

Variable plug-in motor A6VE Series 71



- ▶ High pressure motor for integration in mechanical gearbox
- ▶ Sizes 60 to 280
- ▶ Nominal pressure 450 bar
- ▶ Maximum pressure 530 bar (sizes 60 to 215)
- ▶ Maximum pressure 500 bar (size 280)
- ▶ Open and closed circuit

Features

- ▶ Space-saving construction due to recessed mounting flange
- ▶ Easy to install. Simply plug into the mechanical gearbox.
- ▶ Approved for very high rotational speeds
- ▶ High starting efficiency
- ▶ Excellent slow-running characteristics
- ▶ High control range (can be swiveled to zero)
- ▶ High torque
- ▶ Optionally with flushing and boost-pressure valve mounted
- ▶ Optionally with integrated or mounted counterbalance valve
- ▶ Bent-axis design

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Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	
A6V	E					0	0			/	71	M	W	V	0					-	

Axial piston unit

01	Bent-axis design, variable, nominal pressure 450 bar, maximum pressure 530 bar (NG60 to 215) resp. maximum pressure 500 bar (NG280)	A6V
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Operating mode

02	Plug-in motor	E
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Size (NG)

03	Geometric displacement, see "Technical data" on page 9	060	085	115	170	215	280
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Control device

				060	085	115	170	215	280	
04	Proportional control hydraulic	positive control	$\Delta p_{St} = 10 \text{ bar}$	●	●	●	●	●	●	HP1
			$\Delta p_{St} = 25 \text{ bar}$	●	●	●	●	●	●	HP2
		negative control	$\Delta p_{St} = 10 \text{ bar}$	●	●	●	●	●	●	HP5
			$\Delta p_{St} = 25 \text{ bar}$	●	●	●	●	●	●	HP6
	Proportional control electric	positive control	$U = 12 \text{ V}$	●	●	●	●	●	●	EP1
			$U = 24 \text{ V}$	●	●	●	●	●	●	EP2
		negative control	$U = 12 \text{ V}$	●	●	●	●	●	●	EP5
			$U = 24 \text{ V}$	●	●	●	●	●	●	EP6
Two-point control hydraulic	negative control	Switching pressure 15 bar ¹⁾	-	-	-	●	●	●	HZ5	
			●	●	●	● ²⁾	-	-	HZ7	
Two-point control electric	negative control	$U = 12 \text{ V}$	-	-	-	●	●	●	EZ5	
		$U = 24 \text{ V}$	-	-	-	●	●	●	EZ6	
		$U = 12 \text{ V}$	●	●	●	-	-	-	EZ7	
		$U = 24 \text{ V}$	●	●	●	-	-	-	EZ8	
Automatic control High pressure dependent, positive control	with minimum pressure increase	$\Delta p \leq \text{approx. } 10 \text{ bar}$	●	●	●	●	●	●	HA1	
		with pressure increase	$\Delta p = 100 \text{ bar}$	●	●	●	●	●	HA2	
		with minimum pressure increase	$\Delta p \leq \text{approx. } 10 \text{ bar}$	●	●	●	●	-	HA3³⁾	

Pressure control/override

				060	085	115	170	215	280	
05	Without pressure control/override			●	●	●	●	●	●	00
	Pressure control fixed setting, only for HP5, HP6, EP5 and EP6			●	●	●	●	●	●	D1
	Override of the HA1, HA2, and HA3 controls, hydraulically remote controlled, proportional			●	●	●	●	●	●	T3

Connector for solenoids⁴⁾ (see page 32)

				060 to 280	
06	Without connector (without solenoid, only for hydraulic control)			●	0
	DEUTSCH - molded connector, 2-pin, without suppressor diode			●	P

Additional function 1

				060 to 280	
07	Without additional function			●	0

Additional function 2

				060 to 280	
08	Without additional function			●	0

● = Available ○ = On request - = Not available

1) For NG 280, the switching pressure is adjustable

2) Only possible in connection with port plate 6 (integrated counterbalance valve)

3) HA3 only in combination with T3

4) Connectors for other electric components may deviate

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	
A6V	E					0	0			/	71	M	W	V	0					-	

Stroking time damping (for selection, see control)

060 to 280

09	Without damping (standard with HP and EP)		●	0
	Damping	HP, EP, HP5,6D. and EP5,6D., HZ, EZ, HA with counterbalance valve BVD/BVE/BVI	●	1
		One-sided in inlet to large stroking chamber (HA)	●	4

Setting range for displacement⁵⁾

10	$V_{g \max}$ setting screw	$V_{g \min}$ setting screw	060	085	115	170	215	280	
	No setting screw	short (0-adjustable)	●	●	●	●	●	-	A
		moderate	●	●	●	●	●	-	B
		long	●	●	●	●	●	-	C
		extra long	-	-	●	●	●	-	D
	short	short (0-adjustable)	●	●	●	●	●	●	E
		moderate	●	●	●	●	●	●	F
		long	●	●	●	●	●	●	G
		extra long	-	-	●	●	●	●	H
	medium	short (0-adjustable)	●	●	●	●	●	●	J
		moderate	●	●	●	●	●	●	K
		long	●	●	●	●	●	●	L
		extra long	-	-	●	●	●	●	M

Series

060 to 280

11	Series 7, Index 1	●	71
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Version of port and fastening threads

060 to 280

12	Metric ports based on ISO 6149 with O-ring seal, metric fastening thread according to DIN 13	●	M
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Direction of rotation

060 to 280

13	Viewed on drive shaft, bidirectional	●	W
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Sealing material

060 to 280

14	FKM (fluoroelastomer)	●	V
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Drive shaft bearing

060 to 280

15	Standard bearing	●	0
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Mounting flange

060 085 115 170 215 280

16	ISO 3019-2	160-2	●	-	-	-	-	-	P2
		190-2	-	●	-	-	-	-	Y2
		200-2	-	-	●	●	-	-	S2
		260-4	-	-	-	-	●	●	Z4

Drive shaft

060 085 115 170 215 280

17	Splined shaft DIN 5480	W35×2×16×9g	●	-	-	-	-	-	Z8
		W40×2×18×9g	-	●	●	-	-	-	Z9
		W45×2×21×9g	-	-	-	●	-	-	A1
		W50×2×21×9g	-	-	-	-	●	● ⁶⁾	A2
		W60×2×28×9g	-	-	-	-	-	●	A4

● = Available ○ = On request - = Not available

5) The adjustment values for the setting screws can be found in the table (page 48).

6) Torque limitation

4 **A6VE Series 71** | Variable plug-in motor
Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	
A6V	E					0	0			/	71	M	W	V	0					-	

Working port

		060	085	115	170	215	280	
18	SAE working ports A and B at rear	●	●	●	●	●	●	1
	SAE working ports A and B at side, opposite	●	●	●	●	●	●	2
	SAE flange ports A and B, at rear, with lateral measuring ports ⁷⁾	-	●	●	●	●	-	4
	SAE working ports A and B , at bottom only with integrated counterbalance valve BVI ⁸⁾	●	●	●	●	-	-	6
	Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (pilot operated) ⁹⁾	BVD20	●	●	●	-	-	7
		BVD25	-	-	●	●	-	8
		BVE25	-	-	●	○	-	8
	Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (direct operated) ⁹⁾	BVD25	-	-	-	●	●	5
		BVE25	-	-	-	●	●	5
		BVD32, BVE32	-	-	-	-	●	● ¹⁰⁾

Valve (see pages 33 to 46)

		060	085	115	170	215	280		
19	Without valve	●	●	●	●	●	●	0	
	With BVD/BVE counterbalance valves mounted ¹¹⁾	●	●	●	●	●	●	W	
	Integrated brake release valve (only with port plate 6)	For external piping	●	●	●	●	-	Y	
		for internal ducting	●	●	●	●	-	Z	
	With flushing and boost-pressure valve mounted flushing on both sides Flushing flow when: $\Delta p = p_{ND} - p_G = 25 \text{ bar}$ and $v = 10 \text{ mm}^2/\text{s}$ (p_{ND} = low pressure, p_G = case pressure) Only possible with port plates 1 and 2	Flushing flow q_v [L/min]							
		3.5	●	●	●	-	-	-	A
		5	●	●	●	-	-	-	B
		8	●	●	●	●	●	-	C
		10	●	●	●	●	●	-	D
		14	●	●	●	-	-	-	F
		15	-	-	-	● ¹²⁾	●	-	G
		18	-	-	● ¹²⁾	● ¹²⁾	●	-	I
		21	-	-	● ¹²⁾	● ¹²⁾	●	-	J
		27	-	-	● ¹²⁾	● ¹²⁾	●	-	K
		31	-	-	● ¹²⁾	● ¹²⁾	●	-	L
		37	-	-	-	● ¹²⁾	●	-	M
		adjustable 0 - 60 ¹³⁾	-	-	-	-	-	●	V

Speed sensor (see page 47)

		060	085	115	170	215	280	
20	Without speed sensor	●	●	●	●	●	●	0
	Prepared for DSA speed sensor	●	●	●	●	●	●	U
	With DSA speed sensor mounted ¹⁴⁾	●	●	●	●	●	●	V

Standard/special version

		060 to 280			
21	Standard version	●			0
	Standard version with installation variants, e.g. T ports open and closed contrary to standard	●			Y
	Special version	●			S

● = Available ○ = On request - = Not available

Notice

- ▶ Note the project planning notes on page 52!
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.
- ▶ Please note that not all type code combinations are available although the individual functions are marked as being available.

7) Only available for efficiency-optimized port plates
 8) Only for HA3, HZ7, EZ5/6, HP5/6 or EP5/6, in each case with negative control. EZ5/6, HP5/6 and EP5/6 are only available for NG 170. Supplement specification for integrated counterbalance valve BVI, see separate type code on page 39. Note the restrictions described on page 40.
 9) Possible only in combination with HP, EP and HA control. Note the restrictions described on page 35.
 10) A port plate for mounting the MHB32 counterbalance valve with a 1-stage pressure relief valve (pilot operated) is available as a special version for applications without boost pressure supply

11) Type code for counterbalance valve to be quoted separately in accordance with data sheet 95522 (BVD), 95526 (BVE BR53), 95528 (BVE/BVD BR52). Note the restrictions described on pages 35 and 39.
 12) Not for EZ7, EZ8 and HZ7
 13) If the low pressure deviates from $\Delta p \leq 25$ bar, please contact us
 14) Specify the type code separately for sensor in accordance with data sheet 95133 (DSA) and observe the requirements for the electronics.

Hydraulic fluids

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
- ▶ 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- ▶ 90223: Fire-resistant, water-containing hydraulic fluids (HFC, HFB)
- ▶ 90225: Limited technical data for operation with water-free and water-containing fire-resistant hydraulic fluids (HFDR, HFDU, HFB, HFC).

Selection of hydraulic fluid

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

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

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

Notice

The axial piston unit is not suitable for operation with HFA hydraulic fluids.

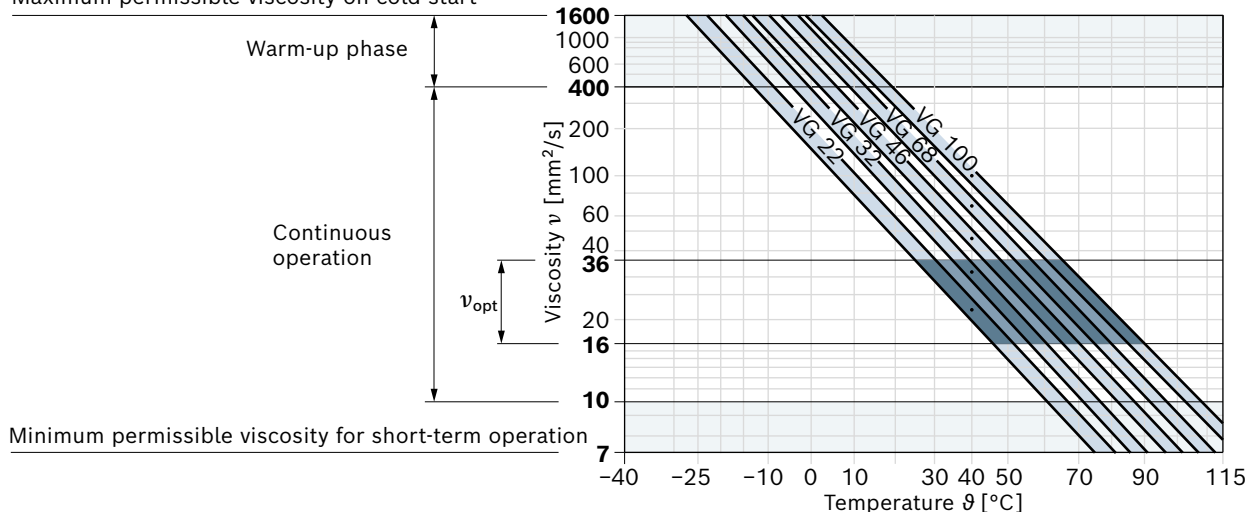
Viscosity and temperature of hydraulic fluids

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

Notice: The maximum circuit temperature of +115 °C must not be exceeded at the working ports **A** and **B** complying with the permissible viscosity.

▼ Selection diagram

Maximum permissible viscosity on cold start



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

2) Special version, please contact us

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

Filtration of the hydraulic fluid

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

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

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

For example, a viscosity of 10 mm²/s corresponds to the following temperatures with the following media:

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

Working pressure range

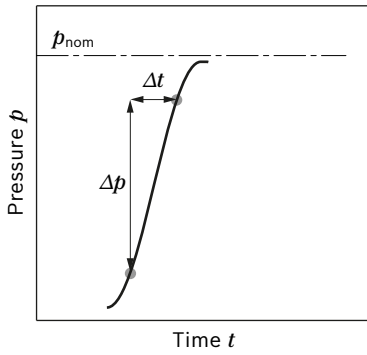
Pressure at working port A or B		Definition
Nominal pressure p_{nom}	450 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	500 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
Single operating period	10 s	Within the total operating period of 300 h, a maximum pressure of 500 bar to 530 bar is permissible for a limited period of 50 h.
Total operating period	300 h	
Maximum pressure p_{max} (only valid for NG 60-215)	530 bar	
Single operating period	10 s	
Total operating period	50 h	
Minimum pressure (high-pressure side)	25 bar	Minimum pressure at the high-pressure side (A and B) which is required in order to prevent damage to the axial piston unit.
Minimum pressure – operation as a pump (inlet)	See the diagram	To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, 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} (pressure A + pressure B)	700 bar	The summation pressure is the sum of the pressures at both working line ports (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	9000 bar/s	
without pressure relief valve	16000 bar/s	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T cont}$	2 bar	Maximum, averaged differential pressure at the shaft seal (housing to ambient pressure)
Maximum differential pressure $\Delta p_{T max}$	See the diagram (next page)	Permissible differential pressure at the shaft seal (housing to ambient pressure)
Pressure peaks $p_{T peak}$	10 bar	$t < 0.1$ s

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

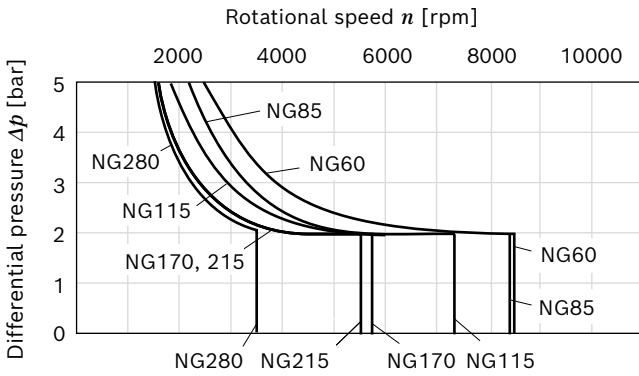
Flow direction

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

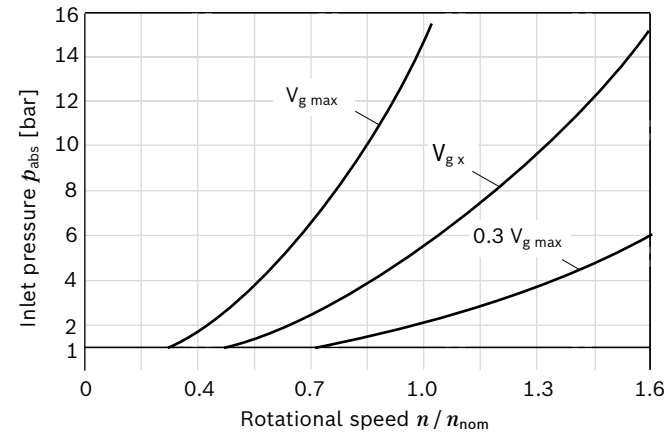
▼ **Rate of pressure change $R_{A \max}$**



▼ **Maximum differential pressure at the shaft seal**

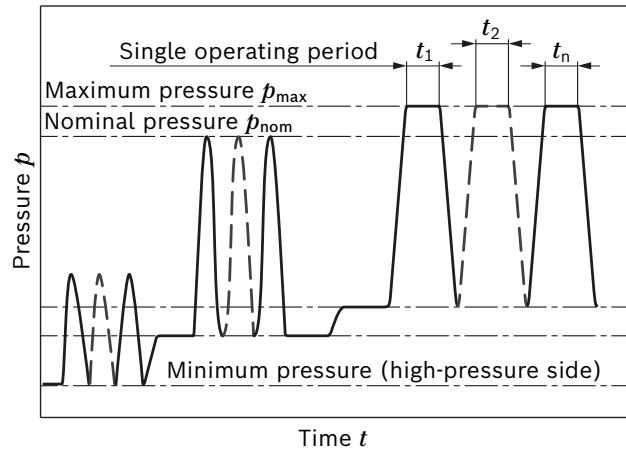


▼ **Minimum pressure - operation as a pump (inlet)**



This diagram is only valid for the optimum viscosity range of $\nu_{opt} = 36$ to $16 \text{ mm}^2/\text{s}$.
If the above-mentioned conditions cannot be ensured, please contact us.

▼ **Pressure definition**



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

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 larger than the external pressure (ambient pressure) at the shaft seal.

Effect of case pressure on beginning of control

An increase in case pressure affects the beginning of control of the variable motor when using the following control options: HP, HA.T3: increase

DA: decrease

With the following settings, an increase in case pressure will have no effect on the beginning of control:

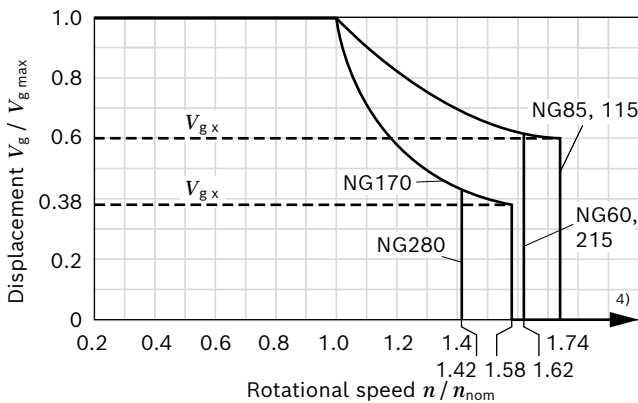
HA.R and HA.U, EP, HA

The factory settings for the beginning of control are made at $p_{abs} = 2$ bar case pressure (sizes 60 to 215) or $p_{abs} = 1$ bar case pressure (size 280).

Technical data

Size		NG	60	85	115	170	215	280
Displacement geometric, per revolution		$V_{g \max}$ cm ³	62.0	85.2	115.6	171.8	216.5	280.1
		$V_{g \min}$ cm ³	0	0	0	0	0	0
		$V_{g x}$ cm ³	37	51	69	65	130	118
Maximum rotational speed ¹⁾ (complying with the maximum permissible inlet flow)	at $V_{g \max}$	n_{nom} rpm	4450	3900	3550	3100	2900	2500
	at $V_g < V_{g x}$ (see diagram)	n_{max} rpm	7200	6800	6150	4900	4800	3550
	at $V_{g 0}$	n_{max} rpm	8400	8350	7350	5750	5500	3550
Inlet flow ²⁾	at n_{nom} and $V_{g \max}$	$q_{v \max}$ l/min	275	332	410	533	628	700
Torque ³⁾	at $V_{g \max}$ and $\Delta p = 450$ bar	M Nm	444	610	828	1230	1550	2006
Rotary stiffness	$V_{g \max}$ to $V_g/2$	c_{min} kNm/rad	15	22	37	52	70	72
	$V_g/2$ to 0 (interpolated)	c_{min} kNm/rad	45	68	104	156	196	209
Moment of inertia of the rotary group		J_{TW} kgm ²	0.0043	0.0072	0.0110	0.0213	0.0303	0.0479
Case volume		V l	0.8	1.0	1.5	2.3	3.0	3.4
Weight approx.	Without BVI	m kg	28	36	46	62	78	109
	With BVI	m kg	37	45	52	70	–	–

▼ Permissible displacement depending on the rotational speed



Notice

- ▶ 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.

