Axial piston variable motor
A6VM series 71

RE 91610
Edition: 11.2018
Replaces: 09.2018

- All-purpose high pressure motor
- 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 circuits

Features

- Robust motor with long service life
- Approved for very high rotational speeds
- High starting efficiency
- Excellent slow-running characteristics
- Large variety of controls
- High control range (can be swiveled to zero)
- High torque
- Optionally with flushing and boost-pressure valve mounted
- Optionally with mounted high-pressure 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	**M**						**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. 500 bar (NG280)	**A6V**

Operating mode

02	Motor	**M**

Size

03	Geometric displacement, see “Technical data” on page 9			**060**	**085**	**115**	**150**	**170**	**215**	**280**

Control device				**060**	**085**	**115**	**150**	**170**	**215**	**280**	
04	Proportional control, hydraulic	positive control	Δp_{St} = 10 bar	●	●	●	●	●	●	●	**HP1**
			Δp_{St} = 25 bar	●	●	●	●	●	●	●	**HP2**
		negative control	Δp_{St} = 10 bar	●	●	●	●	●	●	●	**HP5**
			Δp_{St} = 25 bar	●	●	●	●	●	●	●	**HP6**
	Proportional control, electric	positive control	U = 12 V	●	●	●	●	●	●	●	**EP1**
			U = 24 V	●	●	●	●	●	●	●	**EP2**
		negative control	U = 12 V	●	●	●	●	●	●	●	**EP5**
			U = 24 V	●	●	●	●	●	●	●	**EP6**
	Two-point control, hydraulic	negative control		–	–	–	●	●	●	●	**HZ5**
				●	●	●	–	–	–	–	**HZ7**
	Two-point control, electric	negative control	U = 12 V	–	–	–	●	●	●	●	**EZ5**
			U = 24 V	–	–	–	●	●	●	●	**EZ6**
			U = 12 V	●	●	●	–	–	–	–	**EZ7**
			U = 24 V	●	●	●	–	–	–	–	**EZ8**
	Automatic control high-pressure related, positive control	with minimum pressure increase	Δp ≤ approx. 10 bar	●	●	●	●	●	●	●	**HA1**
		with pressure increase	Δp = 100 bar	●	●	●	●	●	●	●	**HA2**
	Automatic control speed-related, negative control	hydr. travel direction valve		●	●	●	●	●	●	–	**DA0**
		electr. travel direction valve + electr. $V_{g\,max}$ override	U = 12 V	●	●	●	●	●	●	–	**DA1**
	p_{St} / p_{HD} = 5/100		U = 24 V	●	●	●	●	●	●	–	**DA2**
	p_{St} / p_{HD} = 3/100	hydr. travel direction valve		–	–	–	–	–	–	●	**DA7**

Pressure control/override				**060**	**085**	**115**	**150**	**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 and HA2 controls	Hydraulic remote control, proportional		●	●	●	●	●	●	●	**T3**
		electric, two-point	U = 12 V	●	●	●	●	●	●	–	**U1**
			U = 24 V	●	●	●	●	●	●	–	**U2**
		electric and travel direction valve, electric	U = 12 V	●	●	●	●	●	●	–	**R1**
			U = 24 V	●	●	●	●	●	●	–	**R2**

Connector for solenoids[1] (see page 70)		**060 to 280**	
06	Without connector (without solenoid, only for hydraulic control)	●	**0**
	DEUTSCH - molded connector, 2-pin, without suppressor diode	●	**P**

● = Available ○ = On request – = Not available

1) 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	**M**						**0**			**/**	**71**	**M**	**W**	**V**	**0**						**–**	

Swivel angle detection (see page 71)

		060	085	115	150	170	215	280	
07	Without	●	●	●	●	●	●	●	**0**
	Neutral position switch	–	●	●	●	●	●	–	**N**

Additional function

		060 to 280	
08	Without additional function	●	**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 BVD/BVE counterbalance valves	●	**1**
		One-sided in inlet to large stroking chamber (HA)	●	**4**
		One-sided in outlet from large stroking chamber (DA)	●	**7**

Setting range for displacement[2)]

	$V_{g\,max}$ setting screw	$V_{g\,min}$ setting screw	060	085	115	150	170	215	280	
10	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**
	moderate[3)]	short (0-adjustable)	●	●	●	●	●	●	●	**J**
		moderate	●	●	●	●	●	●	●	**K**
		long	●	●	●	●	●	●	●	**L**
		extra long	–	–	●	●	●	●	●	**M**

Series

		060 to 280	
11	Series 7, Index 1	●	**71**

Version of port and fastening threads

		060 to 280	
12	Metric ports according to ISO 6149 with O-ring seal, metric fastening thread according to DIN 13	●	**M**

Direction of rotation

		060 to 280	
13	Viewed on drive shaft, bidirectional	●	**W**

Sealing material

		060 to 280	
14	FKM (fluoroelastomer)	●	**V**

Drive shaft bearing

		060 to 280	
15	Standard bearing	●	**0**

Mounting flange

			060	085	115	150	170	215	280	
16	ISO 3019-2	125-4	●	–	–	–	–	–	–	**M4**
		140-4	–	●	–	–	–	–	–	**N4**
		160-4	–	–	●	–	–	–	–	**P4**
		180-4	–	–	–	●	●	–	–	**R4**
		200-4	–	–	–	–	–	●	●	**S4**

● = Available ○ = On request – = Not available

2) The settings for the setting screws can be found in the table (page 84 and 85).

