	$p_{max\ abs}$ [bar][3)]	Status[6)]
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
T_1	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	X[4)]
T_2	Drain port	DIN 3852[5)]	M18 × 1.5; 12 deep	3	O[4)]

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A2FE dimensions, SAE flange ports at bottom

A2FEN sizes 90 and 107
A2FEM sizes 80 and 90
A2FEH sizes 80 and 90

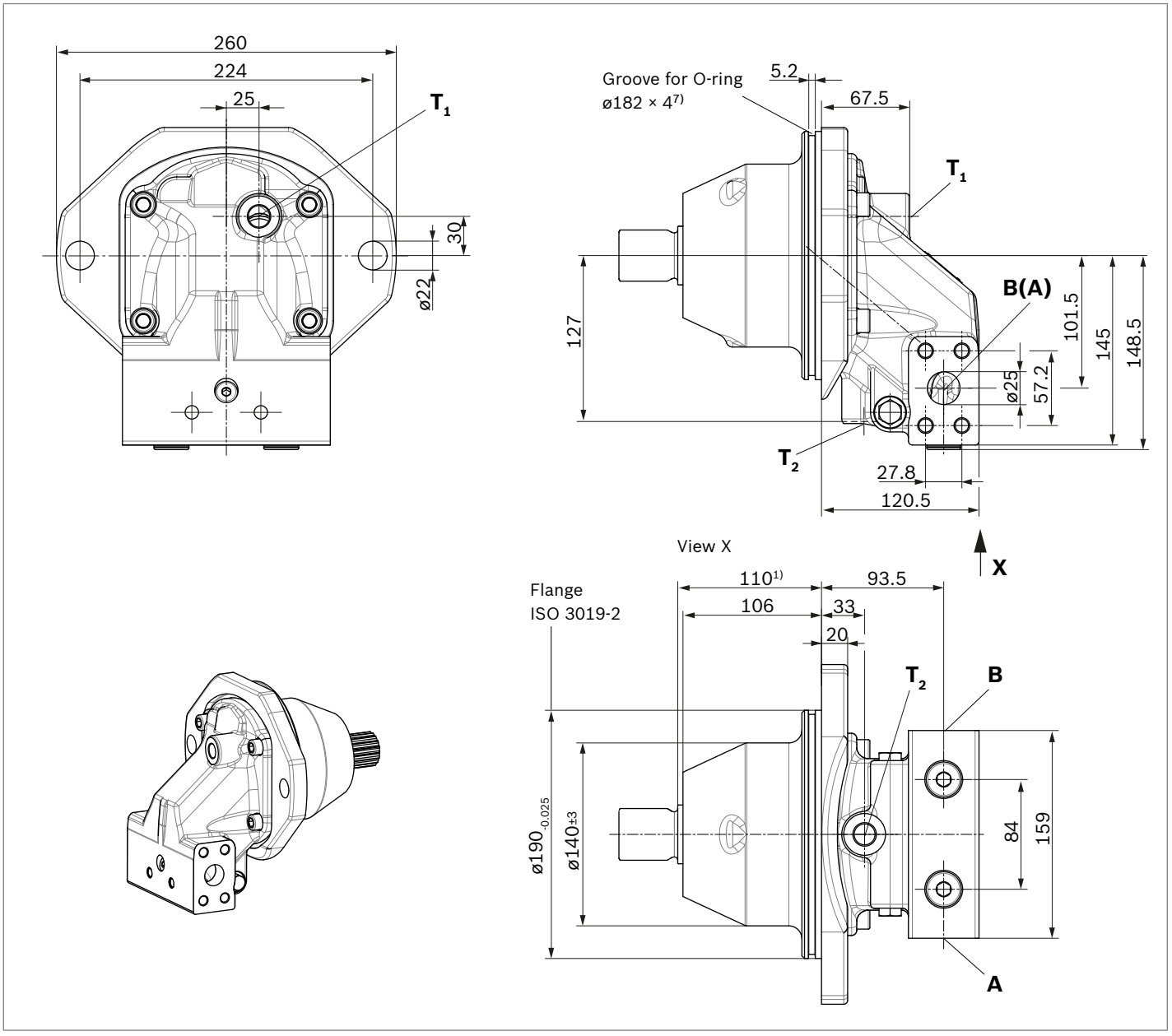


Ports		Standard	Size 2)	$p_{max\ abs}$ [bar] 3)	Status 6)
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
T_1	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	X 4)
T_2	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	O 4)

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601554.