Determination of the characteristics

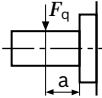
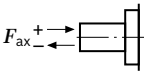
Inlet flow	$q_v = \frac{V_g \times n}{1000 \times \eta_v}$	[l/min]
Rotational speed	$n = \frac{q_v \times 1000 \times \eta_v}{V_g}$	[rpm]
Torque	$M = \frac{V_g \times \Delta p \times \eta_{\text{hm}}}{20 \times \pi}$	[Nm]
Power	$P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p \times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

Key

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

- The values are applicable:
 - for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 mm²/s
 - with hydraulic fluid based on mineral oils
- Note inlet flow limitation due to counterbalance valve (page 35).
- Torque without radial force, with radial force see page 10.
- Values in this range on request

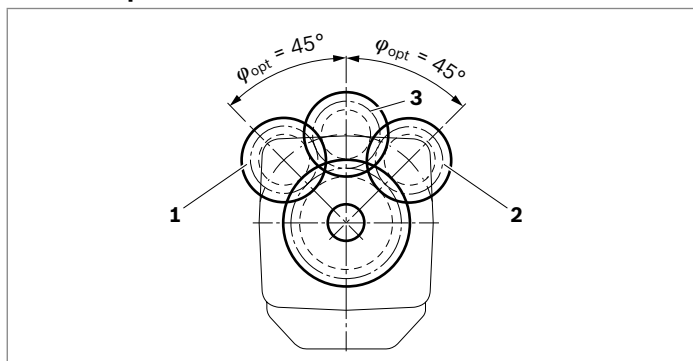
Permissible radial and axial loading on the drive shafts

Size	NG		60	85	115	170	215	280	
Drive shaft			W35	W40	W40	W45	W50	W60	
Maximum radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	N	10266	12323	16727	21220	25016	26913
		a	mm	20.0	22.5	22.5	25.0	27.5	35.0
Maximum torque at $F_{q \max}$	$T_{q \max}$	Nm	444	610	828	1200	1550	2005	
Maximum differential pressure at $V_{g \max}$ and $F_{q \max}$	$\Delta p_{q \max}$	bar	450	450	450	440	450	450	
Maximum axial force at standstill or depressurized operation		$+ F_{ax \max}$	N	0	0	0	0	0	
		$- F_{ax \max}$	N	500	710	900	1120	1250	1575
Permissible axial force per bar working pressure	$+ F_{ax \text{ perm}/\text{bar}}$	N/bar	7.5	9.6	11.3	15.1	17.0	19.4	

Effect of radial force F_q on bearing service life

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

▼ **Gear output drive**



- 1 "Counter-clockwise" rotational direction, pressure at port B
- 2 "Clockwise" rotational direction, pressure at port A
- 3 Bidirectional direction of rotation

Notice

- ▶ 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 bearing service life is reduced.
- ▶ Special requirements apply in the case of belt output drives. Please contact us.

1) With intermittent operation

HP – Proportional control, hydraulic

The proportional hydraulic control provides infinite adjustment of the displacement. The control is proportional to the pilot pressure at port **X**.

HP1, HP2 positive control

- ▶ Beginning of control at $V_{g \min}$ (minimum torque, maximum permissible rotational speed at minimum pilot pressure)
- ▶ End of control at $V_{g \max}$ (maximum torque, minimum rotational speed at maximum pilot pressure)

HP5, HP6 negative control

- ▶ Beginning of control at $V_{g \max}$ (maximum torque, minimum rotational speed at minimum pilot pressure)
- ▶ End of control at $V_{g \min}$ (minimum torque, maximum permissible rotational speed, at maximum pilot pressure)

Notice

- ▶ Maximum permissible pilot pressure: $p_{St} = 100$ bar
- ▶ The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please keep in mind that at port **G**, pressures up to 530 bar (NG60 to 215) and 500 bar (NG280) can occur.
- ▶ Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 10 bar.
- ▶ The beginning of control and the HP characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 8) and thus a parallel displacement of the characteristic curve.
- ▶ A leakage flow of maximum 0.3 l/min can occur at port **X** due to internal leakage (working pressure > pilot pressure). The control is to be suitably configured to avoid an independent build-up of pilot pressure.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.

Standard

HP without damping.

HP.D with throttle pin on both sides, symmetrical (see table), size 280 with orifice $\varnothing 1.2$

Option

HP with throttle pin on both sides, symmetrical (see table), size 280 with orifice $\varnothing 1.2$

▼ Throttle pin overview

Size	060	085	115	170	215
Groove size [mm]	0.45	0.45	0.55	0.55	0.65

HP1, HP5 – pilot pressure increase $\Delta p_{St} = 10$ bar

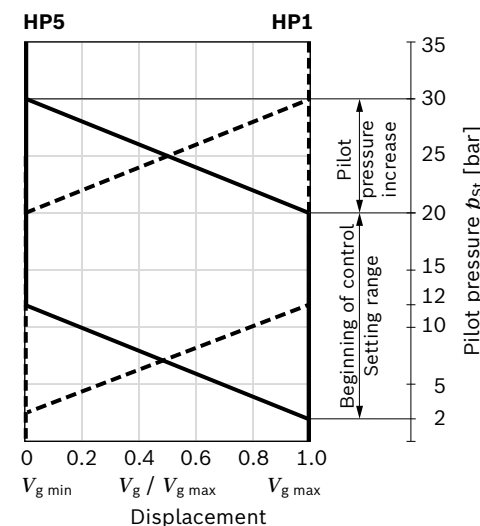
HP1 positive control

A pilot pressure increase of 10 bar at port **X** results in an increase in displacement from $V_{g \min}$ to $V_{g \max}$.

HP5 negative control

A pilot pressure increase of 10 bar at port **X** results in a decrease in displacement from $V_{g \max}$ to $V_{g \min}$.
 Beginning of control, setting range 2 to 20 bar
 Standard setting:
 beginning of control at 3 bar (end of control at 13 bar)

▼ Characteristic curve



HP2, HP6 pilot pressure increase $\Delta p_{st} = 25$ bar
HP2 positive control

A pilot pressure increase of 25 bar at port **X** results in an increase in displacement from $V_{g\ min}$ to $V_{g\ max}$.

HP6 negative control

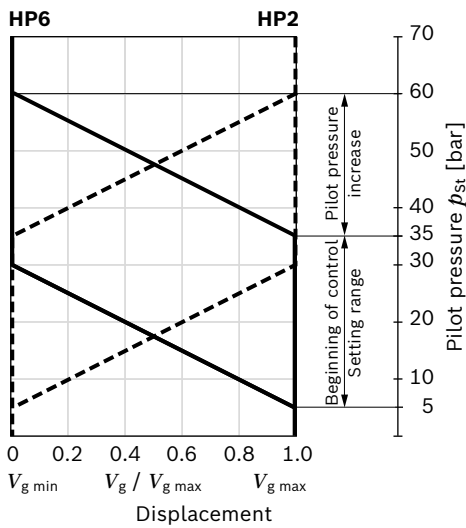
A pilot pressure increase of 25 bar at port **X** results in a decrease in displacement from $V_{g\ max}$ to $V_{g\ min}$.

Beginning of control, setting range 5 to 35 bar

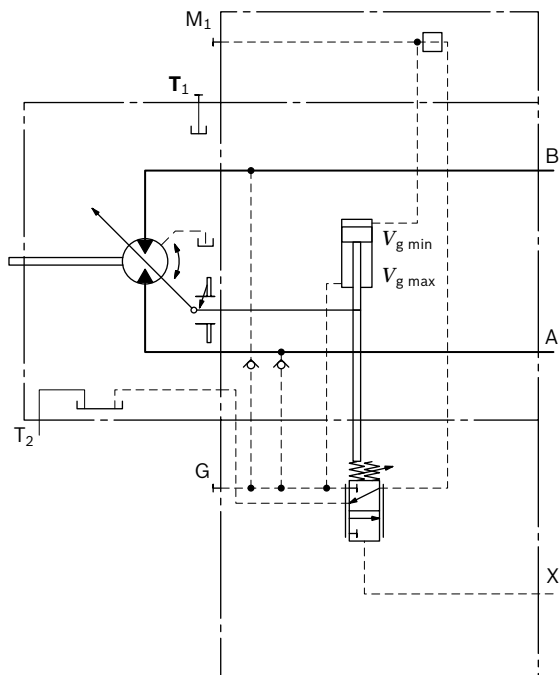
Standard setting:

Beginning of control at 10 bar (end of control at 35 bar)

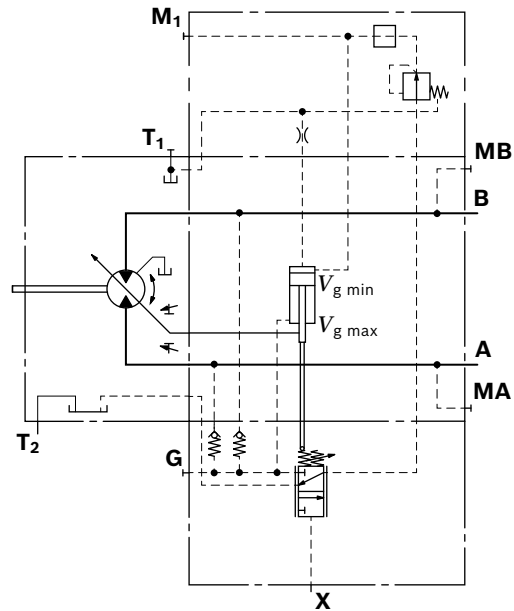
▼ **Characteristic curve**



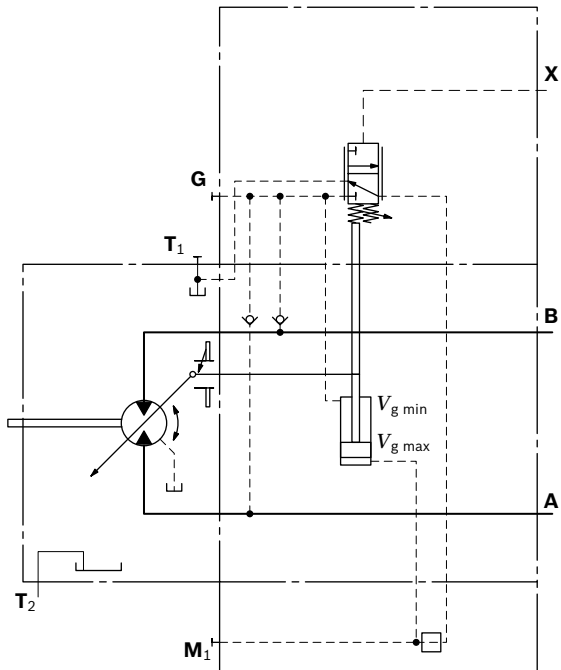
▼ **Circuit diagram HP1, HP2 size 60 to 215 (positive control)**



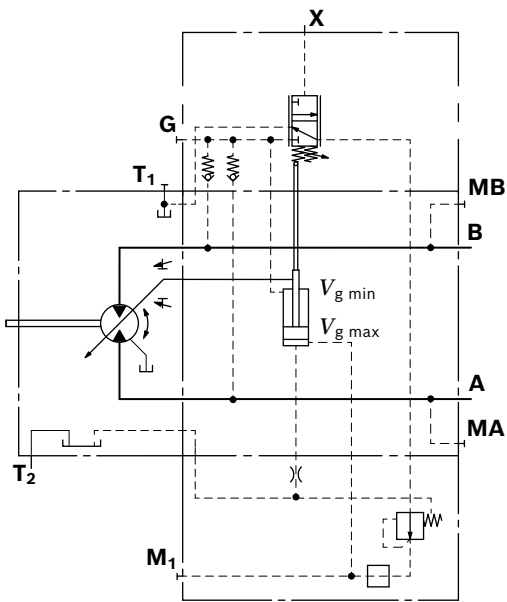
▼ **Circuit diagram HP1, HP2 size 280 (positive control)**



▼ **Circuit diagram HP5, HP6 size 60 to 215 (negative control)**



▼ **Circuit diagram HP5, HP6 size 280 (negative control)**



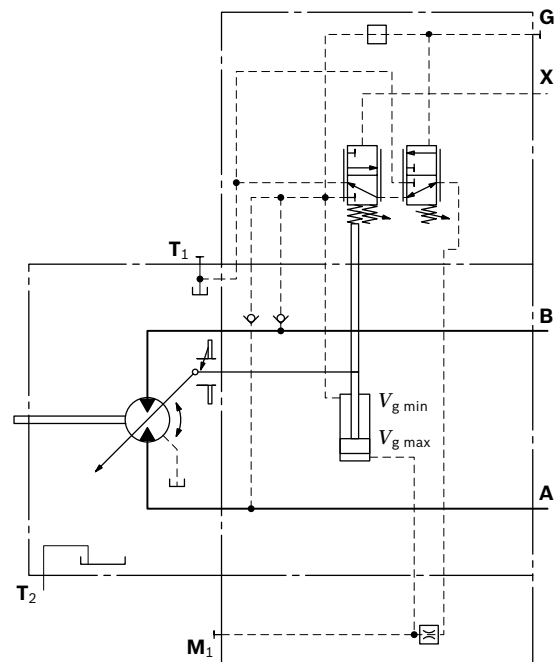
HP5D1, HP6D1 Pressure control, fixed setting

The pressure control overrides the HP control function. If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement.

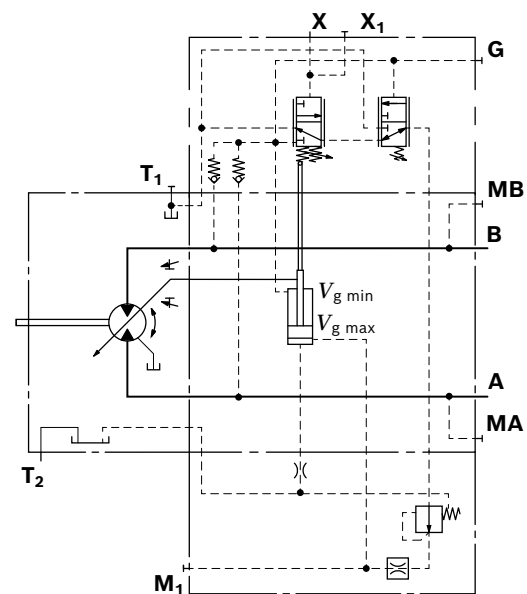
The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range of the pressure control valve 80 to 450 bar

▼ **Circuit diagram HP5D1, HP6D1 size 60 to 215 (negative control)**



▼ **Circuit diagram HP5D1, HP6D1 size 280 (negative control)**



EP – Proportional control, electric

The proportional electric control provides infinite adjustment of the displacement. Control is proportional to the electric control current applied to the solenoid.

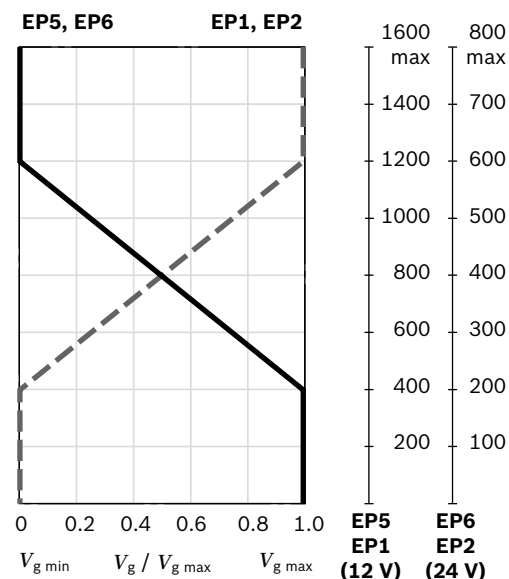
EP1, EP2 positive control

- ▶ Beginning of control at $V_{g \min}$ (minimum torque, maximum permissible rotational speed at minimum control current)
- ▶ End of control at $V_{g \max}$ (maximum torque, minimum rotational speed at maximum control current)

EP5, EP6 negative control

- ▶ Beginning of control at $V_{g \max}$ (maximum torque, minimum rotational speed at minimum control current)
- ▶ End of control at $V_{g \min}$ (minimum torque, maximum permissible rotational speed at maximum control current)

▼ Characteristic curve



Notice

The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please bear in mind that at port **G**, pressures up to 530 bar (NG60 to 215) and 500 bar (NG280) can occur.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.

Standard for sizes 60 to 280

EP without damping.

EP.D with throttle pin on both sides, symmetrical (see table), size 280 with orifice $\varnothing 1.2$

Optional for sizes 60 to 280

(see table), size 280 with orifice $\varnothing 1.2$

▼ Throttle pin overview

Size	60	85	115	170	215
Groove size [mm]	0.45	0.45	0.55	0.55	0.65

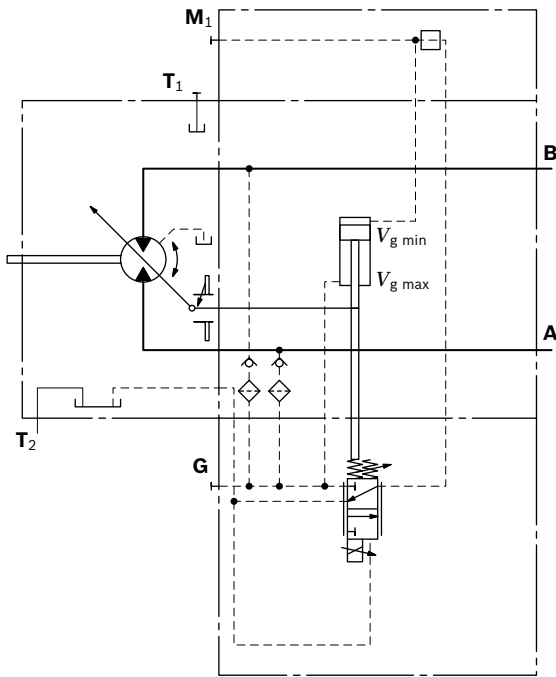
Technical data, solenoid	EP1, EP5	EP2, EP6
Voltage	12 V ($\pm 20\%$)	24 V ($\pm 20\%$)
Control current		
Start of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither		
frequency	100 Hz	100 Hz
minimum oscillation range ¹⁾	240 mA	120 mA
Duty cycle	100%	100%
Type of protection: see connector version page 32		

Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.

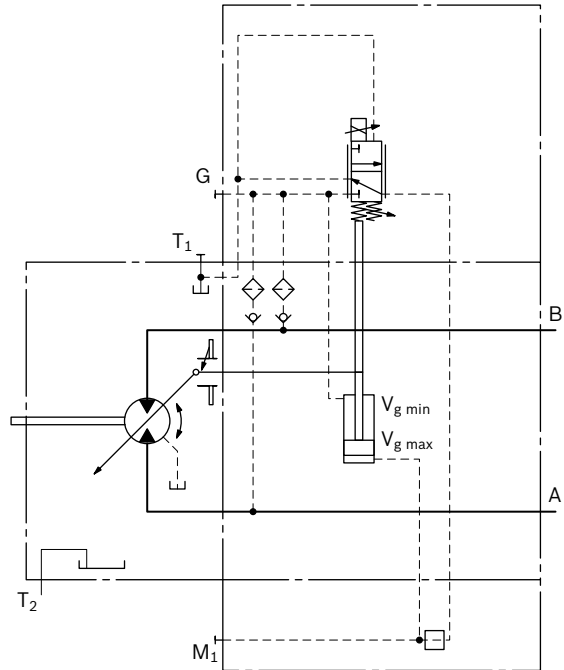
Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics.