3) $V_{g\,max}$ for size 280 not adjustable, limitation by cap

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

Drive shaft			**060**	**085**	**115**	**150**	**170**	**215**	**280**	
17	Splined shaft ANSI B92.1a	1 1/4 in 14T 12/24 DP	●	–	–	–	–	–	–	**S7**
		1 1/4 in 17T 12/24 DP	–	●	–	–	–	–	–	**S9**
		1 3/4 in 13T 8/16 DP	–	–	●	●	–	–	–	**T1**
		2 in 15T 8/16 DP	–	–	–	○	●	●	–	**T2**
		2 1/4 in 17T 8/16 DP	–	–	–	–	–	–	●	**T3**
	Splined shaft DIN 5480	W35×2×16×9g	●	–	–	–	–	–	–	**Z8**
		W40×2×18×9g	–	●	●	–	–	–	–	**Z9**
		W45×2×21×9g	–	–	–	●	●	–	–	**A1**
		W50×2×24×9g	–	–	–	–	–	●	–	**A2**
		W60×2×28×9g	–	–	–	–	–	–	●	**A4**

Working port			**060**	**085**	**115**	**150**	**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 bottom, with integrated counterbalance valve[4]		–	–	–	●	●	–	–	**6**
	Port plate for mounting a counterbalance valve, with 1-stage pressure-relief valve (pilot operated)[5]	BVD 20	●	●	●	–	–	–	–	**7**
		BVD 25	–	–	●	●	●	–	–	**8**
		BVE 25	–	–	●	–	–	–	–	**8**
	Port plate for mounting a counterbalance valve, with 1-stage pressure-relief valve (direct operated)[5]	BVE 25	–	–	–	●	●	●	–	**5**
		BVD 25	–	–	–	–	–	●	–	**5**
		BVD/BVE 32	–	–	–	–	–	●	●[6]	**9**

Valve (see page 72 to 82)			**060**	**085**	**115**	**150**	**170**	**215**	**280**	
19	Without valve		●	●	●	●	●	●	●	**0**
	With BVD/BVE counterbalance valves mounted[7]		●	●	●	●	●	●	–	**W**
	With flushing and boost-pressure valve mounted, flushing on both sides Flushing flow when: $\Delta p = p_{ND} - p_G = 25$ bar and $v = 10$ mm²/s (p_{ND} = low pressure, p_G = case pressure) Only possible for port plates 1 and 2	**Flushing flow q_v [l/min]**								
		3.5	●	●	●	–	–	–	–	**A**
		5	●	●	●	–	–	–	–	**B**
		8	●	●	●	●	●	●	–	**C**
		10	●	●	●	●	●	●	–	**D**
		14	●	●	●	–	–	–	–	**F**
		15	–	–	●[8]	●	●	●	–	**G**
		16	●	●	●[8]	–	–	–	–	**H**
		18	–	–	●[8]	●	●	●	–	**I**
		21	–	–	●[8]	●	●	●	–	**J**
		27	–	–	●[8]	●	●	●	–	**K**
		31	–	–	●[8]	●	●	●	–	**L**
		37	–	–	–	●	●	●	–	**M**
		adjustable 0-60	–	–	–	–	–	–	●	**V**

● = Available ○ = On request – = Not available

4) Only in combination with HZ5, EZ5, EZ6, HP or EP with respective negative control
5) Possible only in combination with HP, EP and HA control
6) 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
7) Type code for counterbalance valve to be quoted separately in accordance with data sheet 95522 (BVD), 95525 (BVE) and 95528 (BVD/BVE32).
Note the restrictions described on page 74.
8) Not for EZ7, EZ8 and HZ7.

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

Speed sensor (see page 83)		**060**	**085**	**115**	**150**	**170**	**215**	**280**	
20	Without speed sensor	●	●	●	●	●	●	●	**0**
	Prepared for HDD speed sensor	–	–	–	–	–	–	●	**F**
	HDD speed sensor mounted[9)]	–	–	–	–	–	–	●	**H**
	Prepared with DSM/DSA speed sensor	●	●	●	●	●	●	○	**U**
	With DSM/DSA speed sensor mounted[9)]	●	●	●	●	●	●	○	**V**

Standard/special version		
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

Notices

▶ Note the project planning notes on page 87.

9) Specify the type code of sensor in accordance with data sheet 95135 (HDD), 95132 (DSM) or 95133 (DSA) and observe the requirements for the electronics.