A2FE dimensions, SAE flange ports at side

A2FEN sizes 90 and 107
A2FEM sizes 80 and 90
A2FEH sizes 80 and 90

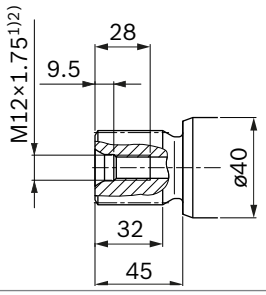


Ports		Standard	Size 2)	$p_{max\ abs}$ [bar] 3)	Status 6)
A, B	Working port Fastening thread A/B	SAE J518 DIN 13	1 in M12 × 1.75; 17 deep	500	O
T_1	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	X 4)
T_2	Drain port	DIN 3852 5)	M18 × 1.5; 12 deep	3	O 4)

1) To shaft collar
2) For notes on tightening torques, see instruction manual.
3) Depending on the application, momentary pressure peaks may occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 26).
5) The spot face can be deeper than as specified in the standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
7) O-ring is not included in the scope of delivery. Bosch Rexroth material number R902601554.

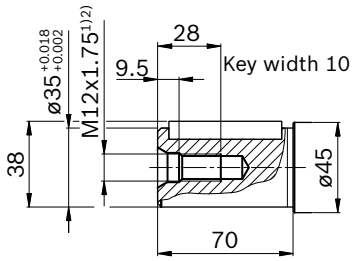
▼ **Splined shaft DIN 5480, size 80**

Z8 – W35×2×16×9g



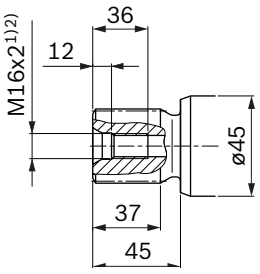
▼ **Parallel keyed shaft, DIN 6885, size 80**

P8 – AS10×8×56



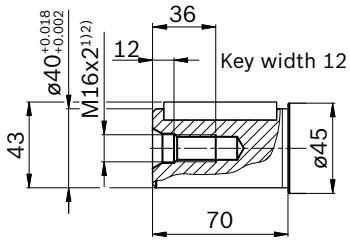
▼ **Splined shaft DIN 5480, sizes 80, 90 and 107**

Z9 – W40×2×18×9g



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

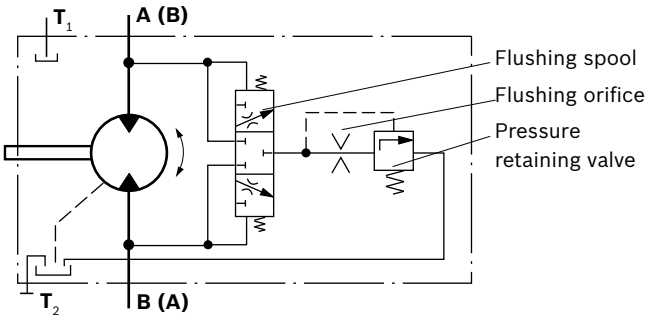
P9 – AS12×8×56



Flushing and boost-pressure valve, integrated

The flushing and boost-pressure valve is used to remove heat from the hydraulic circuit.
In a closed circuit, it is used for flushing the case and safeguarding the minimum boost pressure.
Hydraulic fluid is directed from the respective low pressure side into the motor case. This is then fed into the reservoir, together with the leakage. The hydraulic fluid removed from the closed circuit must be replaced by cooled hydraulic fluid from the boost pump.