¹⁾ Minimum required oscillation range of the control current $\Delta I_{p,p}$ (peak to peak) within the respective control range (start of control to end of control)

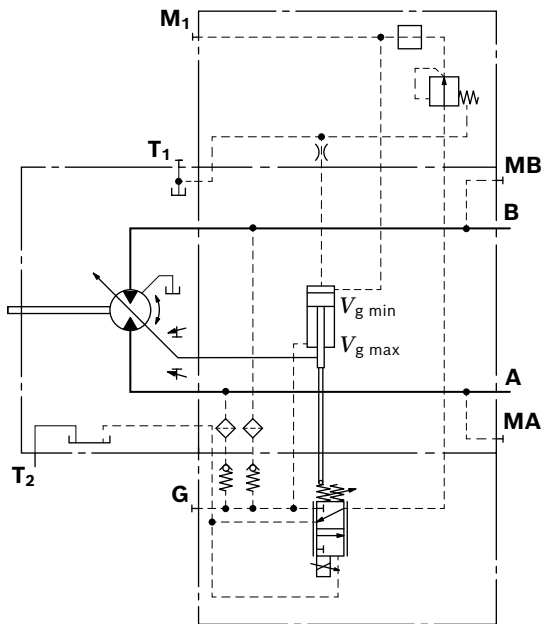
▼ **Circuit diagram EP1, EP2 size 60 to 215 (positive control)**



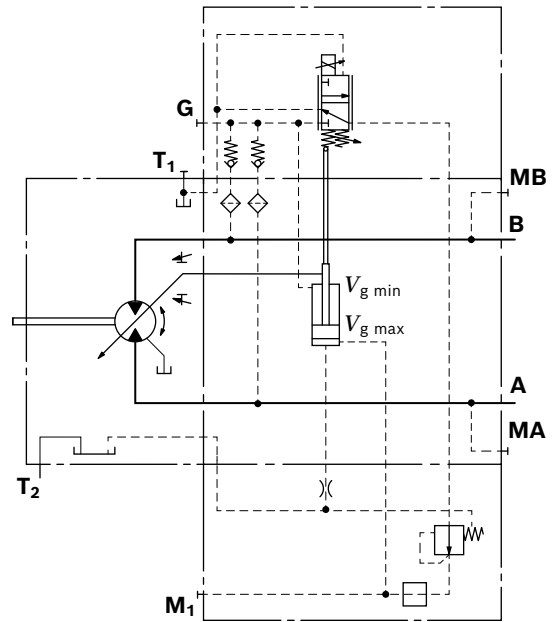
▼ **Circuit diagram EP5, EP6 size 60 to 215 (negative control)**



▼ **Circuit diagram EP1, EP2 size 280 (positive control)**



▼ **Circuit diagram EP5, EP6 size 280 (negative control)**

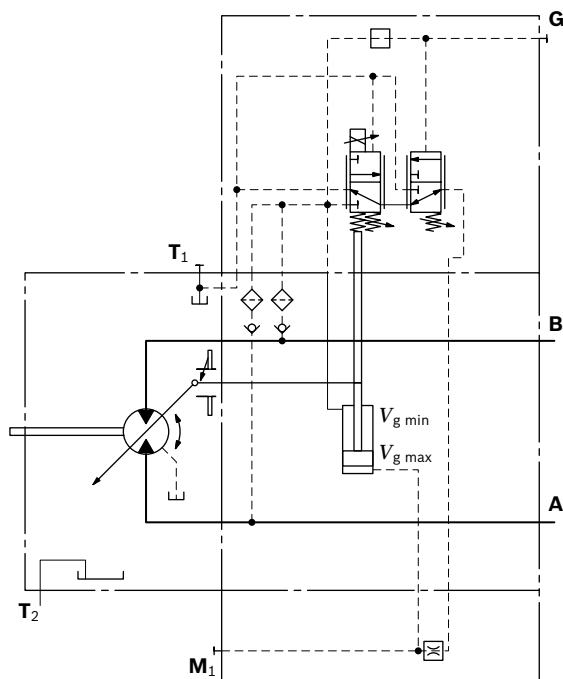


EP5D1, EP6D1 Pressure control, fixed setting

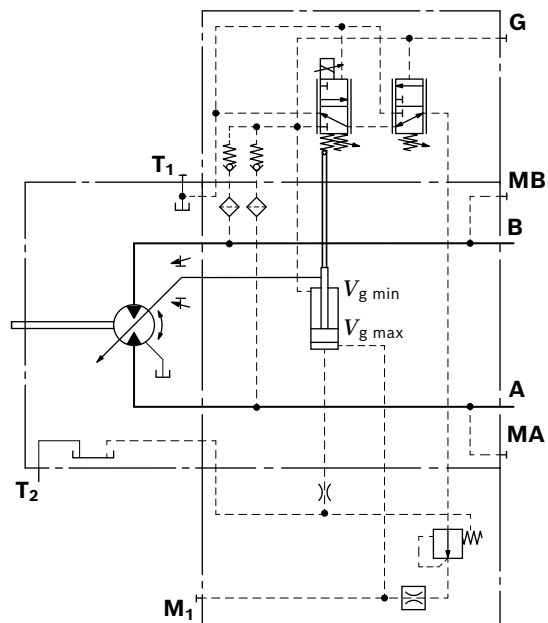
The pressure control overrides the EP control function. If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement. The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range of the pressure control valve 80 to 450 bar

▼ **Circuit diagram EP5D1, EP6D1 size 60 to 215 (negative control)**



▼ **Circuit diagram EP5D1, EP6D1 size 280 (negative control)**



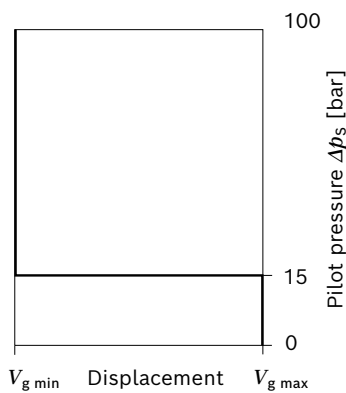
HZ – Two-point control, hydraulic

The hydraulic two-point control allows the displacement to be set to either $V_{g \min}$ or $V_{g \max}$ by switching the pilot pressure at port **X** on or off.

HZ5, HZ7 negative control

- ▶ Position at $V_{g \max}$ (without pilot pressure, maximum torque, minimum rotational speed)
- ▶ Position at $V_{g \min}$ (with pilot pressure > 15 bar activated, minimum torque, maximum permissible rotational speed)

▼ Characteristic curve HZ5, HZ7



Notice

- ▶ Maximum permissible pilot pressure: 100 bar
- ▶ The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please bear in mind that at port **G**, pressures up to 530 bar (NG60 to 215) and 500 bar (NG280) can occur.
- ▶ A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.

Standard for sizes 170 to 280

HZ5 with throttle pin on both sides, symmetrical (see table), size 280 with orifice $\varnothing 1.2$

Standard for sizes 115 and 170 with BVI

HZ7 with throttle pin on both sides 0.30, symmetrical

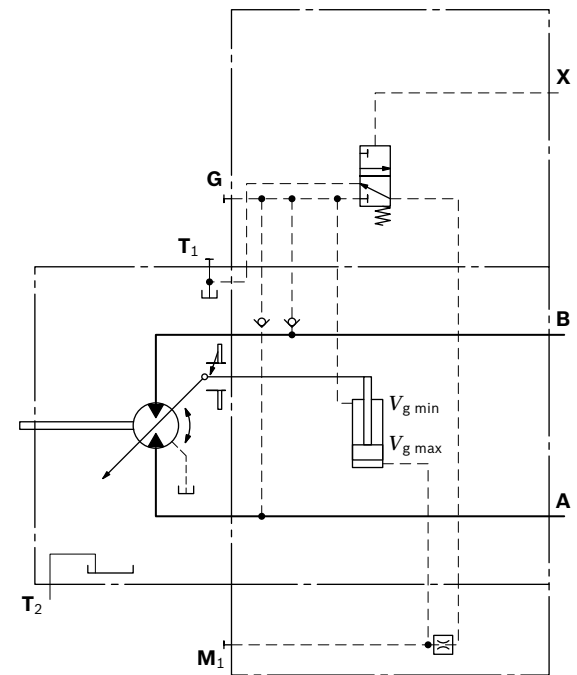
Standard for sizes 60 to 115

HZ7 (synchronous piston) with throttle pin on both sides, symmetrical (see table)

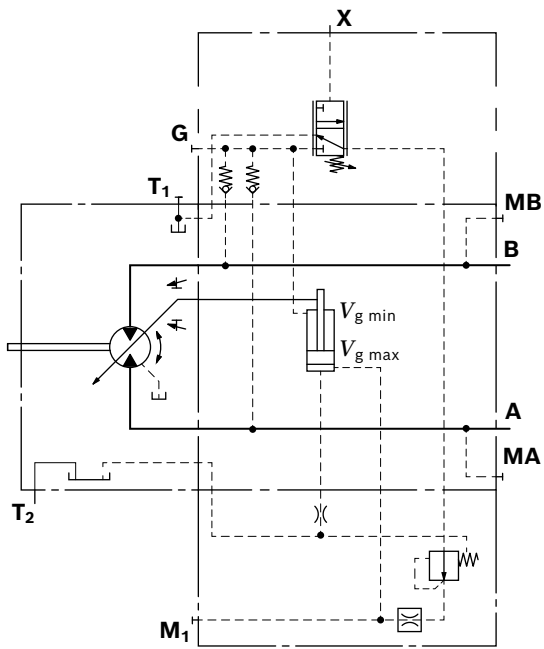
▼ Throttle pin overview

Size	60	85	115	170	215
Groove size [mm]	0.30	0.30	0.30	0.55	0.65

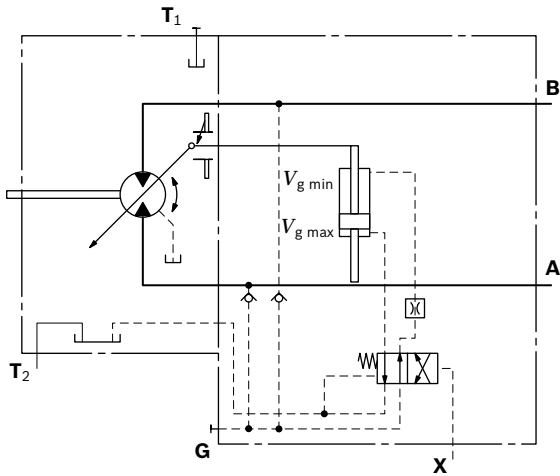
▼ Circuit diagram HZ5 sizes 170 an 215 (negative control)



▼ **Circuit diagram HZ5 size 280 (negative control)**



▼ **Circuit diagram HZ7 (negative control) sizes 60 to 115**



EZ – Two-point control, electric

The electric two-point control allows the displacement to be set to either $V_{g \min}$ or $V_{g \max}$ by switching the electric current to a switching solenoid on or off.

Notice

The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.

Please note that at port **G**, up to 530 bar (NG60 to 215) and 500 bar (NG280) may occur.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.

Standard for sizes 170 to 280

EZ5, EZ6 with throttle pin on both sides, symmetrical (see table), size 280 with orifice $\varnothing 1.2$

Standard for sizes 60 to 115

EZ7, EZ8 (synchronous piston) with throttle pin on both sides, symmetrical (see table)

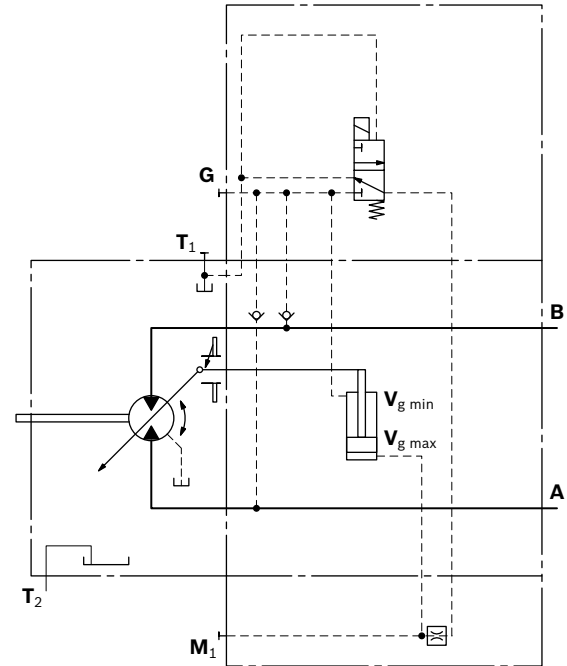
▼ Throttle pin overview

Size	60	85	115	170	215
Groove size [mm]	0.30	0.30	0.30	0.55	0.65

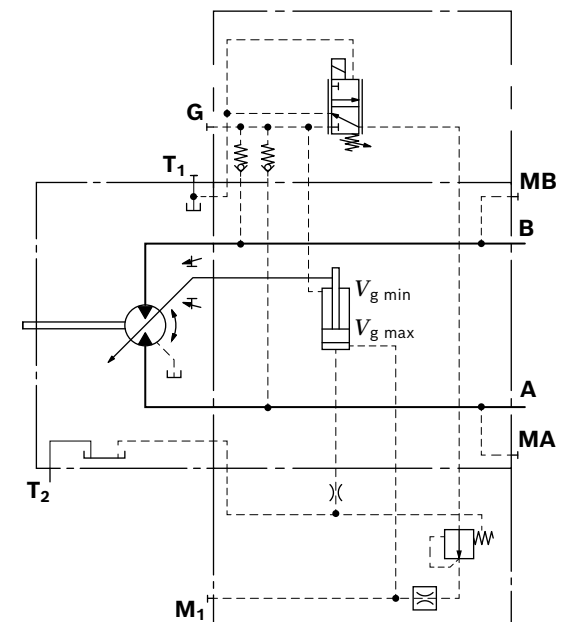
Sizes 170 to 280

Technical data, solenoid with $\varnothing 37$	EZ5	EZ6
Voltage	12 V ($\pm 20\%$)	24 V ($\pm 20\%$)
Position $V_{g \max}$	de-energized	de-energized
Position $V_{g \min}$	current switched on	current switched on
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum active current required	1.32 A	0.67 A
Duty cycle	100%	100%
Type of protection: see connector version page 32		

▼ Circuit diagram EZ5, EZ6 sizes 170 to 215 (negative control)



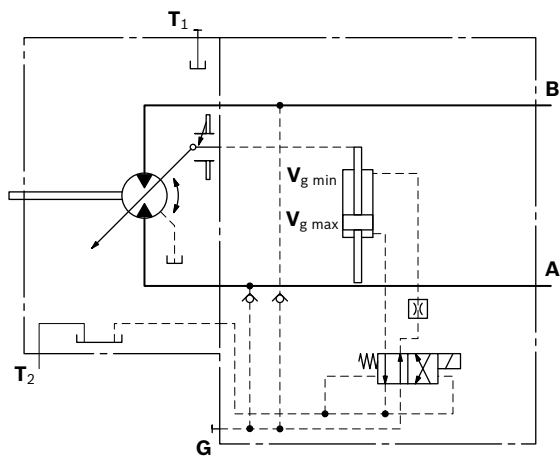
▼ Circuit diagram EZ5, EZ6 size 280 (negative control)



Sizes 60 to 115

Technical data, solenoid with $\varnothing 45$	EZ7	EZ8
Voltage	12 V ($\pm 20\%$)	24 V ($\pm 20\%$)
Position $V_{g \max}$	de-energized	de-energized
Position $V_{g \min}$	current switched on	current switched on
Nominal resistance (at 20 °C)	4.8 Ω	19.2 Ω
Nominal power	30 W	30 W
Minimum active current required	1.5 A	0.75 A
Duty cycle	100%	100%
Type of protection: see connector version page 32		

▼ **Circuit diagram EZ7, EZ8 (negative control)**



HA – Automatic control, high-pressure related

The automatic high-pressure related control adjusts the displacement automatically depending on the working pressure.

The beginning of control of the A6VE motor with HA control is $V_{g \min}$ (maximum rotational speed and minimum torque). The control device internally measures the working pressure at **A** or **B** (no control line required) and, when the specified beginning of control is reached, the controller swivels the motor with increasing working pressure from $V_{g \min}$ to $V_{g \max}$. The displacement is controlled between $V_{g \min}$ and $V_{g \max}$ depending on the load.

HA1, HA2, HA3 positive control

- ▶ Beginning of control at $V_{g \min}$ (minimum torque, maximum rotational speed)
- ▶ End of control at $V_{g \max}$ (maximum torque, minimum rotational speed)

Notice

- ▶ For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g \min}$ (standard for HA).
- ▶ The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please bear in mind that at port **G**, pressures up to 530 bar (NG60 to 215) and 500 bar (NG280) can occur.
- ▶ The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in case pressure causes an increase in the beginning of control (see page 8) and thus a parallel displacement of the characteristic curve.
- ▶ A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir. Only for HA.T control.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.

Standard for sizes 60 to 280

HA1,2 with throttle pin on one side, the throttling is effected from $V_{g \min}$ to $V_{g \max}$. (see table) HA3 and HA3T3 with BVI and throttle pin on both sides, 0.30, symmetrical

▼ Throttle pin overview

Size	60	85	115	170	215	280
Groove size [mm]	0.45	0.45	0.55	0.55	0.65	2×1.0

Standard for sizes 60 to 215

HA with BVD or BVE counterbalance valve, with throttle screw (see table)

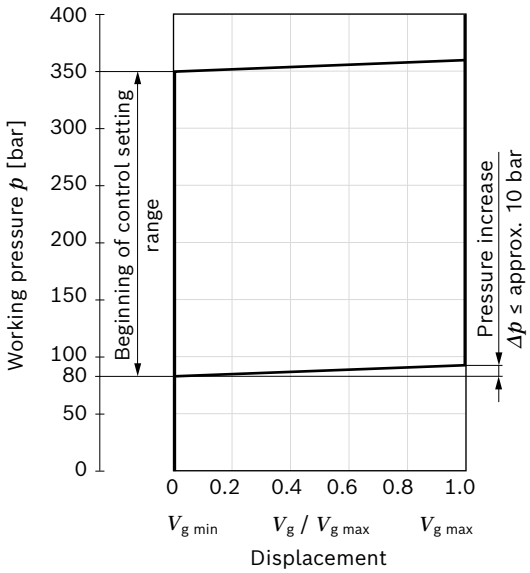
▼ Throttle screw

Size	60	85	115	170	215
Diameter [mm]	0.80	0.80	0.80	0.80	0.80

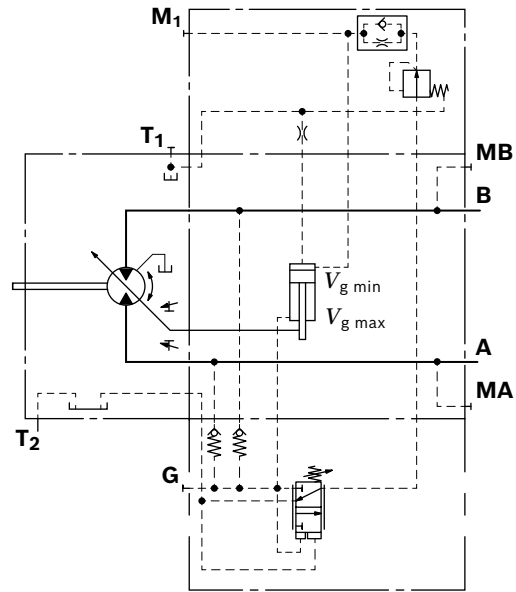
HA1, HA3 with minimum pressure increase, positive control

A working pressure increase of $\Delta p \leq$ approx. 10 bar results in an increase in displacement from $V_{g \text{ min}}$ to $V_{g \text{ max}}$.
 Beginning of control, setting range 80 to 350 bar
 Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 300 bar.