Hydraulic fluids

The A6VM variable motor 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 by means of the Fluid Rating according to data sheet 90235.
Hydraulic fluids which have been evaluated positively in the Fluid Rating are contained in the following data sheet:

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

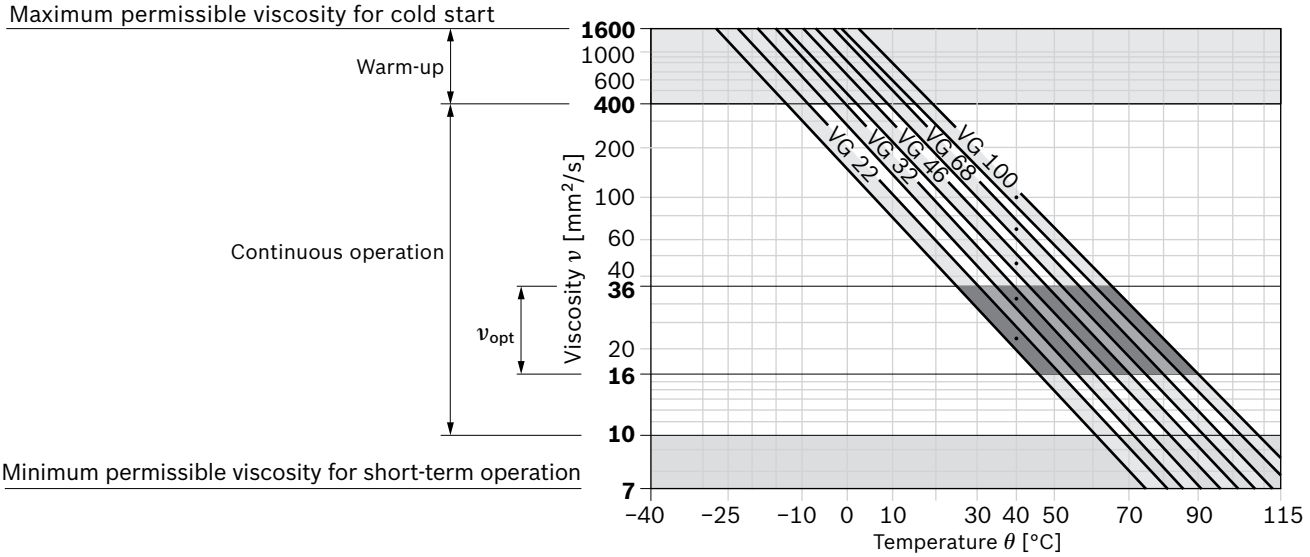
The hydraulic fluid should be selected so the operating viscosity in the operating temperature range is within the optimal range (v_{opt}; see selection diagram).

Notice
The axial piston unit is not suitable for operation with HFA hydraulic fluids. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Viscosity and temperature of hydraulic fluids

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

▼ **Selection diagram**



1) This corresponds, for example on 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.

Hydraulic fluid filtration

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

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

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

For example, the viscosity 10 mm²/s at:

- HLP 32 corresponds to a temperature of 73 °C
- HLP 46 corresponds to a temperature of 85 °C.

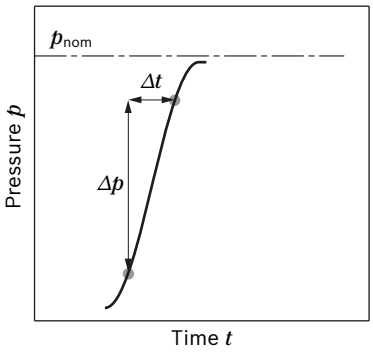
Flow direction

Direction of rotation as viewed on drive shaft	
Clockwise	Counterclockwise
A to **B**	**B** to **A**

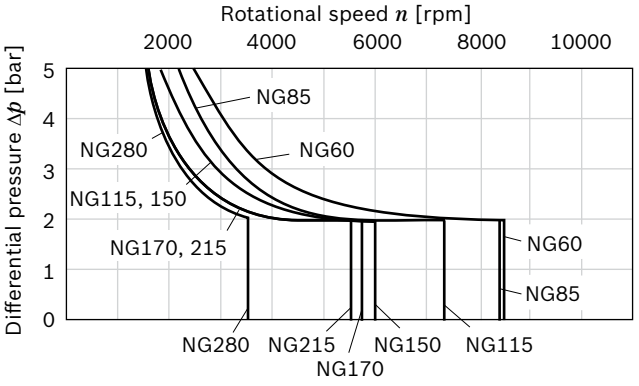
Working pressure range

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 is the maximum working pressure during a single operating period. The sum of single operating periods must not exceed the total operating period. 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.
Maximum Single operating period	10 s	
Total operating period	300 h	
Maximum pressure p_{max} (only valid for NG 60-215)	530 bar	
Maximum 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** or **B**) which is required to prevent damage to the axial piston unit.
Minimum pressure – pump operating mode (inlet)	see the diagram	To prevent damage to the axial piston motor in pump operating mode (change of the high-pressure side at constant 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 the working 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 built-in pressure relief valve	9000 bar/s	
without pressure relief valve	16000 bar/s	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T\ cont}$	2 bar	Maximum, averaged differential pressure at the shaft seal (case to ambient pressure)
Maximum differential pressure $\Delta p_{T\ max}$	see the diagram	Permissible differential pressure at the shaft seal (case to ambient pressure)
Pressure peaks $p_{T\ peak}$	10 bar	t < 0.1 s