Circuit diagram



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

▶ Sizes 45 to 107(N), fixed setting 16 bar

Switching pressure of flushing spool

▶ Sizes 45 to 107(N)
Δp = 8±1 bar

Flushing flow

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

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

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

Pressure relief valve

The MHDB pressure relief valves (see data sheet 64602 and 64612) protect the hydraulic motor from overload. As soon as the set cracking pressure is reached, the hydraulic fluid flows from the high-pressure side to the low-pressure side.

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

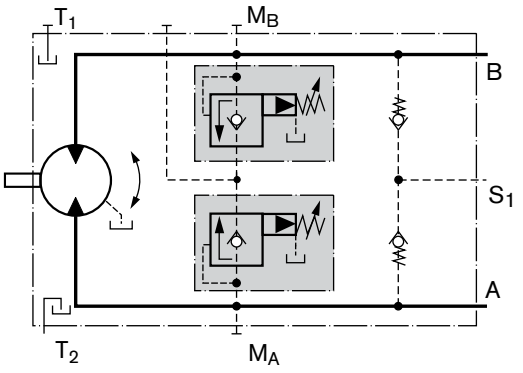
Cracking pressure setting range 50 to 420 bar

With the version "with pressure boost facility" 09S , a higher pressure setting can be realized by applying an external pilot pressure of 25 to 30 bar to port P_{St}.

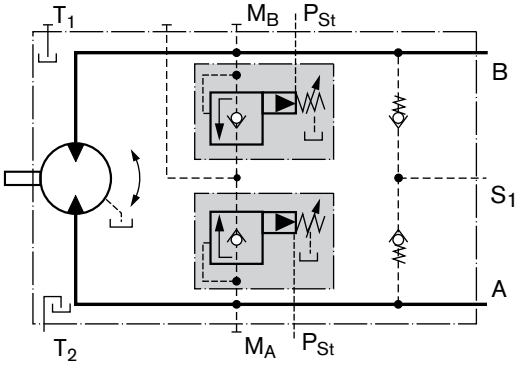
When ordering, please state in plain text:
- Cracking pressure of pressure relief valve
- Cracking pressure with pilot pressure applied to P_{St} (only with version 09S)