▼ **Characteristic curve HA1, HA3**



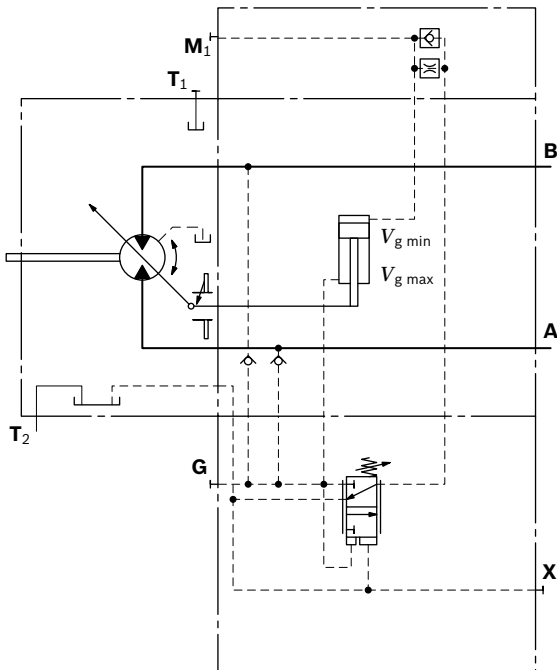
▼ **Circuit diagram HA1 size 280**



▼ **Circuit diagram HA3**

With integrated counterbalance valve BVI, see page 42

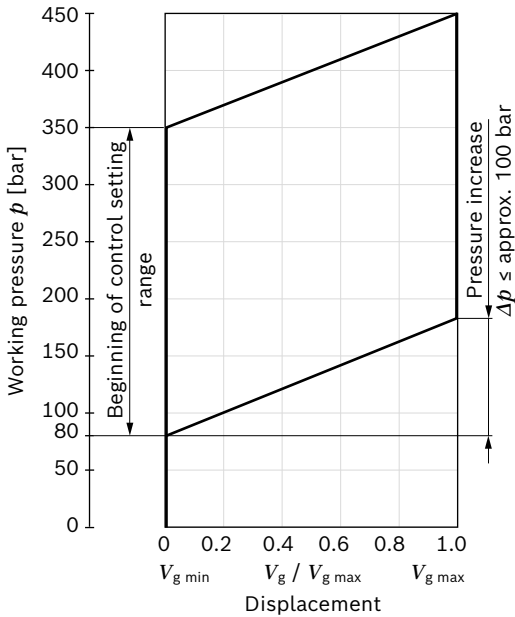
▼ **Circuit diagram HA1 size 60 to 215**



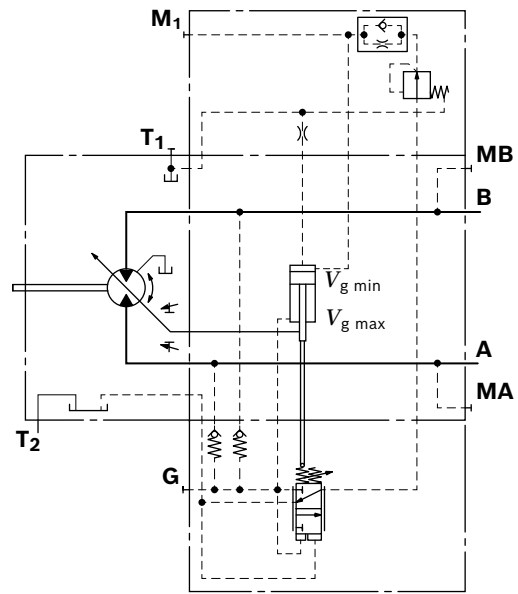
HA2 with pressure increase, positive control

A working pressure increase of $\Delta p \leq$ approx. 100 bar results in an increase in displacement from $V_{g \min}$ to $V_{g \max}$.
 Beginning of control, setting range 80 to 350 bar
 Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 200 bar.

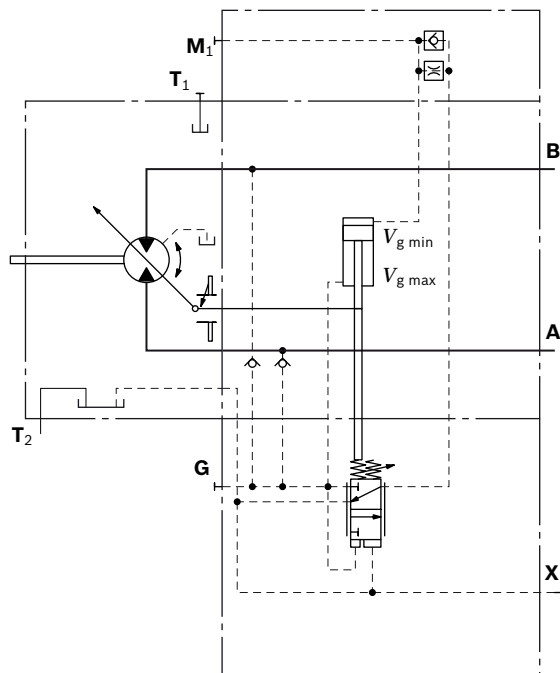
▼ Characteristic curve HA2



▼ Circuit diagram HA2 size 280



▼ Circuit diagram HA2 size 60 to 215



HA.T3 override, hydraulic, remote controlled, proportional

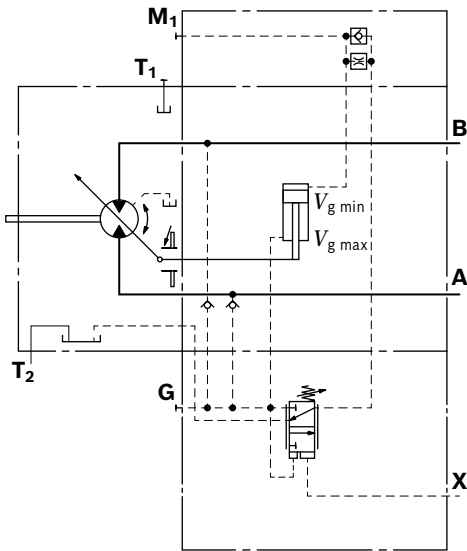
With the HA.T3 control, the beginning of control can be influenced by applying a pilot pressure to port **X**. The beginning of control is reduced by 17 bar or by 23 bar for size 280 per 1 bar pilot pressure.

Settings for the beginning of control	NG60 ... 215		NG280
	300 bar	300 bar	300 bar
Pilot pressure at port X	0 bar	10 bar	10 bar
Beginning of control at	300 bar	130 bar	70 bar

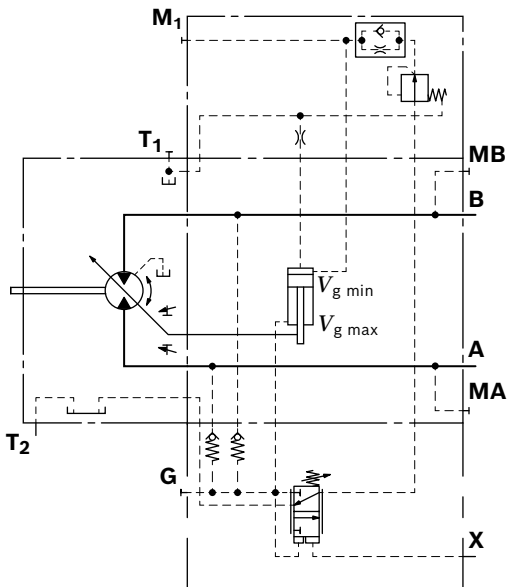
Notice

Maximum permissible pilot pressure 100 bar.

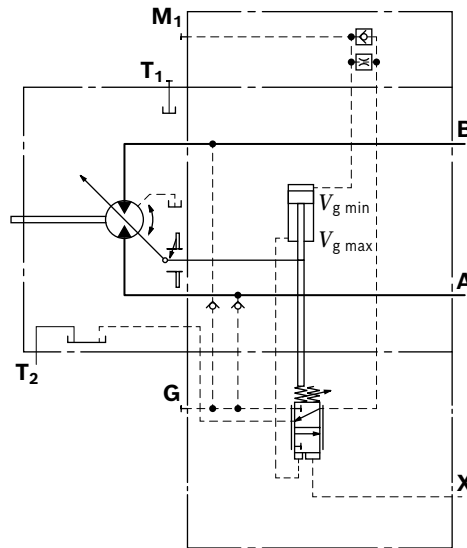
▼ **Circuit diagram HA1T3 size 60 to 215**



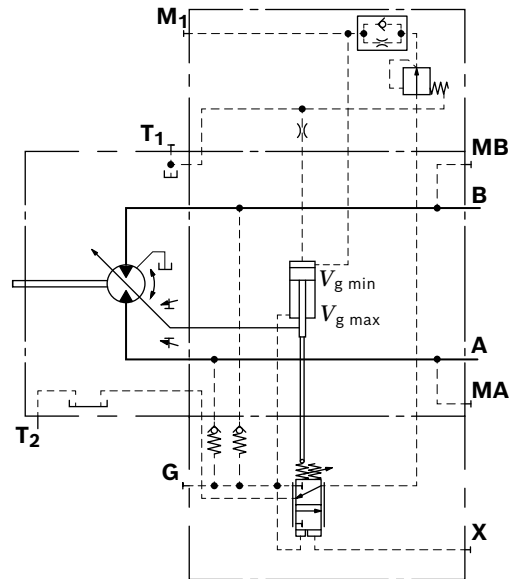
▼ **Circuit diagram HA1T3 size 280**



▼ **Circuit diagram HA2T3 size 60 to 215**



▼ **Circuit diagram HA2T3 size 280**



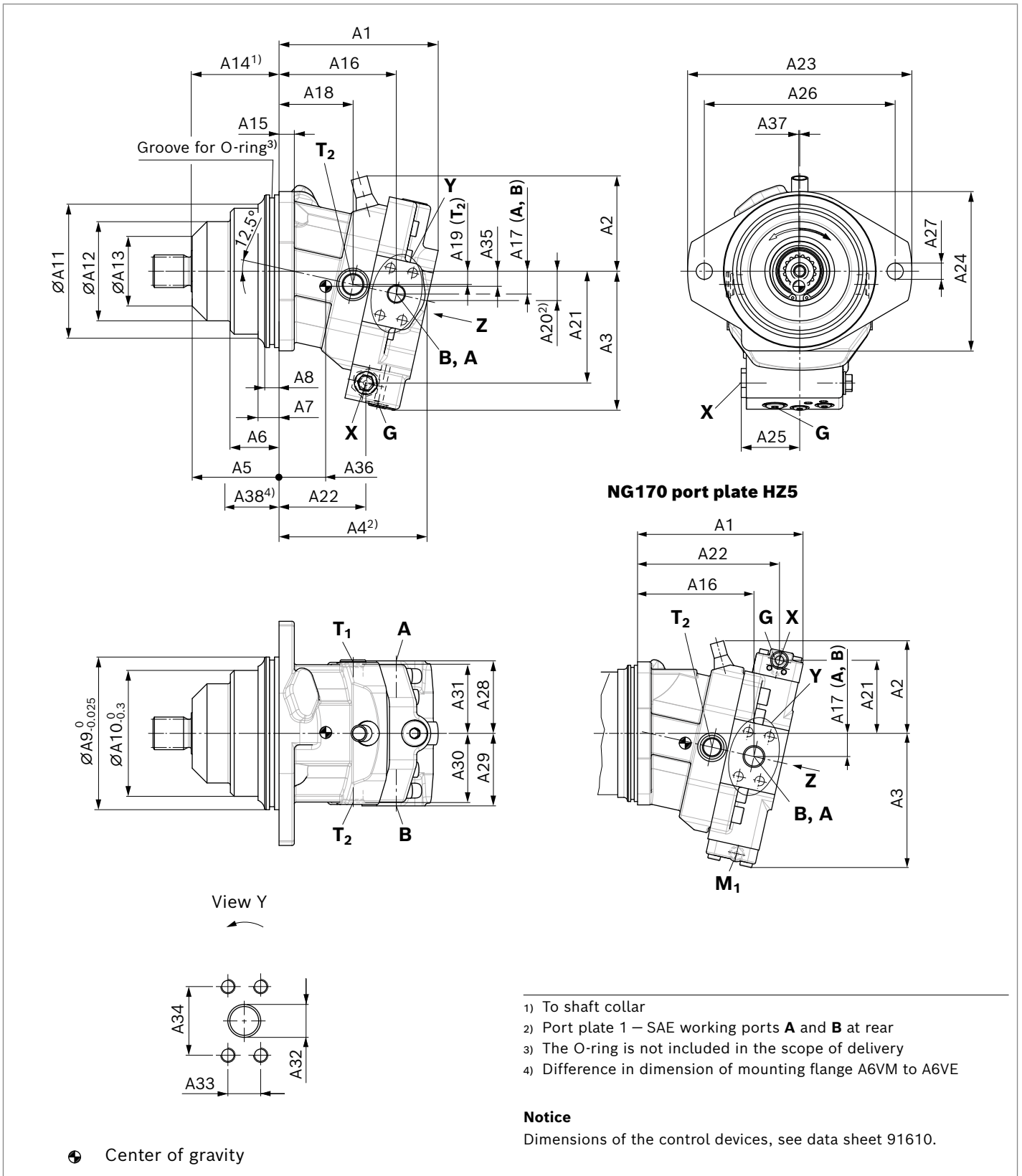
▼ **Circuit diagram HA3T3**

With integrated counterbalance valve BVI, see page 42

Dimensions, sizes 60 to 170

HZ7 – Two-point control, hydraulic

Port plate 2 – SAE working ports **A** and **B** at side, opposite



- 1) To shaft collar
- 2) Port plate 1 – SAE working ports **A** and **B** at rear
- 3) The O-ring is not included in the scope of delivery
- 4) Difference in dimension of mounting flange A6VM to A6VE

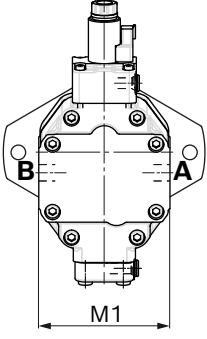
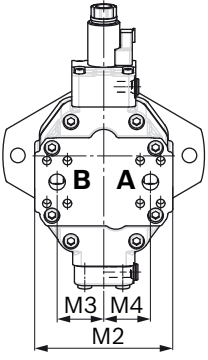
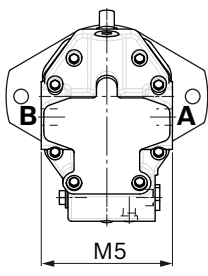
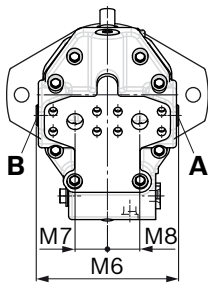
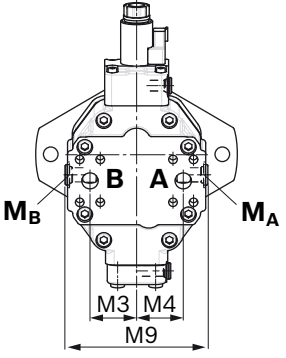
Notice

Dimensions of the control devices, see data sheet 91610.

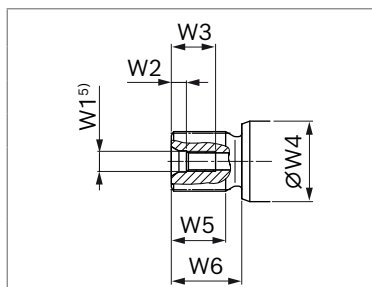
NG	A1	A2	A3	A4	A5	A6	A7	A8	∅A9	∅A10	∅A11	∅A12	∅A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24
60 ¹⁾	167	100	146	153	91	51	22	15	160	132	140.5	104	73z	92	16	123	24	77	14	30	117	91	235	167
85 ¹⁾	176	114	161	164	109.5	65	30	15	190	143	151	116	88	110.5	18	130	28	78	16	35	132	93	260	198
115 ¹⁾	187	121	172	175	121.8	73	35	15	200	160	168	132	90	122.8	18	137	30	82	17	38	143	99	286	210
170 ²⁾	243	133	197	212	122	67	29	15	200	180	188	146	100	123	20	171	34	109	20	43	107	208	286	210

NG	A25	A26	A27	A28	A29	A30	A31	A32	A33	A34	A35	A36	A37	A38	O-ring	M1	M2	M3	M4	M5	M6	M7	M8	M9
60 ¹⁾	57	200	17	76	76	73	73	19	23.8	50.8	15.8	48.8	1	60	150 × 4	152	165	54	54	152	165	37.5	37.5	-
85 ¹⁾	57	224	21	82	82	78.5	78.5	25	27.8	57.2	15.9	44.2	0.6	78.5	182 × 4	164	171	54	54	164	177	42	42	178
115 ¹⁾	61	250	21	90	90	86.5	86.5	25	27.8	57.2	15.2	42.9	0.5	83	192 × 4	164	187	54	54	164	193	42	42	194
170 ²⁾	40.5	250	21	102	102	98.5	98.5	32	31.8	66.7	14.3	69.9	0.5	83	192 × 4	204	220	76	76	-	-	-	-	226

▼ **Location of working ports on the port plates (View Z)**

<p>2 SAE working ports A and B at side, opposite</p> 	<p>1 SAE working ports A and B at rear</p> 	<p>2 SAE working ports A and B at side, opposite, only HZ7, EZ7/8 (NG60 to 115)</p> 	<p>1 SAE working ports A and B at rear only HZ7, EZ7/8 (NG60 to 115)</p> 
<p>4 SAE working ports A and B at rear with lateral threaded plugs</p> 			

▼ **Drive shaft**



NG	Splined shaft DIN 5480	W1	W2	W3	∅W4	W5	W6
60	Z8 - W35×2×16×9g	M12 × 1.75	9.5	28	45	32	40
85	Z9 - W40×2×18×9g	M16 × 2	12	36	50	37	45
115	Z9 - W40×2×18×9g	M16 × 2	12	36	60	37	45
170	A1 - W45×2×21×9g	M16 × 2	12	36	70	42	50

- 1) HZ7 control
- 2) HZ5 control
- 3) Center bore according to DIN 332 (thread according to DIN 13)

NG	Working port SAE J518¹⁾ A, B		Drain port ISO 6149²⁾ T₁, T₂	Synchronous control ISO 6149²⁾ G	Pilot pressure port ISO 6149²⁾ X (HA1, HA2)	Pilot pressure port ISO 6149²⁾ X (HP, HZ, HA1T/2T)
60	3/4 in	M10 × 1.5; 17 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep
85	1 in	M12 × 1.75; 17 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep
115	1 in	M12 × 1.75; 17 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep
170	1 1/4 in	M14 × 2; 19 deep	M27 × 2; 19 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep
State⁵⁾	O		X/O (T ₂) ⁴⁾	X	X	O
p_{max} [bar]³⁾	530		3	530	3	100

NG	Control pressure measuring port ISO 6149²⁾ M₁	Measuring port pressure A, B ISO 6149²⁾ M_A / M_B
60	M14 × 1.5; 11.5 deep	–
85	M14 × 1.5; 11.5 deep	M18 × 1.5; 14.5 deep
115	M14 × 1.5; 11.5 deep	M18 × 1.5; 14.5 deep
170	M14 × 1.5; 11.5 deep	M22 × 1.5; 15.5 deep
State⁵⁾	X	X
p_{max} [bar]³⁾	530	530