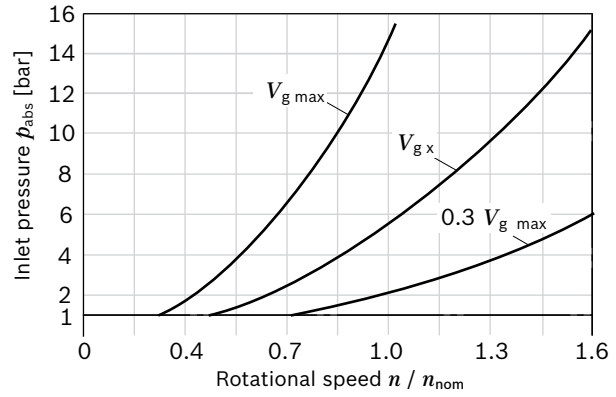
▼ **Rate of pressure change $R_{A\,max}$**



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

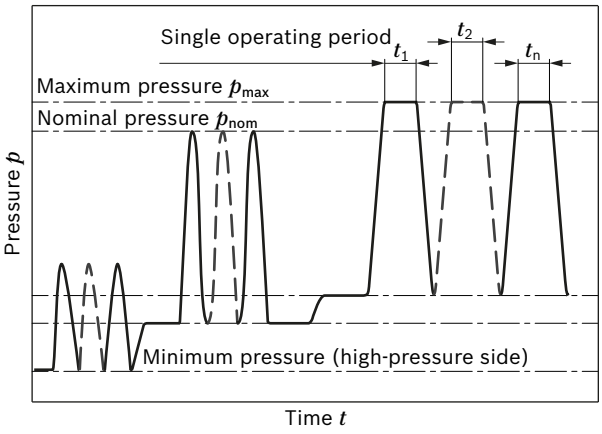


▼ **Minimum pressure – pump operating mode (inlet)**



This diagram is valid only for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s.
If the above mentioned conditions cannot be ensured, please contact us.

▼ **Pressure definition**



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

Notice

- Working pressure range applies when using mineral oil-based hydraulic fluids. 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 leakage pressure in the case.
- The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
- The case pressure must be greater than the ambient pressure.

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 setting of the beginning of control is made at p_{abs} = 2 bar case pressure (sizes 60 to 215) resp. p_{abs} = 1 bar case pressure (size 280).

Technical data

Size		NG		60	85	115	150	170	215	280
Displacement geometric, per revolution		$V_{g\,max}$	cm³	62.0	85.2	115.6	152.1	171.8	216.5	280.1
		$V_{g\,min}$	cm³	0	0	0	0	0	0	0
		$V_{g\,x}$	cm³	37	51	69	91	65	130	118
Maximum rotational speed[1] (complying with the maximum permissible inlet flow)	At $V_{g\,max}$	n_{nom}	rpm	4450	3900	3550	3250	3100	2900	2500
	at $V_g < V_{g\,x}$ (see diagram)	n_{max}	rpm	7200	6800	6150	5600	4900	4800	3550
	at $V_{g\,0}$	n_{max}	rpm	8400	8350	7350	6000	5750	5500	3550
Inlet flow[2]	at n_{nom} and $V_{g\,max}$	$q_{v\,max}$	l/min	275	332	410	494	533	628	700
Torque[3]	at $V_{g\,max}$ and Δp = 450 bar	T	Nm	444	610	828	1089	1230	1550	2006
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	kNm/rad	15	22	37	44	52	70	72
	$V_g/2$ to 0 (interpolated)	c_{min}	kNm/rad	45	68	104	124	156	196	209
Moment of inertia of rotary group		J_{TW}	kgm²	0.0043	0.0072	0.0110	0.0181	0.0213	0.0303	0.0479
Maximum angular acceleration		α	rad/s²	21000	17500	15500	11000	11000	10000	7000
Case volume		V	l	0.8	1.0	1.5	1.7	2.3	2.8	3.4
Weight approx.		m	kg	28	36	46	61	62	78	101

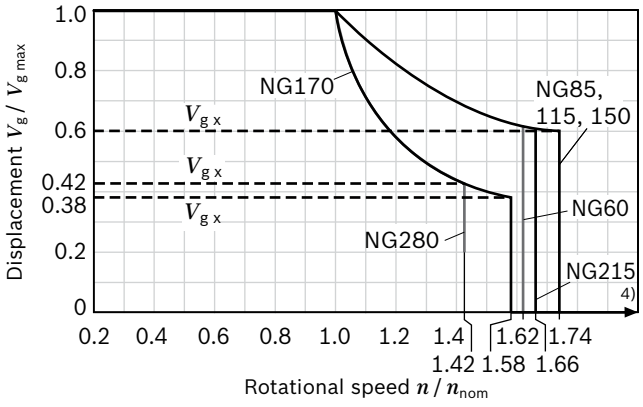
Speed range

The minimum rotational speed n_{min} is not limited. For applications with requirements on the evenness of the rotation at low rotational speeds, please contact us.