Circuit diagram

Version without pressure sequencing stage 09R



Version with pressure sequencing stage 09S

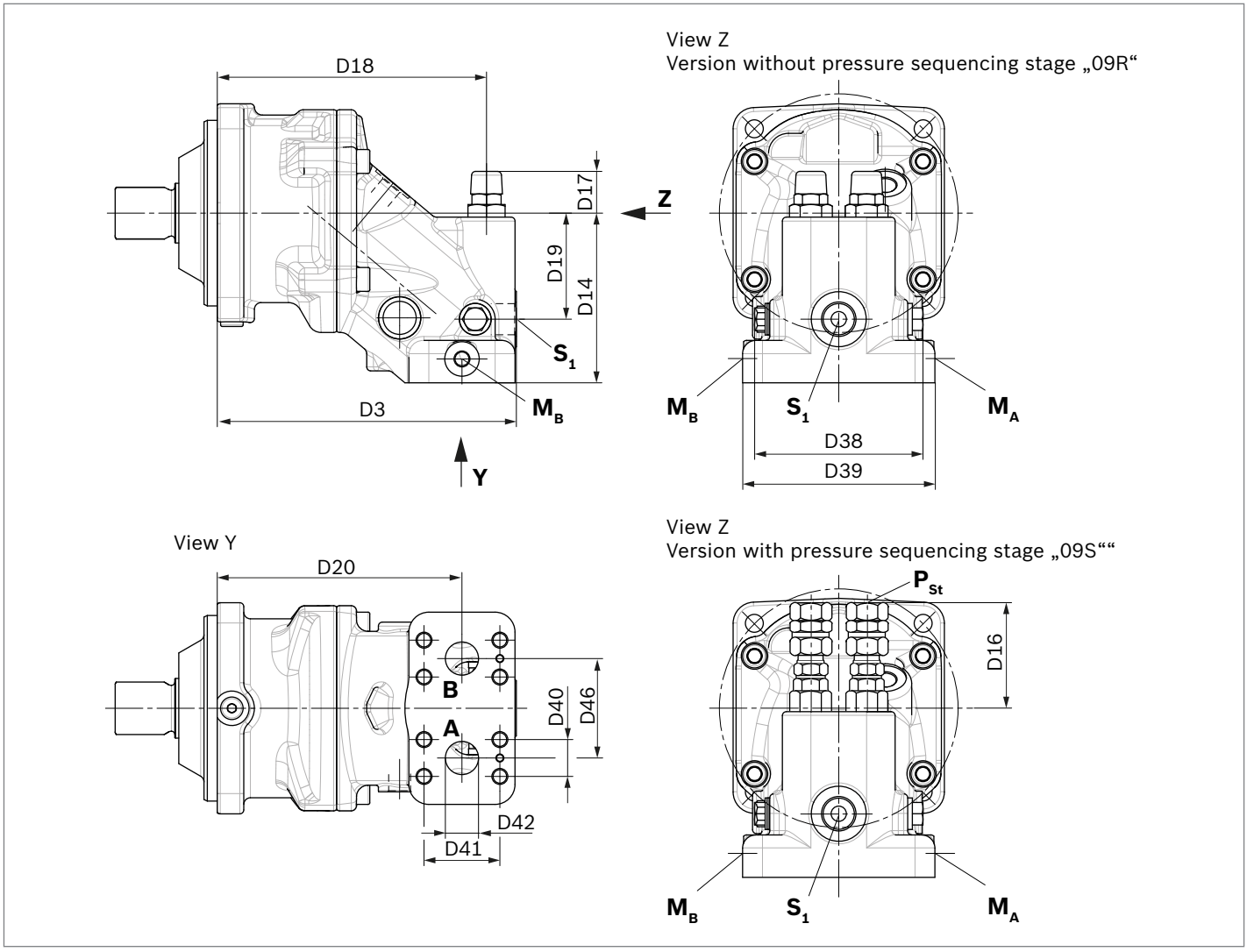


Permissible input flow or pressure for version with pressure relief valves

Motor	Without valve		Restricted values in operation with DBV			
			DBV			
NG	p_{nom}/p_{max} [bar]	$q_{V\,max}$ [l/min]	NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code
45	400/450	255	22	350/420	240	09R, 09S
56		280				
63		315				
80		360				
90		405				

DBV = pressure relief valve

Dimensions



Size		D3	D14	D16	D17	D18	D19	D20	D38	D39	D40	D41	D42	D46
45, 56, 63	MHDB..**22**	205.7	120	74	32.5	181.7	75	163.2	137	130	23.8	50.8	ø19	75
80, 90	MHDB..**22**	225.5	128	73	31.5	203	80	184.5	127	145	27.8	57.2	ø25	75

Size	A, B	S_1[1)]	M_A, M_B[1)]	P_{St}[1)]
45, 56, 63	3/4 in	M22 × 1.5; 14 deep	M12 × 1.5; 12 deep	G 1/4
80, 90	1 in	M26 × 1.5; 16 deep	M12 × 1.5; 12 deep	G 1/4

Anschlüsse

Size		Standard	Size[1)]	p_{max} [bar][2)]	Status[4)]
A, B	Working port	SAE J518	see table above	420	O
S_1	Boost port (only with working ports 09R/09S)	DIN 3852[3)]	see table above	5	O
M_A, M_B	Measuring port pressure A/B	DIN 3852[3)]	see table above	420	X
P_{St}	Pilot pressure port (only with working ports 09S)	DIN ISO 228	see table above	30	O

1) For notes on tightening torques, see instruction manual
2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
3) The countersink can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Counterbalance valve BVD

Function

Counterbalance valves for travel drives and winches operations are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking, when driving 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 collapses.

If the supply pressure falls below the level specified for the relevant counterbalance valve, the counterbalance valve piston moves into the closed position. The cross-sectional area of the counterbalance valve return duct 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 is again as it should be for the given inlet flow.