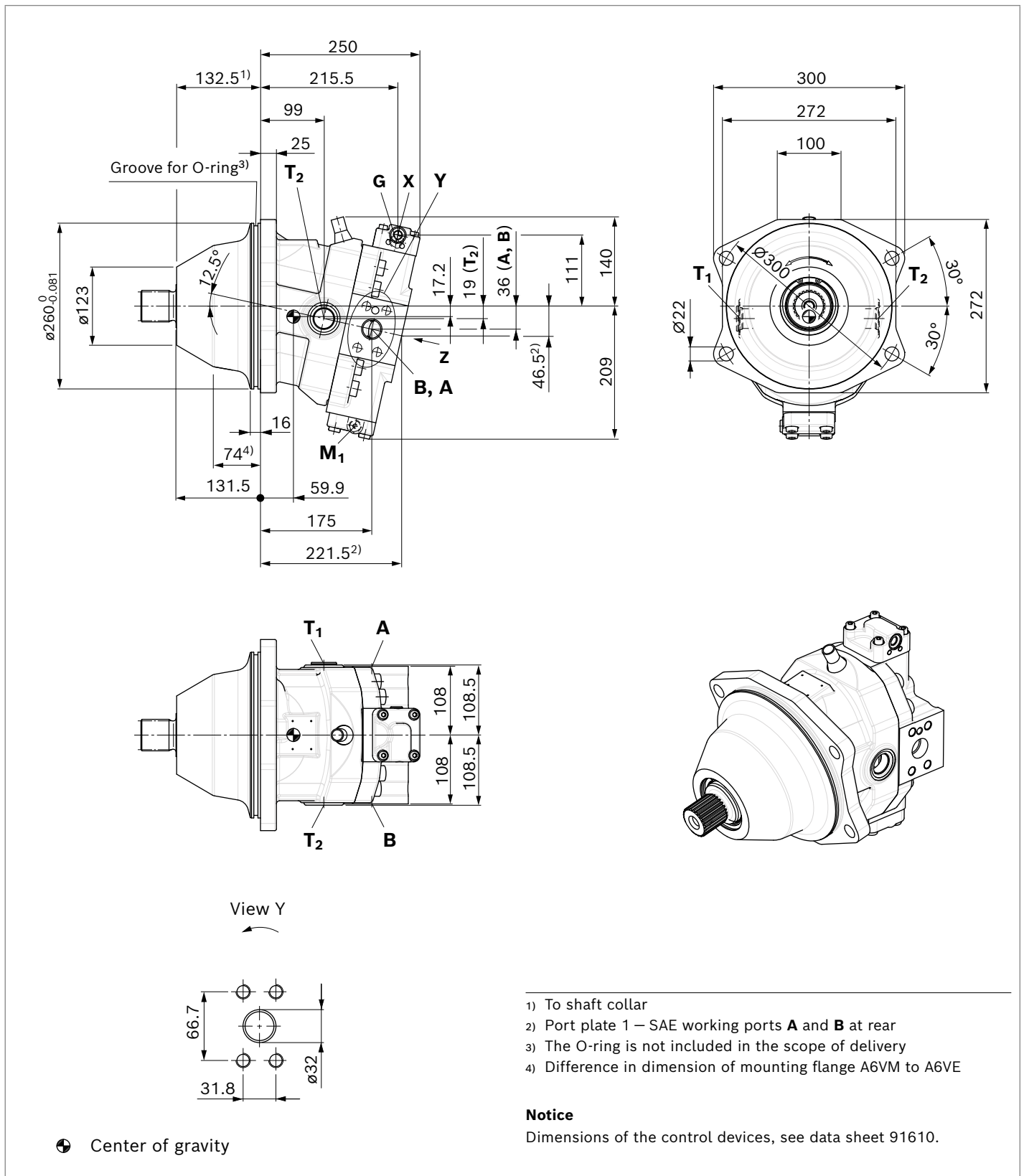
- 1) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
2) The countersink may be deeper than specified in the standard.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

- 4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 50).
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

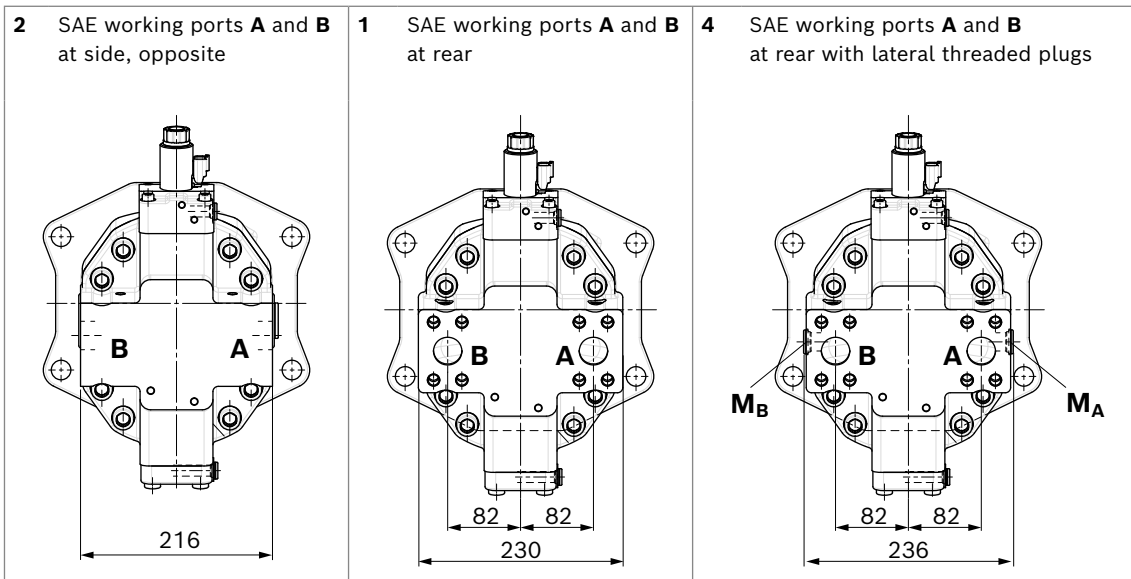
Dimensions, size 215

HZ5 – Two-point control, hydraulic

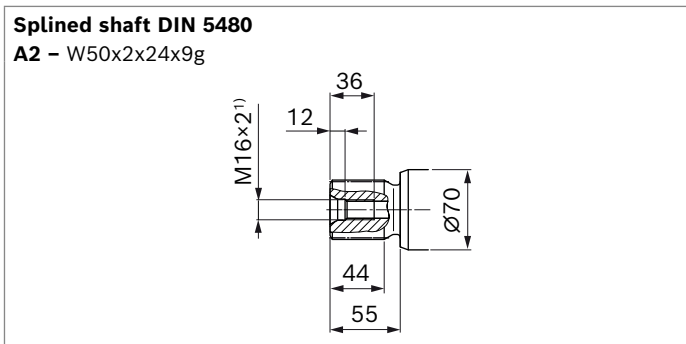
Port plate 2 – SAE working ports **A** and **B** at side, opposite



▼ **Location of working ports on the port plates (View Z)**



▼ **Drive shaft**



Ports		Standard	Size	p_{max} [bar] ²⁾	State ⁶⁾
A, B	Working port	SAE J518	1 1/4 in	530	O
	Fastening thread	DIN 13 ³⁾	M14 × 2; 19 deep		
T₁, T₂	Drain port	ISO 6149 ⁵⁾	M33 × 2; 19 deep	3	X/O (T ₂) ⁴⁾
G	Synchronous control	ISO 6149 ⁵⁾	M14 × 1.5; 11.5 deep	530	X
X (HA1, HA2)	Pilot pressure port	ISO 6149 ⁵⁾	M14 × 1.5; 11.5 deep	3	X
X (HP, HZ, HA.T3)	Pilot pressure port	ISO 6149 ⁵⁾	M14 × 1.5; 11.5 deep	100	O
M₁	Control pressure measuring port	ISO 6149 ⁵⁾	M14 × 1.5; 11.5 deep	530	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149 ⁵⁾	M22 × 1.5; 15.5 deep	530	X

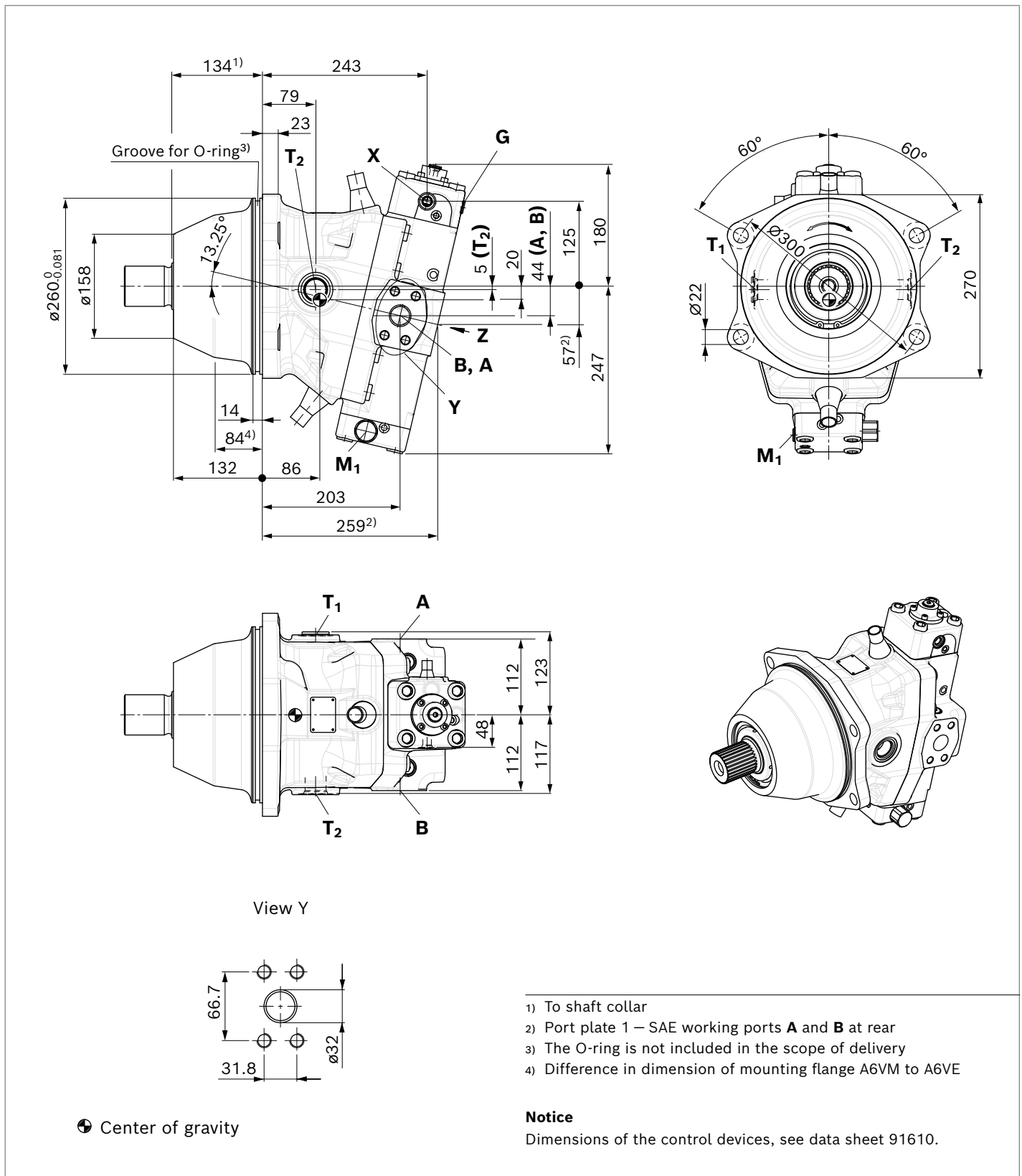
1) Center bore according to DIN 332 (thread according to DIN 13)
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 50).
 5) The countersink may be deeper than specified in the standard.
 6) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

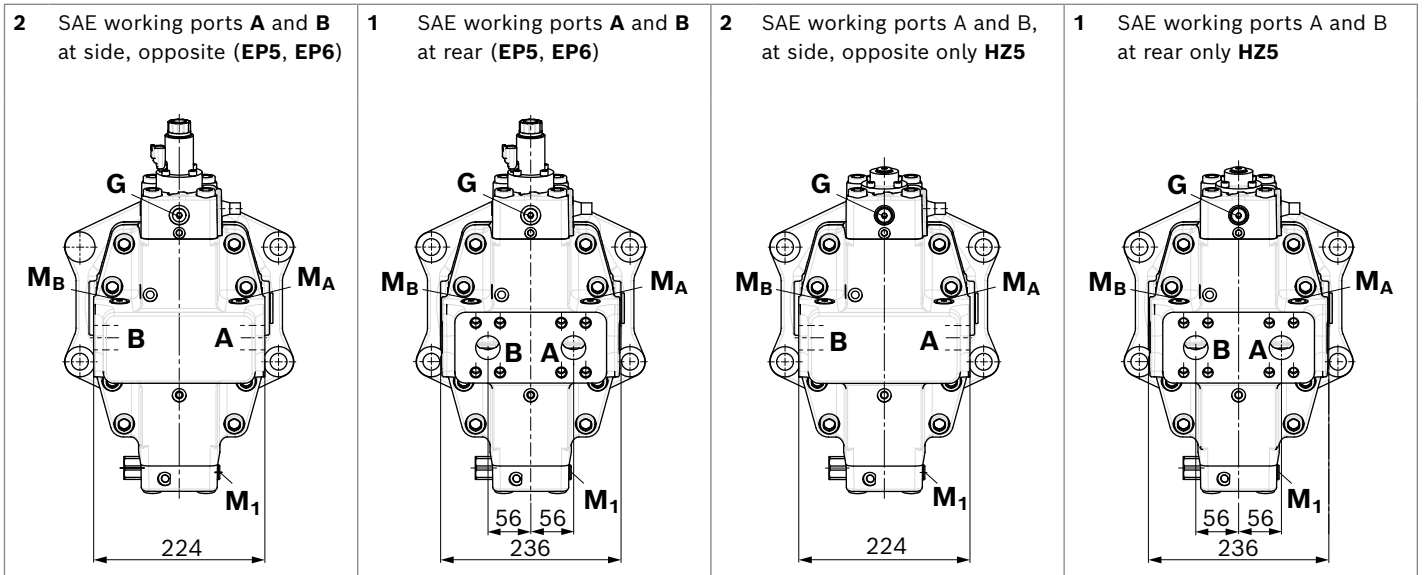
Dimensions, size 280

HZ5 – Two-point control, hydraulic

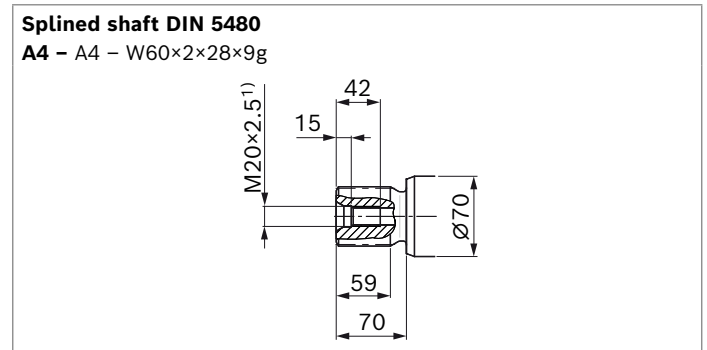
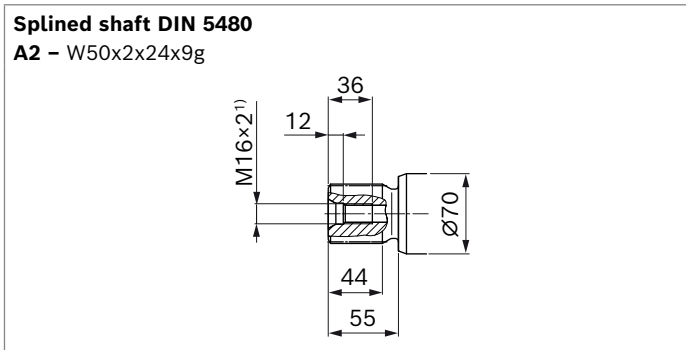
Port plate 2 – SAE working ports **A** and **B** at side, opposite



▼ **Location of working ports on the port plates (View Z)**



▼ **Drive shaft**



Ports	Standard	Size	p_{max} [bar] ²⁾	State ⁶⁾
A, B	Working port Fastening thread	SAE J518 DIN 13 ³⁾	1 1/4 in M14 x 2; 19 deep	500 O
T₁, T₂	Drain port	ISO 6149 ⁵⁾	M33 x 2; 19 deep	3 X/O (T₂) ⁴⁾
G	Synchronous control	ISO 6149 ⁵⁾	M14 x 1.5; 11.5 deep	500 X
X (HA1, HA2)	Pilot pressure port	ISO 6149 ⁵⁾	M14 x 1.5; 11.5 deep	3 X
X (HP, HZ, HA.T3)	Pilot pressure port	ISO 6149 ⁵⁾	M14 x 1.5; 11.5 deep	100 O
M₁	Control pressure measuring port	ISO 6149 ⁵⁾	M14 x 1.5; 11.5 deep	500 X
M_A, M_B	Measuring port, pressure A, B	ISO 6149 ⁵⁾	M14 x 1.5; 11.5 deep	500 X

1) Center bore according to DIN 332 (thread according to DIN 13)
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 50).
 5) The countersink may be deeper than specified in the standard.
 6) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Connector for solenoids

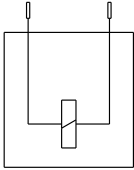
DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode

The following type of protection ensues with the installed mating connector:

- ▶ IP67 (DIN/EN 60529) and
- ▶ IP69K (DIN 40050-9)

▼ Switching symbol



▼ Mating connector DEUTSCH DT06-2S-EP04

Consisting of	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).

Notice

- ▶ If necessary, you can change the position of the connector by turning the solenoid body.
- ▶ The procedure is defined in the instruction manual.

Flushing and boost-pressure valve

The flushing and boost-pressure valve is used to remove heat from the hydraulic circuit.

In a closed circuit, it is used for flushing the case and safeguarding the minimum boost pressure.

Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.

The valve is mounted on the port plate or integrated (depending on the control type and size).

Cracking pressure of pressure retention valve

(observe when setting the primary valve)

- ▶ Size 60 to 215, fixed setting 16 bar
- ▶ Size 280, adjustable 15 to 35 bar

Switching pressure of flushing spool Δp

- ▶ Size 60 to 115 (small flushing valve) 8 ± 1 bar
- ▶ Sizes 115 to 215 (medium and large flushing valve) 17.5 ± 1.5 bar
- ▶ Size 280 8 ± 1 bar

Flushing flow q_v

Orifices can be used to adjust the flushing flows as required. The following parameters are based on:

$$\Delta p_{ND} = p_{ND} - p_G = 25 \text{ bar ad } v = 10 \text{ mm}^2/\text{s}$$

(p_{ND} = low pressure, p_G = case pressure)

Notice

- ▶ Port **S_a** only for sizes 170 to 280
- ▶ From a flushing flow of 35 l/min¹⁾, it is recommended that port **S_a** be connected in order to prevent an increase in case pressure. An increased case pressure reduces the flushing flow.

Small flushing valve for sizes 60 to 115

Material number of orifice	Ø [mm]	q_v [l/min]	Code
R909651766	1.2	3.5	A
R909419695	1.4	5	B
R909419696	1.8	8	C
R909419697	2.0	10	D
R909444361	2.4	14	F

Medium flushing valve for size 115

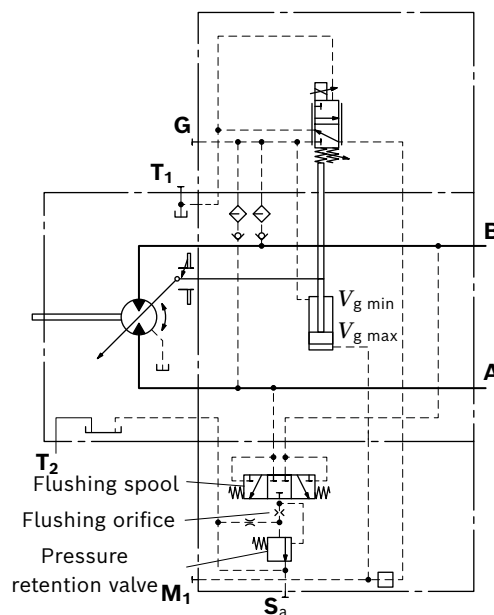
Material number of orifice	Ø [mm]	q_v [l/min]	Code
R909431310	2.8	18	I
R902138235	3.1	21	J
R909435172	3.5	27	K
R909449967	5.0	31	L

1) Please contact us concerning size 280.