Notices

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

▼ **Permissible displacement in relation to rotational speed**



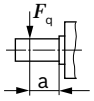
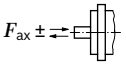
Determining characteristics					
Inlet flow	q_v	=	$\frac{V_g \times n}{1000 \times \eta_v}$		[l/min]
Rotational speed	n	=	$\frac{q_v \times 1000 \times \eta_v}{V_g}$		[rpm]
Torque	M	=	$\frac{V_g \times \Delta p \times \eta_{hm}}{20 \times \pi}$		[Nm]
Power	P	=	$\frac{2\,\pi \times M \times n}{60000}$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

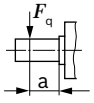
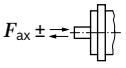
Key

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

1) The values are valid:
   – for the optimum viscosity range from v_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oils
2) Note input flow limitation due to counterbalance valve (page 74).
3) Torque without radial force, with radial force see page 10.
4) Values in this range on request

Permissible radial and axial loading on the drive shafts

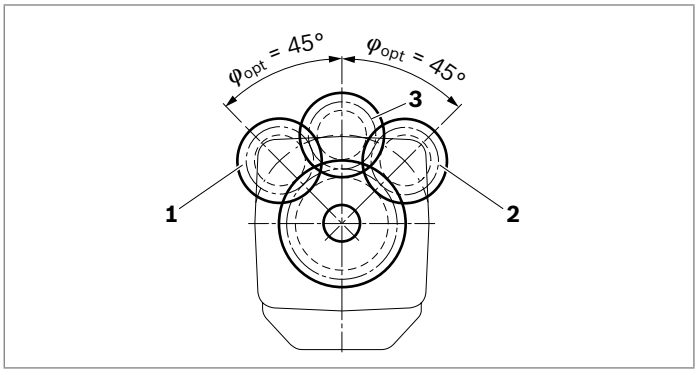
Size	NG		60	60	85	85	115	115	150	150	150
Drive shaft			1 1/4 in	W35	1 1/2 in	W40	1 3/4 in	W40	1 3/4 in	2 in	W45
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	7620	10266	12463	12323	14902	16727	15948	17424	19534
	a	mm	24.0	20.0	27.0	22.5	33.5	22.5	33.5	33.5	25.0
Maximum torque at $F_{q\,max}$	$T_{q\,max}$	Nm	310	444	595	610	828	828	890	1089	1089
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	315	450	440	450	450	450	370	450	450
Maximum axial force at standstill or depressurized operation 	$+F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
	$-F_{ax\,max}$	N	500	500	710	710	900	900	1300	1300	1300
Permissible axial force per bar working pressure	$+F_{ax\,perm}$/ bar	N/ bar	7.5	7.5	9.6	9.6	11.3	11.3	13.3	13.3	13.3

Size	NG		170	170	215	215	280	280
Drive shaft			2 in	W45	2 in	W50	2 1/4 in	W60
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	19370	21220	22602	25016	26821	26913
	a	mm	33.5	25.0	33.5	27.5	40.0	35.0
with permissible torque	$T_{q\,max}$	Nm	1230	1200	1445	1550	1916	2005
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	450	440	420	450	430	450
Maximum axial force at standstill or depressurized operation 	$+F_{ax\,max}$	N	0	0	0	0	0[1)]	0[1)]
	$-F_{ax\,max}$	N	1120	1120	1250	1250	1575	1575
Permissible axial force per bar working pressure	$+F_{ax\,perm}$/ bar	N/ bar	15.1	15.1	17.0	17.0	19.4	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 service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

▼ **Gear output drive**



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

Notices

- The values given are maximum values and do not apply to continuous operation.
- The permissible axial force in direction $-F_{ax}$ is to be avoided as the lifetime of the bearing is reduced.
- Special requirements apply in the case of belt drives. Please contact us.

1) Please contact us.

HP – Proportional hydraulic control

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 necessary 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 pressures up to 530 bar (NG60 to 215) resp. 500 bar (NG280) can occur at port **G**.
- Please state 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 the case pressure causes an increase in the beginning of control (see page 7) 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 Ø1.2

Optional

HP with throttle pin on both sides, symmetrical (see table), size 280 with nozzle Ø1.2

▼ **Throttle pin overview**

Size	60	85	115	150	170	215
Groove size [mm]	0.45	0.45	0.55	0.55	0.55	0.65

HP1, HP5 pilot pressure increase Δp_{St} = 10 bar

HP1 positive control

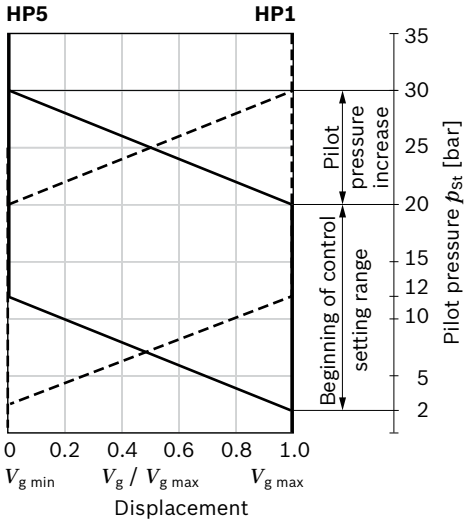
A pilot pressure increase of 10 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