Note

- BVD available for sizes 45 bis 90.
- The counter balance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
  Ordering example:
  A2FMM90/70NWVN4Z907W000 + BVD20F27S/41B–V03K16D0400S12
- The counterbalance valve does not replace the mechanical service brake and park brake.
- Observe the detailed notes on the BVD counterbalance valve in RE 95522!
- For the design of the brake release valve, we must know for the mechanical park brake:
  - the pressure at the start of opening
  - the volume of the counterbalance spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - die benötigte Schließzeit bei warmem Gerät (Ölviskosität ca. 15 mm2/s)

Permissible input flow or pressure for version with counter balance valve

Motor	Without valve		Restricted values in operation with BVD			
			BVD			
NG	p_{nom}/p_{max} [bar]	$q_{V\,max}$ [l/min]	NG	p_{nom}/p_{max} [bar]	q_V[1] [l/min]	Code
45	400/450	255	20	350/420	220	07W
56		280				
63		315				
80		360				
90		405				

BVD = Counter balance valve, double acting

1) Schluckstromeinschränkung mit Gegenhalteventil

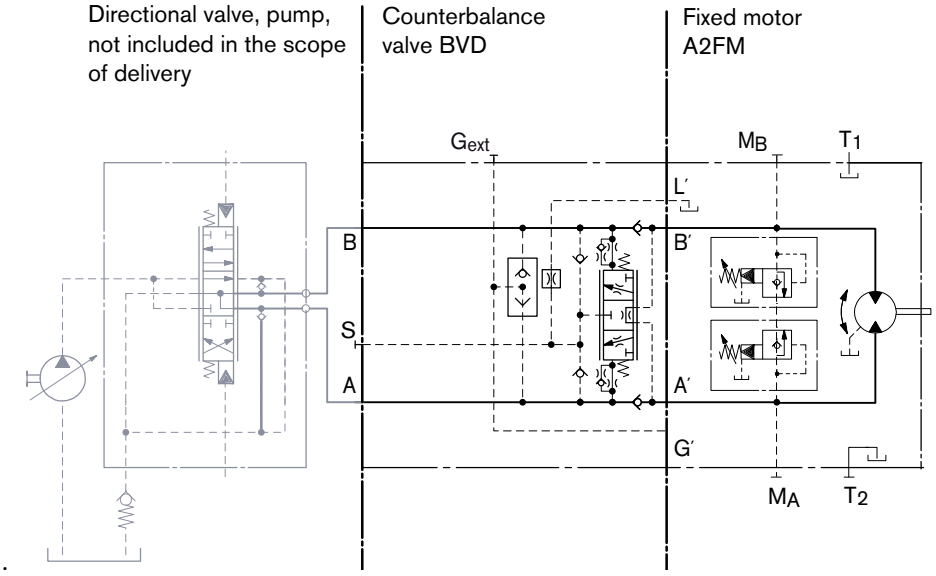
Travel brake valve BVD..F

Application option

- Travel drive for wheeled excavators

Example circuit diagram for travel drive on wheeled excavators

A2FMM90/70NWVN4Z907W000 + BVD20F27S/41B–V03K16D0400S12



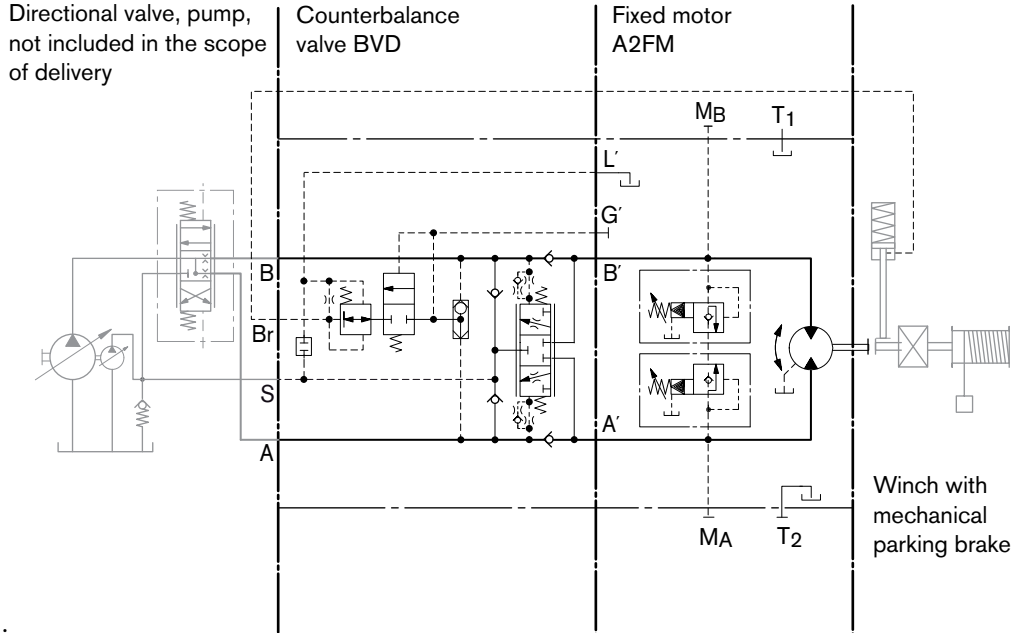
Winch brake valve BVD..W

Application option

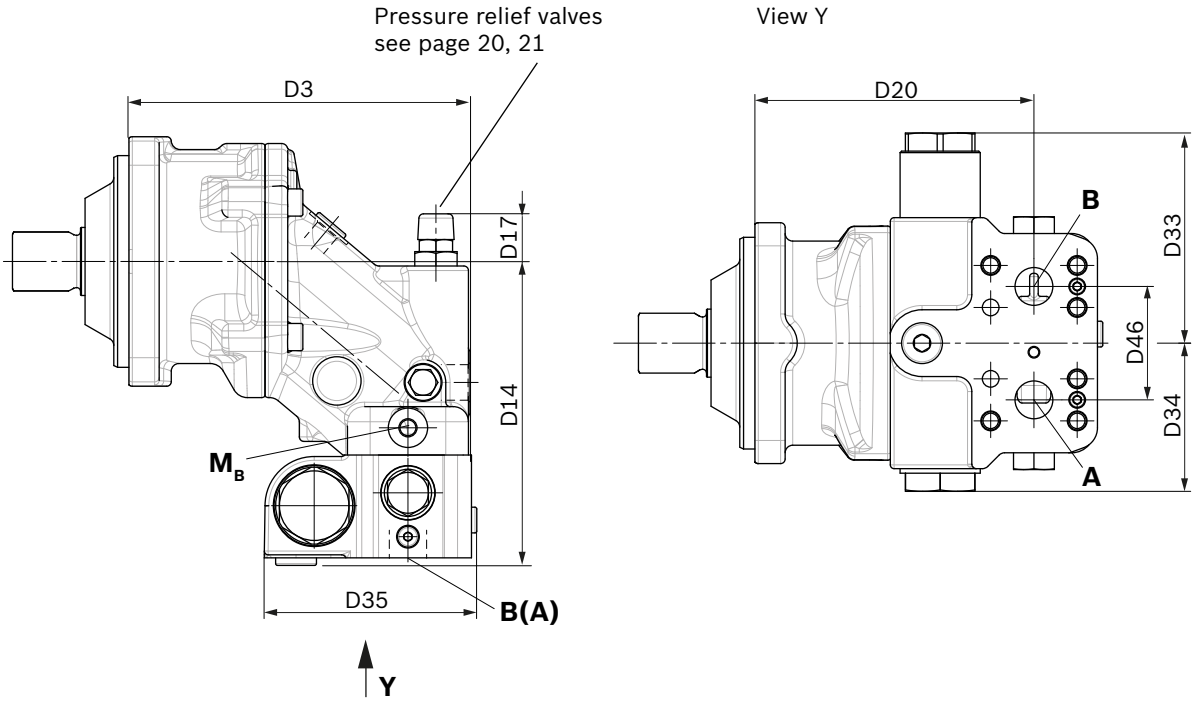
- Winch drives in cranes (BVD)
- Track drive in excavator crawlers (BVD)