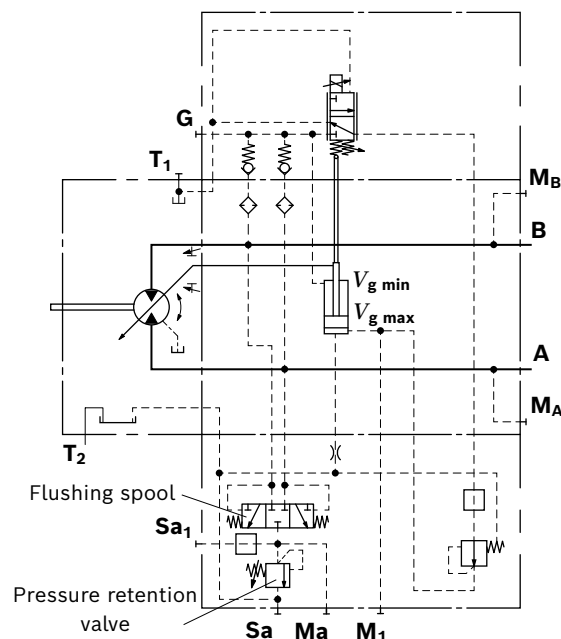
Large flushing valve for sizes 170 to 215

Material number of orifice	Ø [mm]	q_v [l/min]	Code
R909449998	1.8	8	C
R909431308	2.0	10	D
R909431309	2.5	15	G
R909431310	2.8	18	I
R902138235	3.1	21	J
R909435172	3.5	27	K
R909436622	4.0	31	L
R909449967	5.0	37	M

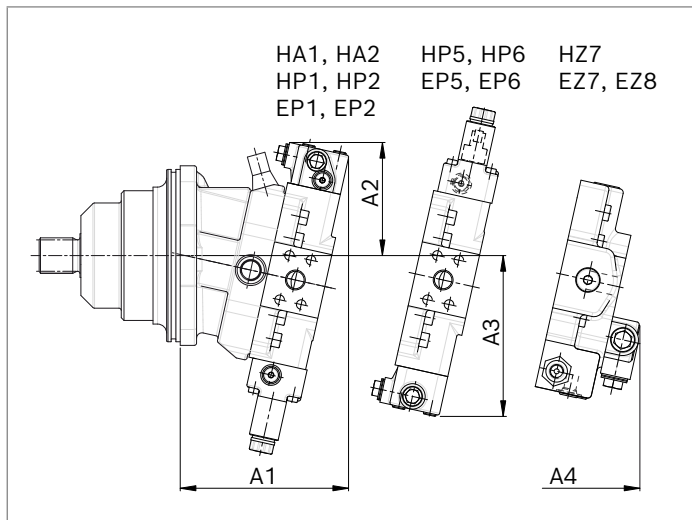
▼ Circuit diagram EP sizes 60 to 215



▼ Circuit diagram EP, size 280

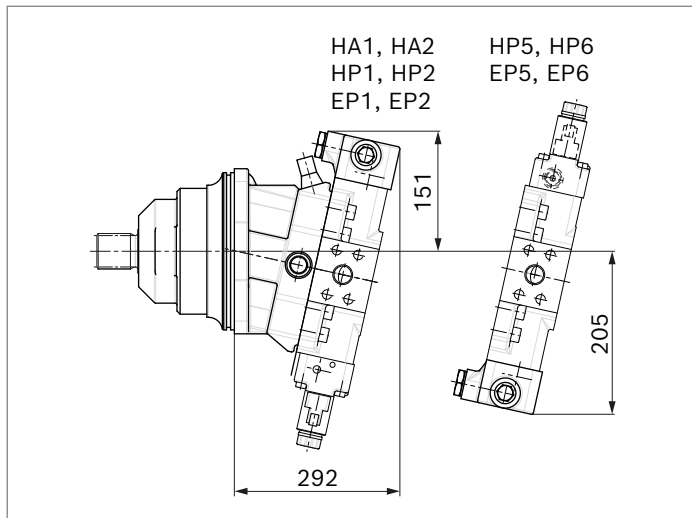


▼ **Dimensions of sizes 60 to 115 (small flushing valve)**



NG	A1	A2	A3	A4
060	183	137	183	176
085	195	142	194	176
115	204	143	202	186

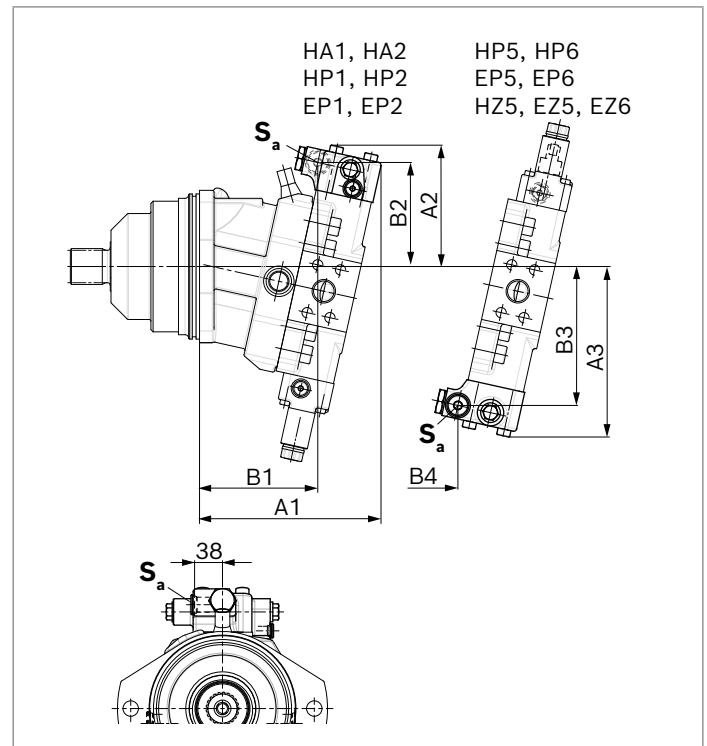
▼ **Dimensions of size 115 (medium flushing valve)**



NG	S _a ¹⁾	S _{a1} ¹⁾	M _a ¹⁾
170	M22 × 1.5; 15.5 deep		
215	M22 × 1.5; 15.5 deep		
280	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M14 × 1.5; 11.5 deep

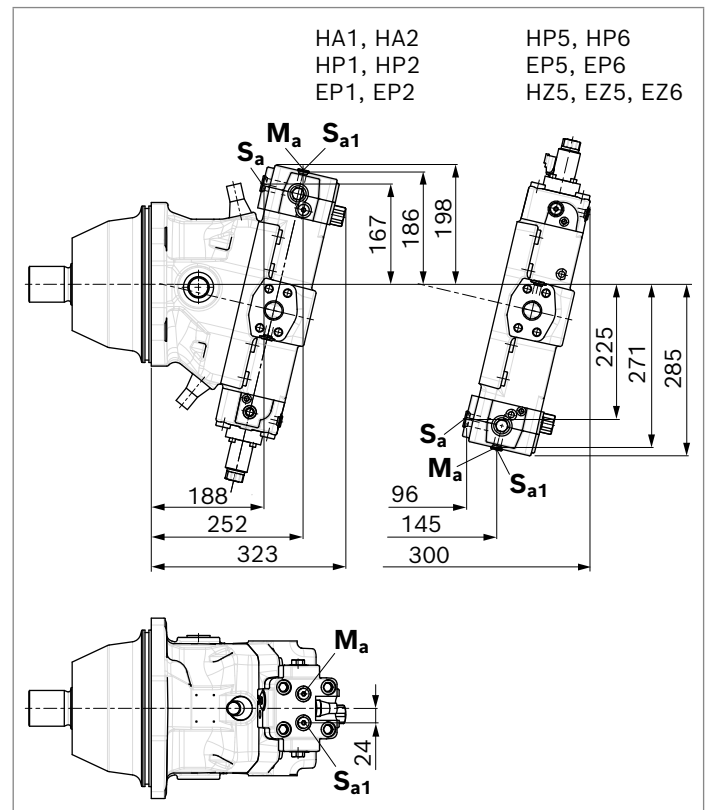
1) ISO 6149, ports plugged (in normal operation)
For notes on tightening torques, see the instruction manual.
The countersink may be deeper than specified in the standard.

▼ **Dimensions of sizes 170 and 215 (large flushing valve)**



NG	A1	B1	A2	B2	A3	B3	B4
170	249	163	165	142	233	190	89
215	256	170	172	148	244	201	93

▼ **Dimensions, size 280**



BVD and BVE counterbalance valve

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 value 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 for sizes 60 to 280 and BVE available for sizes 115 to 280.
- ▶ The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.

Order example: A6VM085HA1T30004A/71MWW0N4S97W0-0 + BVD20F27S/41B-V03K16D0400S12

- ▶ For safety reasons, controls with beginning of control at $V_{g \min}$ (e.g. HA) are not permissible for lifting winch drives!
- ▶ Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- ▶ The counterbalance valve does not replace the mechanical service brake and holding brake.
- ▶ Observe the detailed information on the counterbalance valve in data sheets 95522 (BVD), 95526 (BVE) and 95528 (BVD/BVE32)!
- ▶ For the design of the brake release valve, we must know the following data for the mechanical holding brake:
 - the cracking pressure
 - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
 - the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

Permissible inlet flow or pressure when using pressure relief valve and BVD/BVE

Motor NG	Without valve		Limited values when using pressure relief valves and BVD/BVE							
	p_{nom}/p_{max} [bar]	$q_{V \max}$ [l/min]	PRV ¹⁾				BVD ²⁾ /BVE ³⁾			
			NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code	NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code
60	450/530	276	22	350/420	240	7	20 (BVD)	350/420	220	7W
85		332								
115		410								
115		410	32	400	8	25 (BVD/BVE)	320	8W		
170		533				25 (BVD)				
170		533	–	300/460	550	5	25 (BVE)	350/420	320	5W
215		628					25 (BVD/BVE)			
215	628	9					32 (BVD/BVE)			
280	450/500		700	650						

Mounting the counterbalance valve

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

The counterbalance valve is finally mounted to the motor by fitting the SAE flange.

The screws to be used and the instructions for mounting can be found in the instruction manual.

1) Pressure relief valve

2) Counterbalance valve, double-acting

3) Counterbalance valve, one-sided

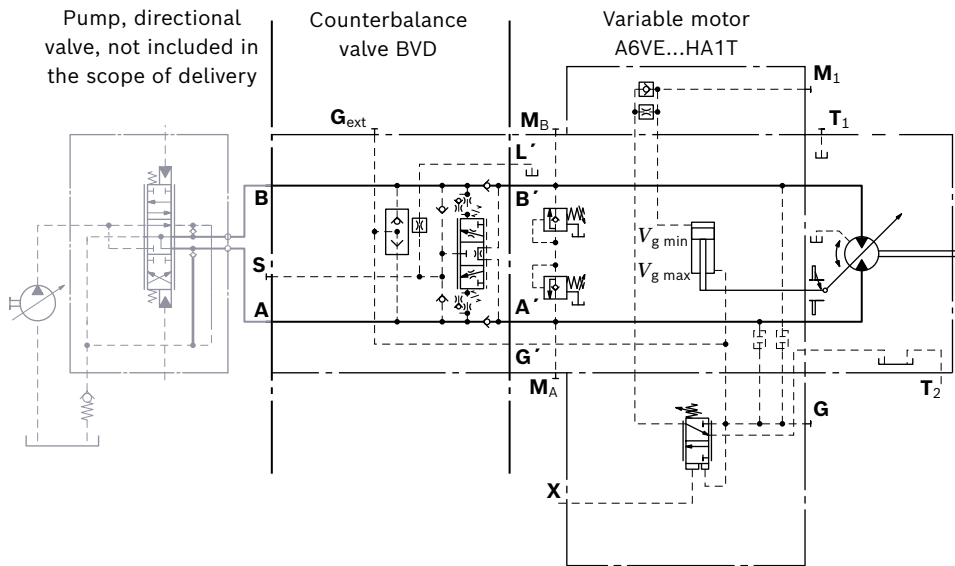
Counterbalance valve for travel drives BVD...F

Application option

- ▶ Travel drives for wheeled excavators (BVD and BVE)

▼ **Example circuit diagram for travel drive in wheeled excavators**

A6VE085HA1T30004A/71MWV0Y2Z97W0-0 + BVD20F27S/41B-V03K16D0400S12



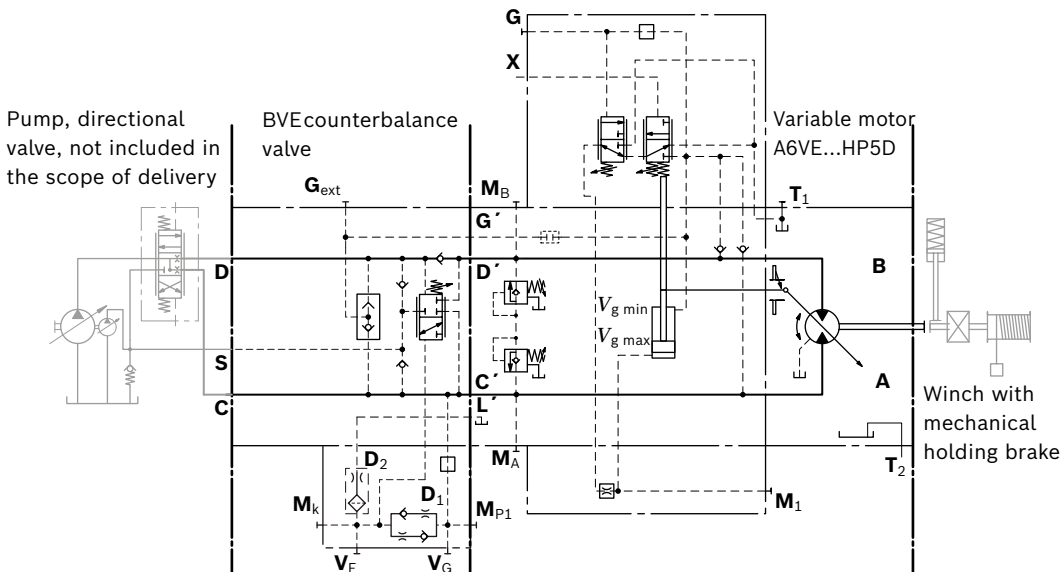
Counterbalance valve for winches and track drives BVD...W and BVE

Application option

- ▶ Winch drives for cranes (BVD and BVE)
- ▶ Track drives for tracked excavators (BVD)

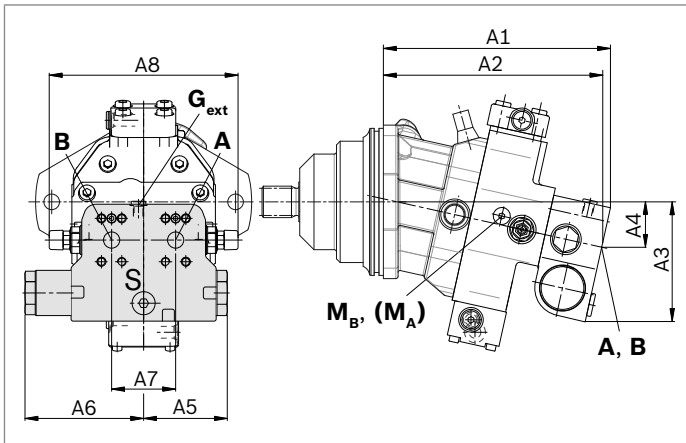
▼ **Example circuit diagram for winch drive in cranes**

A6VE115HP5D10001A/71MWV0S2A18W0-0 + BVE25W38S/53NC-V100K00D4599T30C20-0

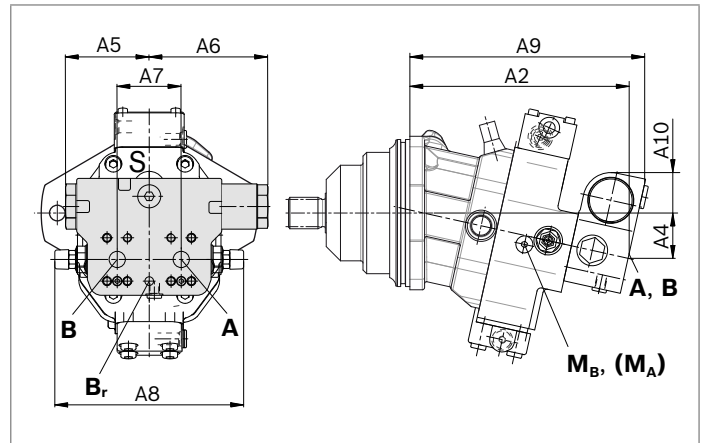


Dimensions of counterbalance valve

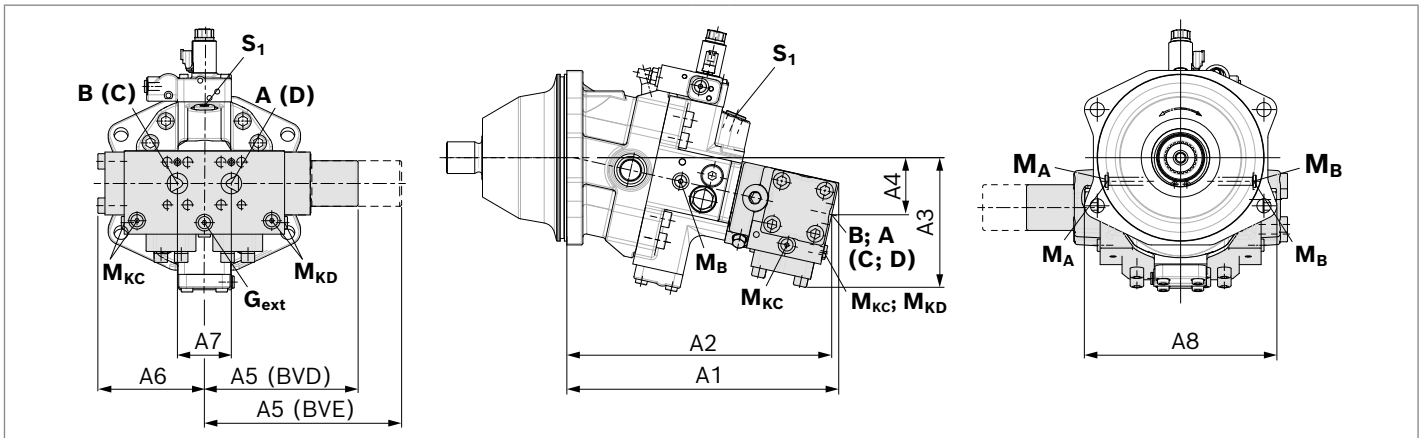
▼ **A6VE...HA, HP1, HP2 and EP1, EP2**



▼ **A6VE...HP5, HP6 and EP5, EP6¹⁾**



▼ **A6VE...HA, HP1, HP2 or EP1, EP2 with BVD/BVE 32**



A6VM NG...plate	Counterbalance valve		Dimensions									
	Type	Ports A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
60...7	BVD20...17	3/4 in	252	243	143	50	98	139	75	222	267	50
85...7	BVD20...27	1 in	261	252	148	55	98	139	75	222	276	46
115...7	BVD20...28	1 in	280	271	152	59	98	139	84	234	295	41
115...8	BVD25...38	1 1/4 in	298	288	165	63	120.5	175	84	238	311	56
170...8	BVD25...38	1 1/4 in	334	324	170	68	120.5	175	84	238	349	51
215...5	BVD25...38	1 1/4 in	356	346	176	74	120.5	175	84	299	370	46
215...9	BVD32...38	1 1/4 in	423	412	202	89	240	166	84	299	-	46
280...9	BVD32...38	On request										
115...8	BVE25...38	1 1/4 in	298	288	171	63	137	214	84	238	315	63
170...5	BVE25...38	1 1/4 in	334	325	176	68	137	214	84	238	349	59
215...5	BVE25...38	1 1/4 in	356	346	182	74	137	214	84	299	370	52
215...9	BVE32...38	1 1/4 in	423	412	202	89	240	166	84	299	-	46
280...9	BVE32...38	On request										

Ports		Version	A6VE Plate	Standard	Size	P_{\max} [bar] ²⁾	State ⁴⁾
A, B	Working port			SAE J518	See table above	420	O
S, S₁	Boost port	BVD20		DIN 3852 ³⁾	M22 × 1.5; 14 deep	30	X
		BVD25, BVE25		DIN 3852 ³⁾	M27 × 2; 16 deep	30	X
Br	Brake release port, reduced high pressure	L	7	DIN 3852 ³⁾	M12 × 1.5; 12.5 deep	30	O
			8	DIN 3852 ³⁾	M12 × 1.5; 12 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			ISO 6149 ³⁾	M18 × 1.5; 14.5 deep	420	X
M_C	Measuring port pressure, counterbalance spool	BVE25/53		DIN 3852 ⁴⁾	M14 × 1.5; 12 deep	420	X
M_K	Measuring port pressure, counterbalance spool	BVE25/53		DIN 3852 ⁴⁾	M14 × 1.5; 12 deep	400	X
M_{KC}	Measuring port pressure, counterbalance spool C	BVD32, BVE32		DIN 3852 ⁴⁾	M14 × 1.5; 12 deep	400	X
M_{KD}	Measuring port pressure, counterbalance spool D	BVE32, BVE32		DIN 3852 ⁴⁾	M14 × 1.5; 12 deep	400	X
M_{P1}	Measuring port, pressure A, B , in front of filter	BVE25/53		DIN 3852 ⁴⁾	M14 × 1.5; 12 deep	420	X

1) At the mounting version for the controls HP5, HP6 and EP5, EP6, the cast-in port designations **A** and **B** on the counterbalance valve BVD/BVE do not correspond with the connection drawing of the A6VE motor.
The designation of the ports on the installation drawing of the motor is binding!