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 Δp_{St} = 25 bar

HP2 positive control

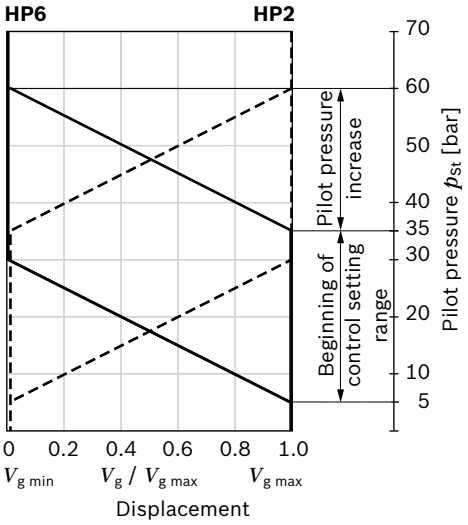
A pilot pressure increase of 25 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP6 negative control

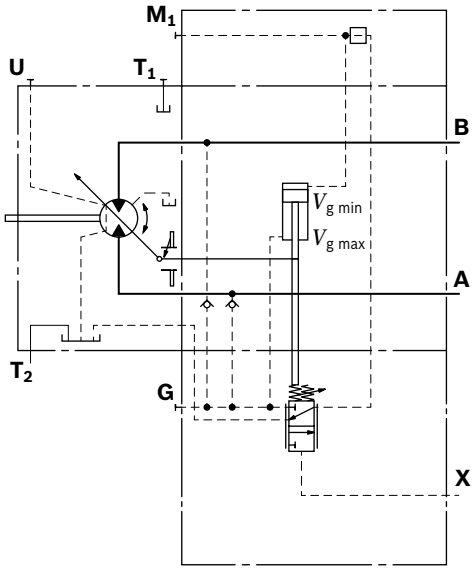
A pilot pressure increase of 25 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

- Beginning of control, setting range 5 to 35 bar
- Standard setting:
  Beginning of control at 10 bar (end of control at 35 bar)

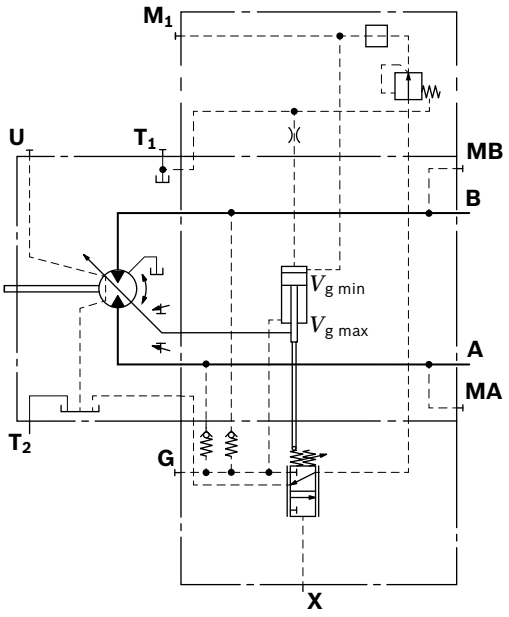
▼ **Characteristic curve**



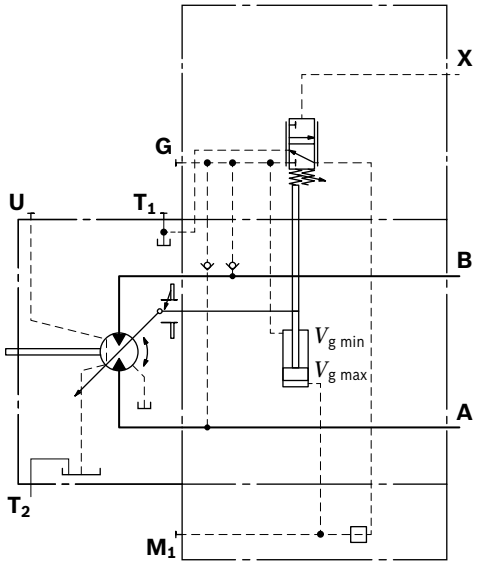
▼ **Circuit diagram HP1, HP2 size 60 to 215 (positive control)**