Example circuit diagram for winch drive in cranes

A2FMM90/70NWVN4Z907W000 + BVD20W27L/41B–V01K00D0600S00



Dimensions



Size		A, B	D3	D14	D17	D20	D33	D34	D35	D46
45, 56, 63	BVD**20**..17	3/4 in	205	193	32.5	163	98	139	140.5	75
80, 90	BVD**20**..27	1 in	226.5	201	31.5	184.5	98	139	140.5	75

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

Mounting of the counterbalance valve

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

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

1) For notes on tightening torques, see instruction manual
2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
3) The countersink can be deeper than as specified in the standard.
4) O = Must be connected (plugged on delivery)
5) X = Plugged (in normal operation)

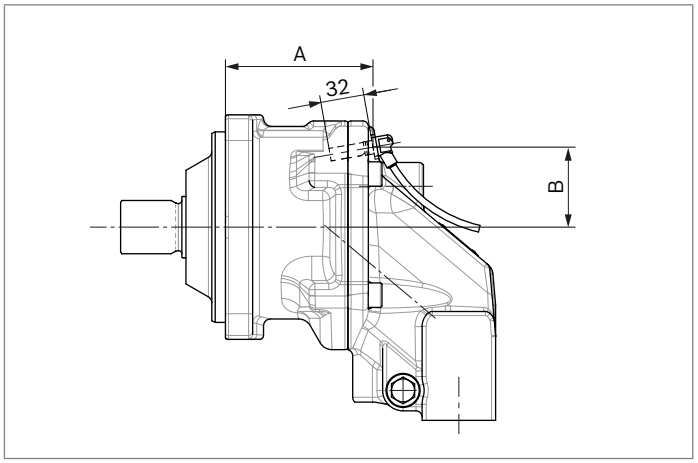
Speed sensors DSA and DSM

The versions A2F...A and A2F...N (“prepared for speed sensor”, i.e. without sensor) is equipped with splines on the rotary group.
A signal proportional to motor speed can be generated with the fitted DSA/DSM speed sensor. The DSA/DSM sensor registers the speed and direction of rotation.
Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95133 – DSA and 95132 – DSM.
The sensor is mounted on the port provided for this purpose with a mounting bolt. On deliveries without sensor, the port is plugged with a pressure-resistant cover.
We recommend ordering the A2F fixed motor complete with mounted sensor.

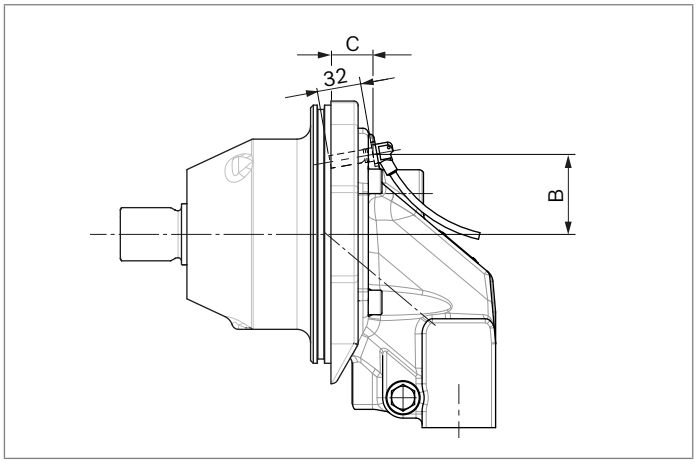
Size	**A2FM/H**	**45, 65, 63**	**80, 90**
	A2FN	**56, 63, 80**	**90, 107**
Number of teeth		47	53
Dimensions	A	96.6	108.4
	B	54.6	58.8
	C	36.3	30.4
	D	70.3	75
	E	86.9	91.6
	F	61.2	72.6