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

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

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

Integrated counterbalance valve BVI

Function

The integrated counterbalance valves for track drives in crawler excavators should reduce the danger of overspeed and cavitation of axial piston motors in open circuits.

Cavitation occurs if, during braking or driving downhill, the rotational speed of the motor is greater than it should be for the given inlet flow, causing the supply pressure to fall sharply.

If the supply pressure falls below the value 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

- ▶ BVI available for sizes 60, 85, 115 and 170.
- ▶ The counterbalance valve must be ordered additionally. Order example: A6VE115HA3T30004A/71MWV0Y2Z 96Y0-0 + BVI510008001-0
- ▶ Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- ▶ The counterbalance valve does not replace the mechanical service brake and holding brake.
- ▶ For the design of the brake release valve, we require the following data for the mechanical holding brake:
 - the cracking pressure
 - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
 - the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

Type code

01	02	03	04	05	06
BVI				-	

Counterbalance valve

01	Counterbalance valve integrated	BVI
----	---------------------------------	------------

Brake spool version		q_v [L/min]	Material number	
02	Volume preselection	≤ 150	R902038832	51
		= 150 – 210	R902038936	52
		= 210 – 270	R902038833	53
		= 270 – 330	R902038834	54
		= 330 – 400	R902038835	55
		≥ 400	R902038836	56

Throttle mounting

03	Constant throttle	R909432302	0008
	Throttle pin	R909651165	0603

Check valve

04	Without residual opening	00
----	--------------------------	-----------

Brake release valve

05	With brake release valve (standard HZ, EZ, EP and HP)	without disable function	1
	With brake release valve (standard HA)	with disable function	2

Standard/special version

06	Standard version	0
	Special version	S

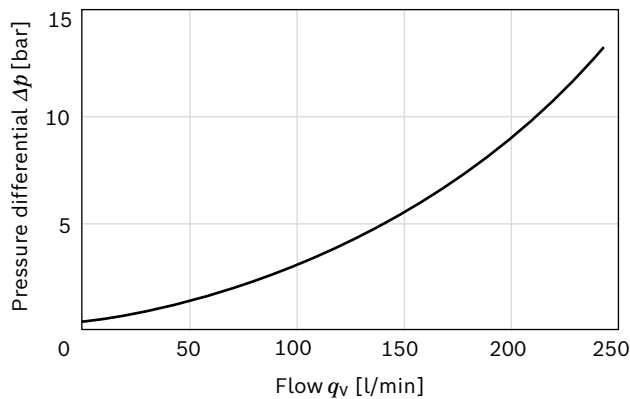
Technical data

Working pressure	Nominal pressure	p	350 bar
	Maximum pressure	p	420 bar
Flow, maximum		$q_{v \max}$	400 l/min
Counterbalance spool	Start of opening	p	12 bar
	Fully open	p	26 bar
Pressure reducing valve for brake release (fixed setting)	Control pressure	p	21 ⁺⁴ bar
	Beginning of control	p	10 ⁺⁴ bar

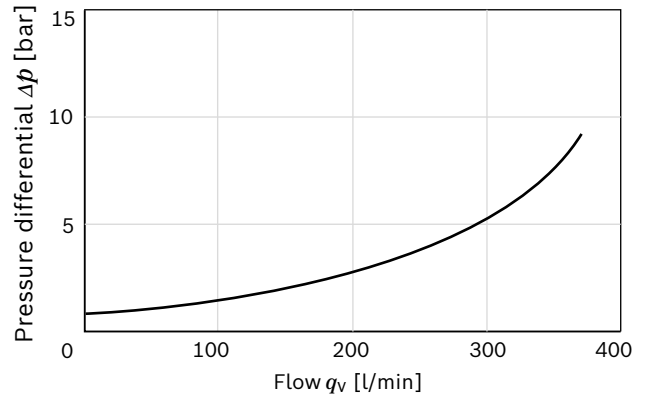
Permissible inlet flow or pressure when using pressure relief valve and BVI

Motor NG	Without restriction Standard plate (1 + 2)		Restricted values Plate with integrated counterbalance valve (6)	
	$p_{\text{nom}}/p_{\text{max}}$ [bar]	$q_{v \max}$ [l/min]	$p_{\text{nom}}/p_{\text{max}}$ [bar]	BVI + PRV q_v [l/min]
60	450/530	275	350/420	240
85		332		
115		410		
170		533		

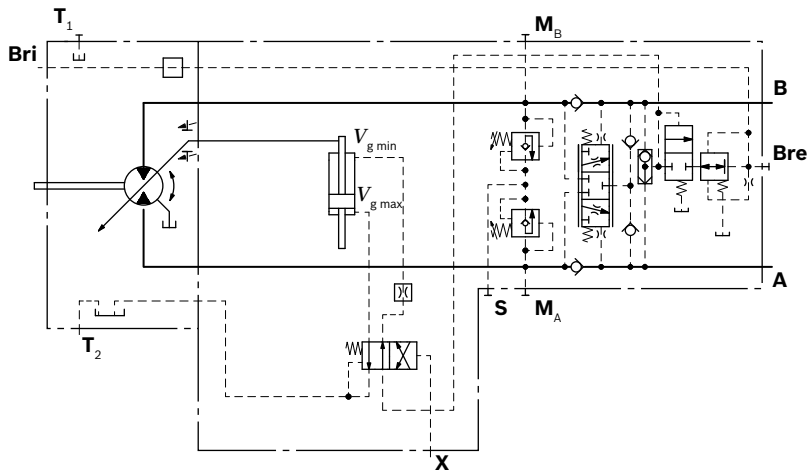
▼ **Boost characteristic NG60, NG85 and NG115**



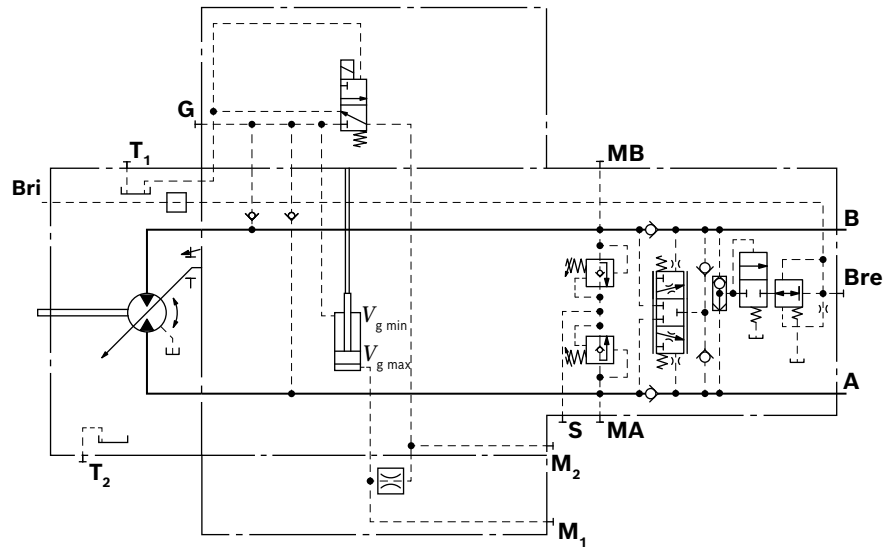
▼ **Boost characteristic NG170**



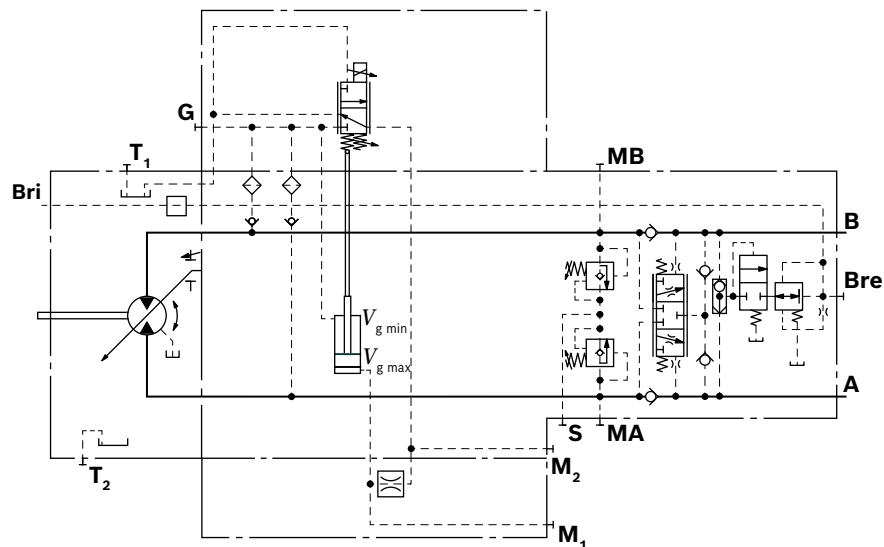
▼ **Circuit diagram HZ7**



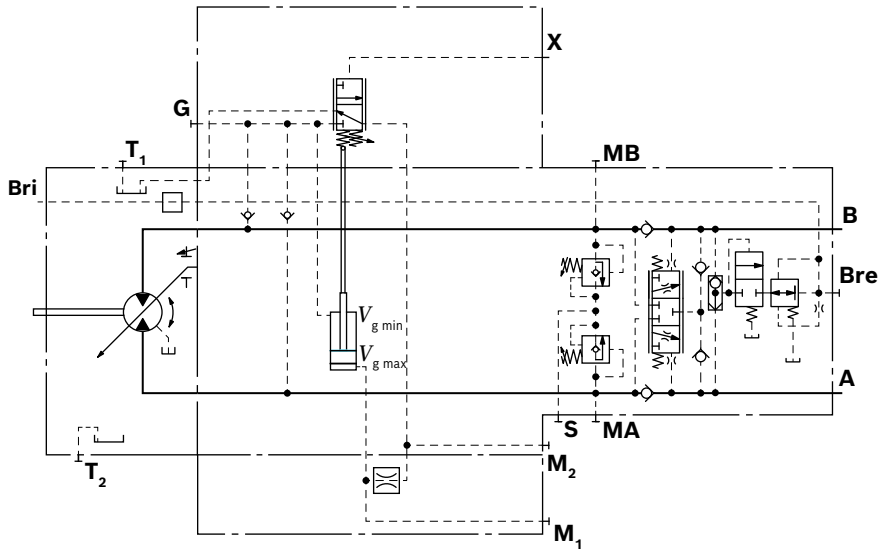
▼ **Circuit diagram EZ5/6**



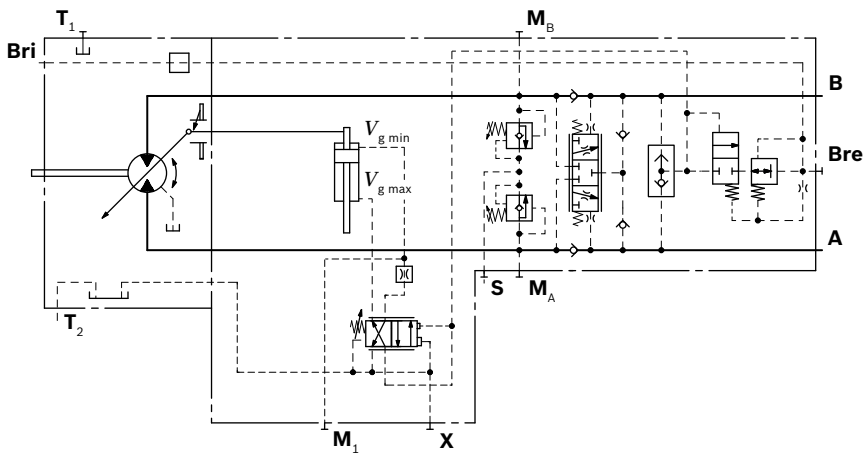
▼ **Circuit diagram EP5/6**



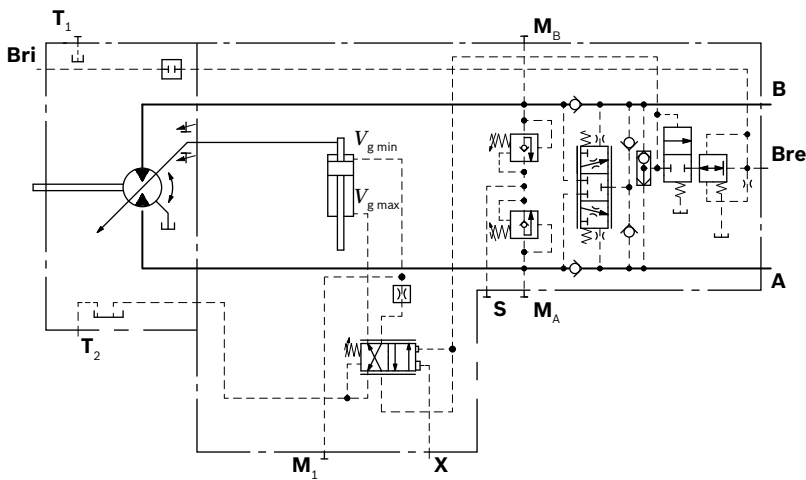
▼ **Circuit diagram HP5/6**



▼ **Circuit diagram HA3**



▼ **Circuit diagram HA3T3**

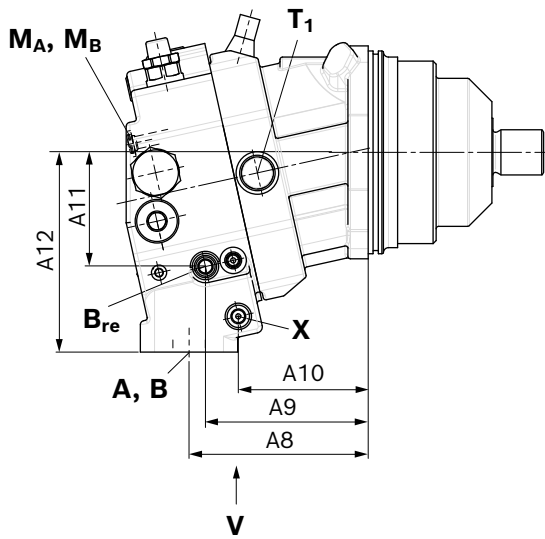
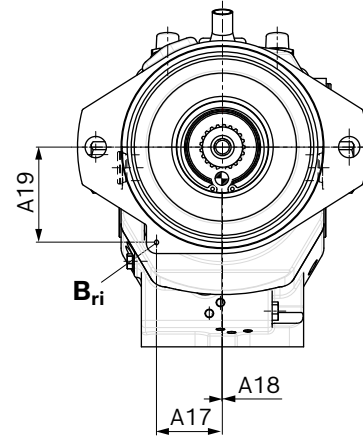
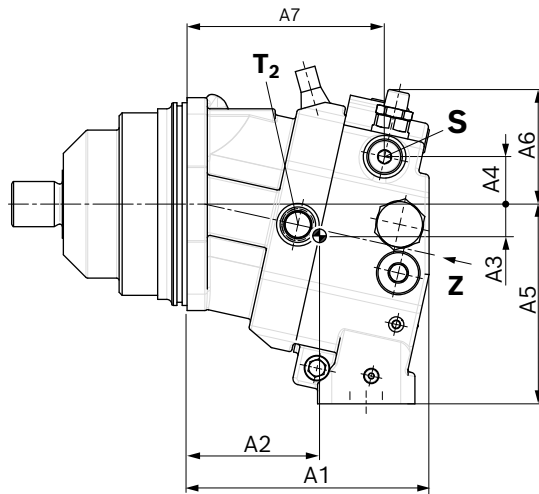


Integrated counterbalance valve BVI dimensions

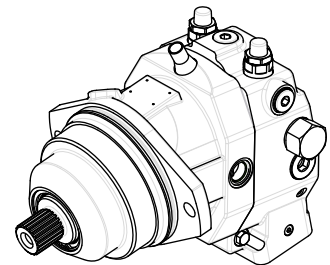
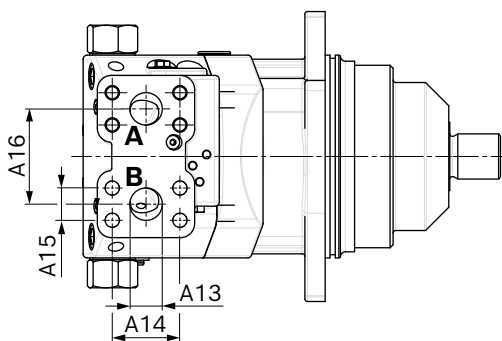
HZ7 – Two-point control, hydraulic

HA3 – Automatic high-pressure related control, positive control

Port plate **6**, with integrated counterbalance valve BVI – SAE working ports **A** and **B** at bottom

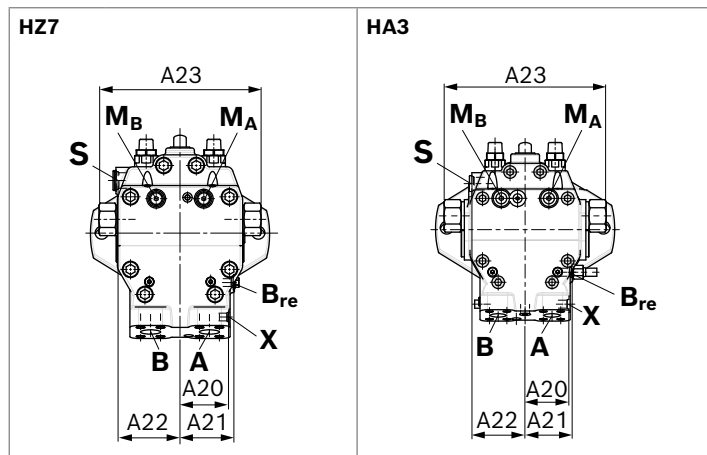


View V



⊕ Center of gravity

▼ **Location of working ports on the port plates** (View Z)



NG	Dimensions																				
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	ØA13	A14	A15	A16	A17	A18	A19	A20	A21
60	192	80.6	24.5	37	144	102	144	133	119	91	86	117	19	50.8	23.8	80	51	0.4	74	64	67
85	198	74.1	27.7	40	162	114 ¹⁾	150	138	123	93	92	132	25	57.2	27.8	86	53	0.4	90	70	70
115	204	68	24.4	40	172	122 ¹⁾	161	144	131	99	98	143	25	57.2	27.8	86	58	0.3	96	70	74
170	240	94	28.8	47	197	136 ¹⁾	195	177	161	128	113	162	32	66.7	31.8	94	65	0.5	94	78	85

NG	Dimensions		Working port SAE J518 ²⁾ A, B	Drain port ISO 6149 ³⁾ T ₁ , T ₂	Pilot pressure port ISO 6149 ³⁾ X	Boost port ISO 6149 ³⁾ S
	A22	A23				
60	83	259	3/4 in	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M22 × 1.5; 15.5 deep
85	83	259	1 in	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M22 × 1.5; 15.5 deep
115	85	259	1 in	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M22 × 1.5; 15.5 deep
170	101.5	259	1 1/4 in	M27 × 2; 19 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
p_{max} [bar] ⁴⁾			420	3	100	30
State ⁶⁾			O	X/O (T ₂) ⁵⁾	O	X

Port	Measuring port Pressure A, B M _A , M _B	Measuring port Control pressure M ₁ not with HZ7	Brake release port external ISO 6149 ³⁾ Bre	Brake release port, internal Bri
60	M14 × 1.5; 11.5 deep	M10 × 1; 10 deep	M14 × 1.5; 11.5 deep	Ø4
85	M14 × 1.5; 11.5 deep	M10 × 1; 10 deep	M14 × 1.5; 11.5 deep	Ø4
115	M14 × 1.5; 11.5 deep	M10 × 1; 10 deep	M14 × 1.5; 11.5 deep	Ø4
170	M14 × 1.5; 11.5 deep	M10 × 1; 10 deep	M14 × 1; 11.5 deep	Ø4
p_{max} [bar] ⁴⁾	420	420	30	30
State ⁶⁾	X	X	O/X ⁷⁾	X/O ⁸⁾

- 1) referring to tamper-proof cap
- 2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
- 3) The countersink may be deeper than specified in the standard.
- 4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 5) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 50).