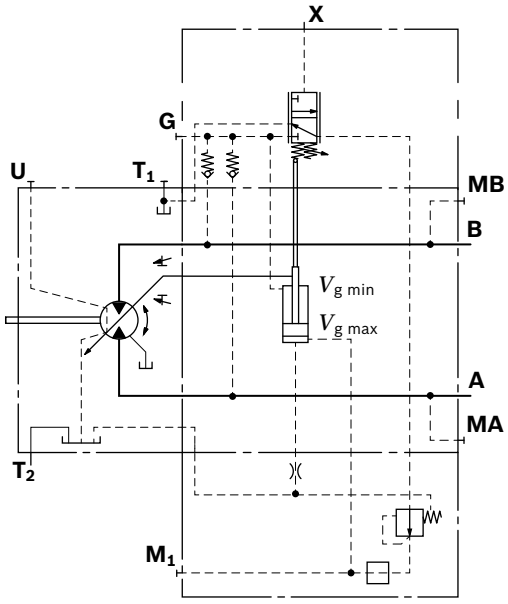
▼ **Circuit diagram HP1, HP2 size 280 (positive control)**



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



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



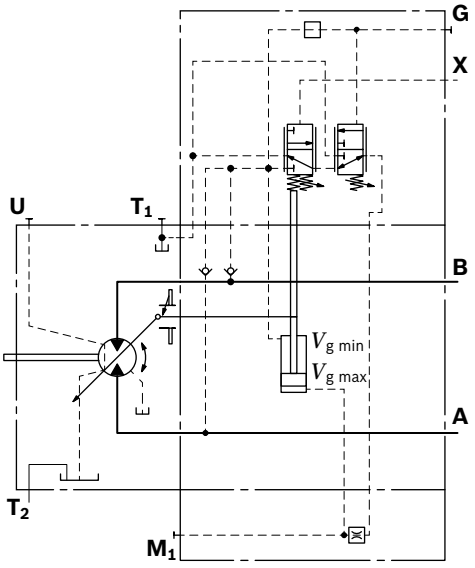
HP5D1, HP6D1 Pressure control, fixed setting

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.

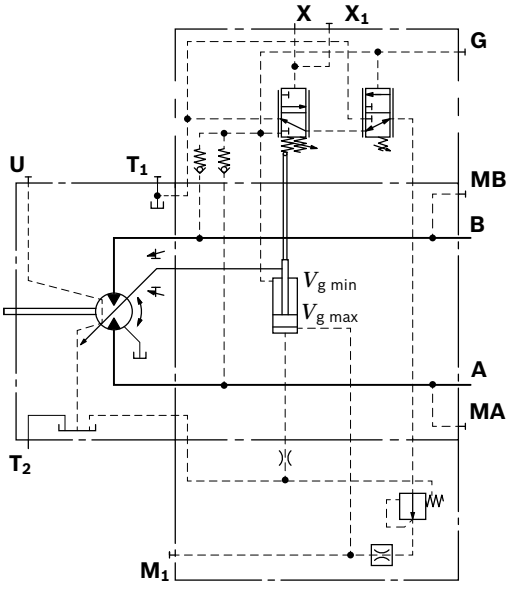
The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

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.

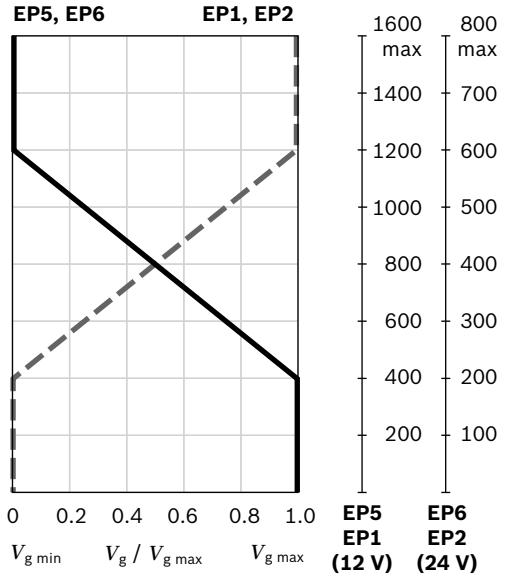
EP1, EP2 positive control

- 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 necessary 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 pressures up to 530 bar (NG60 to 215) resp. 500 bar (NG280) can occur at port **G**.

Size 280: The beginning of control and the EP characteristic curve are influenced by the case pressure.

Stroking time damping

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

Standard

EP without damping.

EP.D with throttle pin on both sides, symmetrical (see table), size 280 with orifice Ø1.2

Optional

EP with throttle pin on both sides, symmetrical (see table), size 280 with orifice Ø1.2

▼ **Throttle pin overview**

Size	60	85	115	150	170	215
Groove size [mm]	0.45	0.45	0.55	0.55	0.55	0.65

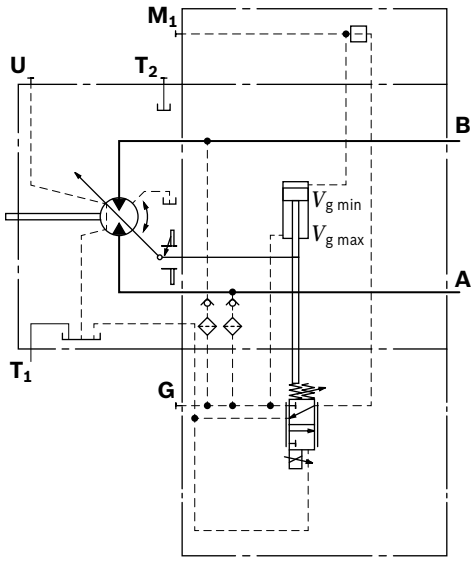
Technical data, solenoid	EP1, EP5	EP2, EP6
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Beginning of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither		
Frequency	100 Hz	100 Hz
minimum oscillation range[1)]	240 mA	120 mA
Duty cycle	100%	100%
Type of protection: see connector version page 70		