Dimensions

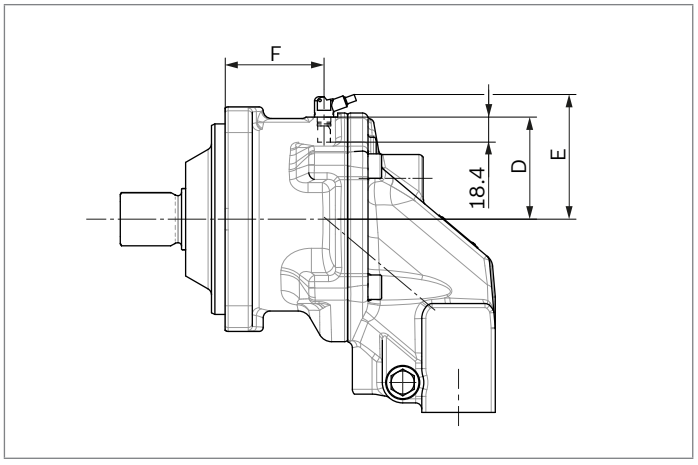
▼ **Version “B”**
A2FM with speed sensor DSA mounted



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



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



Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position “drive shaft upwards”, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T_1**, **T_2**).
If a shared drain line is used for several units, make sure that the respective case pressure is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operational circumstances, particularly at cold start. If this is not possible, separate drain lines must be laid if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Note

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

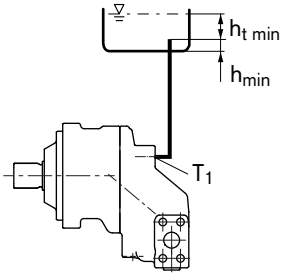
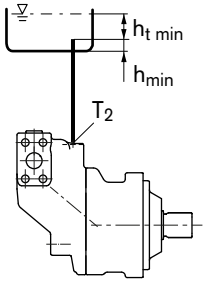
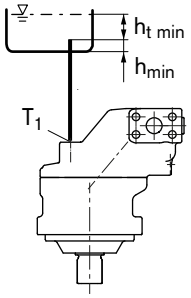
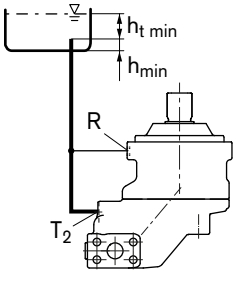
Key	
F	Filling / air bleeding Note: F is part of the external piping
R	Air bleed port (special version)
T_1, T_2	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir base (100 mm)

Installation position

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

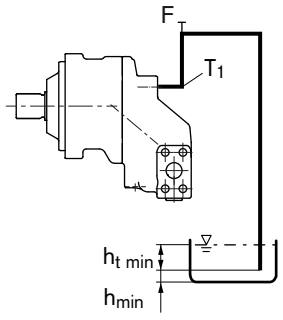
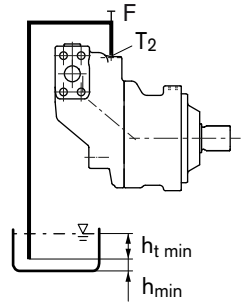
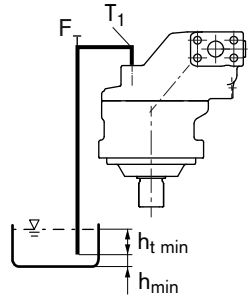
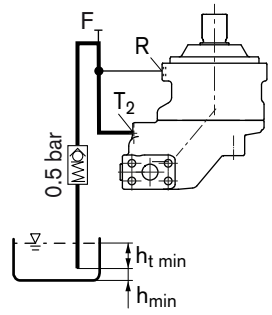
Below-reservoir installation (standard)

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

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

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Recommendation for installation position **8** (drive shaft upward): A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the housing area.

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

Note

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

Project planning notes

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

Safety instructions

- During and shortly after operation, there is a risk of burns on the axial piston unit. Take appropriate safety measures (e.g. by wearing protective clothing).

Bosch Rexroth AG
Glockeraustraße 4
89275 Elchingen, Germany
Tel. +49 7308 82-0
info.ma@boschrexroth.de
www.boschrexroth.com