- 6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
- 7) Must be connected for external piping. Is plugged for internal channel routing.
- 8) Is plugged for external channel routing. Must be connected for internal piping.

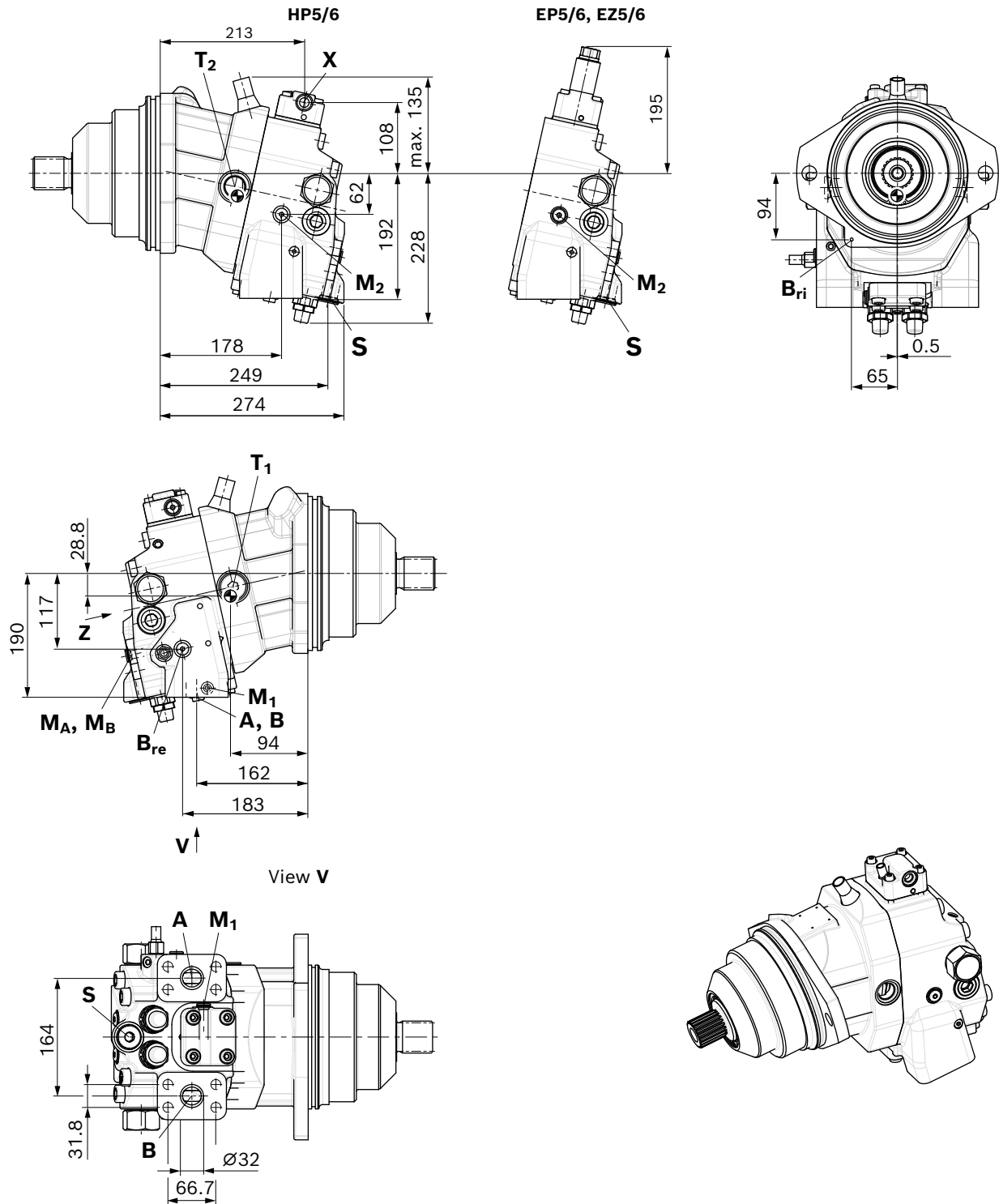
Integrated counterbalance valve BVI dimensions, size 170

HP5/6 – Hydraulic proportional control

EP5/6 – Electric proportional control

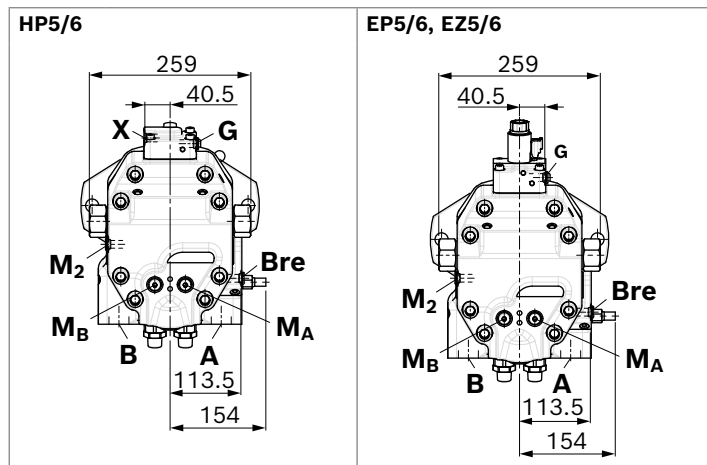
EZ5/6 – Two-point control, electric

Port plate **6**, with integrated counterbalance valve BVI – SAE working ports **A** and **B** at bottom



⊕ Center of gravity

▼ **Location of working ports on the port plates** (View Z)



Ports		Standard	Size	p_{\max} [bar] ³⁾	State ⁵⁾
A, B	Working port Fastening thread	SAE J518 DIN 13 ¹⁾	1 1/4 in M14 x 2; 19 deep	420	O
T₁, T₂	Drain port	ISO 6149 ²⁾	M27 x 2; 19 deep	30	X/O (T ₂) ⁴⁾
G	Synchronous control	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	420	X
X (HP, HZ)	Pilot pressure port	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	100	O
M₁	Control pressure measuring port	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	420	X
M₂	Control pressure measuring port	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	420	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	420	X
Bre	Brake release port, external	ISO 6149 ²⁾	M14 x 1.5; 11.5 deep	30	O/X ⁶⁾
Bri	Brake release port, internal	ISO 6149 ²⁾	∅4	30	O/X ⁷⁾
S	Boost port	ISO 6149 ²⁾	M27 x 2; 19 deep	30	X

1) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
 2) The countersink may be deeper than specified in the standard.
 3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 4) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 50).

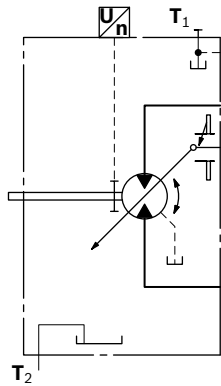
5) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)
 6) Must be connected for external piping. Is plugged for internal channel routing.
 7) Is plugged for external channel routing. Must be connected for internal piping.

Speed sensor

The A6VE...U version ("prepared for speed sensor", i.e. without sensor) is equipped with a spline on the rotary group.

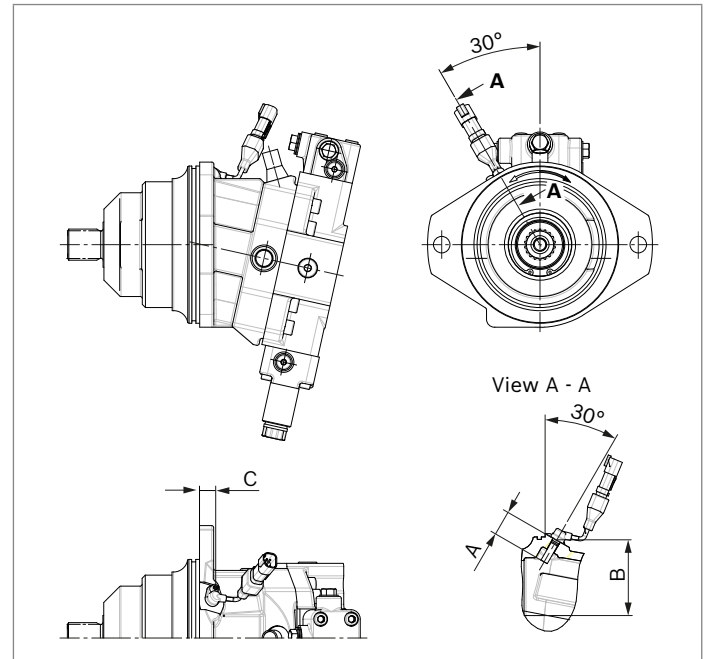
A signal proportional to the rotational speed of the motor can be generated with the mounted DSA speed sensor. The DSA sensor registers the rotational speed and direction of rotation. Type code, technical data, dimensions and details on the connector plus safety instructions about the sensor can be found in the relevant data sheet 95133 (DSA). 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 A6VE variable motor complete with mounted sensor.

▼ Circuit diagram EP



▼ Dimensions

Version "V" with mounted speed sensor



Size	60	85	115	170	215	280
Number of teeth	54	58	67	75	80	78
A Installation depth (tolerance -0.25)	32	32	32	32	32	32
B Contact surface	83.3	87.3	96.3	104.3	109.2	105.4
C	26	16.5	14.2	28.5	22.7	32

Setting range for displacement

	60				85				115			
	$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)	
	from	to	from	to	from	to	from	to	from	to	from	to
A	62.0	62.0	0.0	15.0	85.2	85.2	0.0	25.0	115.6	115.6	0.0	24.0
	without screw		M10 × 60 R909154690		without screw		M12 × 70 R909085976		without screw		M12 × 70 R909085976	
B	62.0	62.0	> 15.0	30.5	85.2	85.2	> 25.0	44.0	115.6	115.6	> 24.0	47.5
	without screw		M10 × 70 R909153779		without screw		M12 × 80 R909153075		without screw		M12 × 80 R909153075	
C	62.0	62.0	> 30.5	43.0	85.2	85.2	> 44.0	59.0	115.6	115.6	> 47.5	71.0
	without screw		M10 × 80 R909154058		without screw		M12 × 90 R909154041		without screw		M12 × 90 R909154041	
D	x		x		x		x		115.6	115.6	> 71.0	80.0
									without screw		M12 × 100 R909153975	
E	< 62.0	47.5	0.0	15.0	< 85.2	62.0	0.0	25.0	< 115.6	93.5	0.0	24.0
	M10 × 60 R909154690		M10 × 60 R909154690		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 70 R909085976	
F	< 62.0	47.5	> 15.0	30.5	< 85.2	62.0	< 25.0	44.0	< 115.6	93.5	> 24.0	47.5
	M10 × 60 R909154690		M10 × 70 R909153779		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 80 R909153075	
G	< 62.0	47.5	> 30.5	43.0	< 85.2	62.0	> 44.0	59.0	< 115.6	93.5	> 47.5	71
	M10 × 60 R909154690		M10 × 80 R909154058		M12 × 70 R909085976		M12 × 90 R909154041		M12 × 70 R909085976		M12 × 90 R909154041	
H	x		x		x		x		< 115.6	93.5	> 71.0	80.0
									M12 × 70 R909085976		M12 × 100 R909153975	
J	< 47.5	33.0	0.0	15.0	< 62.0	43.0	0.0	25.0	< 93.5	71.0	0.0	24.0
	M10 × 70 R909153779		M10 × 60 R909154690		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 70 R909085976	
K	< 47.5	33.0	> 15.0	30.5	< 62.0	43.0	> 25.0	44.0	< 93.5	71.0	> 24.0	47.5
	M10 × 70 R909153779		M10 × 70 R909153779		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075	
L	< 47.5	33.0	> 30.5	43.0	< 62.0	43.0	> 44.0	59.0	< 93.5	71.0	> 47.5	71.0
	M10 × 70 R909153779		M10 × 80 R909154058		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041	
M	x		x		x		x		< 93.5	71.0	> 71.0	80.0
									M12 × 80 R909153075		M12 × 100 R909153975	

Specify exact settings for $V_{g \min}$ and $V_{g \max}$ in plain text when ordering:

▶ $V_{g \min} = \dots \text{ cm}^3$, $V_{g \max} = \dots \text{ cm}^3$

Theoretical, maximum setting:

▶ for $V_{g \min} = 0.7 \times V_{g \max}$

▶ for $V_{g \max} = 0.3 \times V_{g \max}$

Settings that are not listed in the table may lead to damage.

Please contact us.

	170				215				280			
	$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)	
	from	to	from	to	from	to	from	to	from	to	from	to
A	171.8	171.8	0.0	28.0	216.5	216.5	0.0	44.5	x	x		
	without screw		M12 × 80 R909153075		without screw		M12 × 80 R909153075					
B	171.8	171.8	> 28.0	56.0	216.5	216.5	> 44.5	80.0	x	x		
	without screw		M12 × 90 R909154041		without screw		M12 × 90 R909154041					
C	171.8	171.8	> 56.0	91.0	216.5	216.5	> 80.0	115.0	x	x		
	without screw		M12 × 100 R909153975		without screw		M12 × 100 R909153975					
D	171.8	171.8	> 91.0	118.0	216.5	216.5	> 115.0	150.0	x	x		
	without screw		M12 × 110 R909154212		without screw		M12 × 110 R909154212					
E	< 171.8	145.0	0.0	28.0	< 216.5	175.0	0.0	44.5	280.1	230.0	0.0	55.0
	M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M16 × 100 R910909811		M16 × 100 R910909811	
F	< 171.8	145.0	> 28.0	56.0	< 216.5	175.0	> 44.5	80.0	280.1	230.0	> 55.0	98.0
	M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M16 × 100 R910909811		M16 × 110 R910909719	
G	< 171.8	145.0	> 56.0	91.0	< 216.5	175.0	> 80.0	115.0	280.1	230.0	> 98.0	141.0
	M12 × 80 R909153075		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 100 R909153975		M16 × 100 R910909811		M16 × 120 R910909477	
H	< 171.8	145.0	> 91.0	118.0	< 216.5	175.0	> 115.0	150.0	280.1	230.0	> 141.0	184.0
	M12 × 80 R909153075		M12 × 110 R909154212		M12 × 80 R909153075		M12 × 110 R909154212		M16 × 100 R910909811		M16 × 130 R910900271	
J	< 145.0	118.0	0.0	28.0	< 175.0	141.0	0.0	44.5	< 230.0	188.0	0.0	55.0
	M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M16 × 110 R910909719		M16 × 100 R910909811	
K	< 145.0	118.0	> 28.0	56.0	< 175.0	141.0	> 44.5	80.0	< 230.0	188.0	> 55.0	98.0
	M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M16 × 110 R910909719		M16 × 110 R910909719	
L	< 145.0	118.0	> 56.0	91.0	< 175.0	141.0	> 80.0	115.0	< 230.0	188.0	> 98.0	141.0
	M12 × 90 R909154041		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 100 R909153975		M16 × 110 R910909719		M16 × 120 R910909477-	
M	< 145.0	118.0	> 91.0	118.0	< 175.0	141.0	> 115.0	150.0	< 230.0	188.0	> 141.0	184.0
	M12 × 90 R909154041		M12 × 110 R909154212		M12 × 90 R909154041		M12 × 110 R909154212		M16 × 110 R910909719		M16 × 130 R910900271	

Specify exact settings for $V_{g \min}$ and $V_{g \max}$ in plain text when ordering:

▶ $V_{g \min} = \dots \text{ cm}^3$, $V_{g \max} = \dots \text{ cm}^3$

Theoretical, maximum setting:

▶ for $V_{g \min} = 0.7 \times V_{g \max}$

▶ for $V_{g \max} = 0.3 \times V_{g \max}$

Settings that are not listed in the table may lead to damage.

Please contact us.

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.

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

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

To achieve favorable noise values, decouple all connecting 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.

Notice

In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

Key

F	Filling/air bleeding
T₁, T₂	Drain port
$h_{t \min}$	Minimum required immersion depth (200 mm)
h_{\min}	Minimum required distance to reservoir bottom (100 mm)

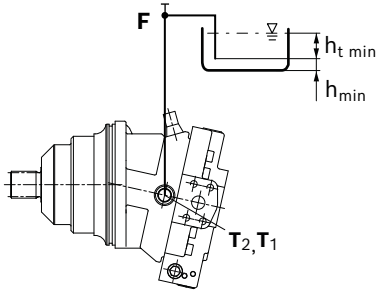
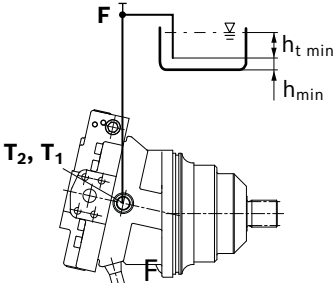
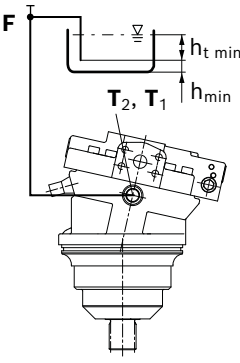
Installation position

See the following examples **1** to **6**.

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

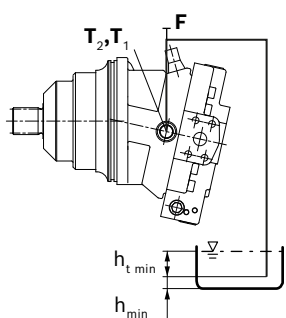
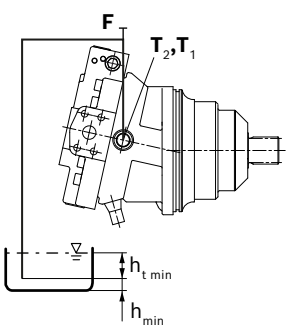
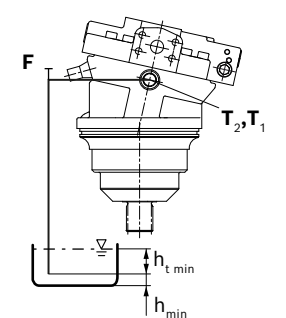
Below-reservoir installation (standard)

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

Installation position	Air bleed	Filling
<p>1</p> 	F	T₂, T₁
<p>2</p> 	F	T₂, T₁
<p>3</p> 	F	T₂, T₁

Above-reservoir installation

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

Installation position	Air bleed	Filling
<p>4</p> 	F	T ₂ , T ₁ (F)
<p>5</p> 	F	T ₂ , T ₁ (F)
<p>6</p> 	F	T ₂ , T ₁ (F)

Notice

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

Project planning notes

- ▶ The motor A6VE 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 notes contained herein must be observed.
- ▶ For safety reasons, controls with beginning of control at $V_{g \min}$ (e.g., HA) are not permissible for winch drives, e.g. anchor winches!
- ▶ Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ 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 under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- ▶ Not all versions of the product are approved for use in safety functions according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- ▶ Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal) Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- ▶ Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- ▶ Working ports:
 - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
 - The service ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- ▶ During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. 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.
Therefore it is the machine and/or system manufacturer's responsibility to make sure that the load can always be put in a safe mode if needed. Also, he needs to ensure that these measures are properly implemented.
- ▶ When using the axial piston motor in winch drives, make certain that the technical limit values are not exceeded under all operating conditions. If the axial piston motor is extremely overloaded (e.g. if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst. The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.

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