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

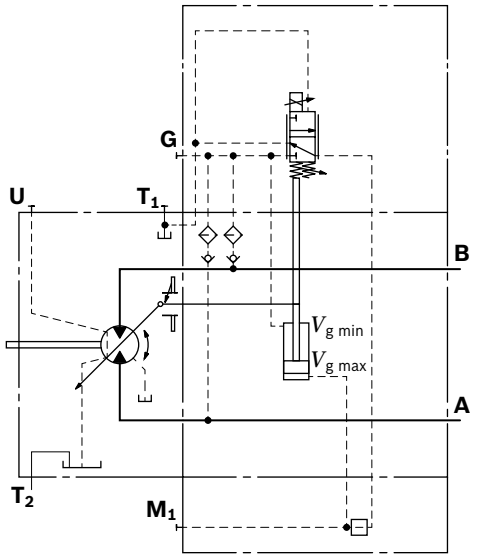
Further information can also be found on the Internet at www.boschrexroth.com/mobilelektronik.

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

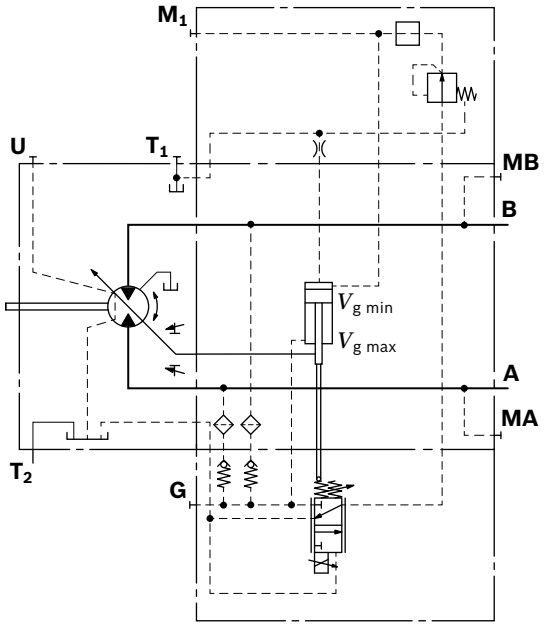
▼ **Circuit diagram EP1, EP2 size 60 to 215 (positive control)**



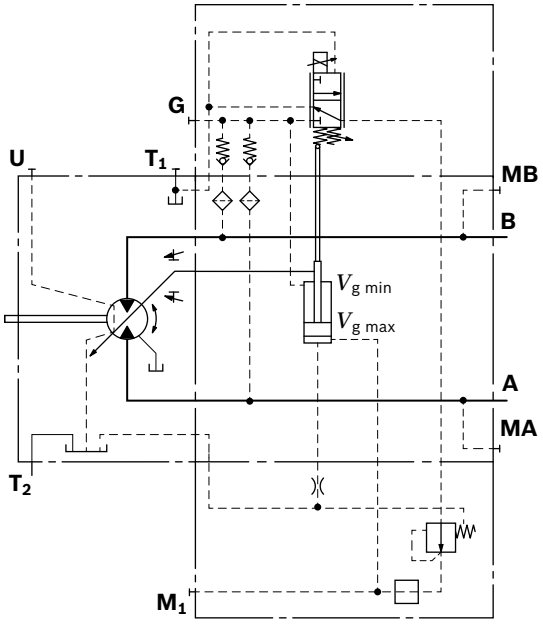
▼ **Circuit diagram EP5, EP6 size 60 to 215 (negative control)**



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



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



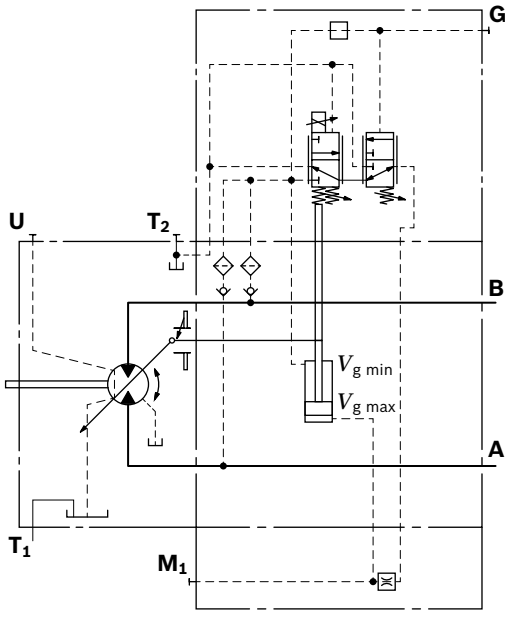
EP5D1, EP6D1 Pressure control, fixed setting

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.

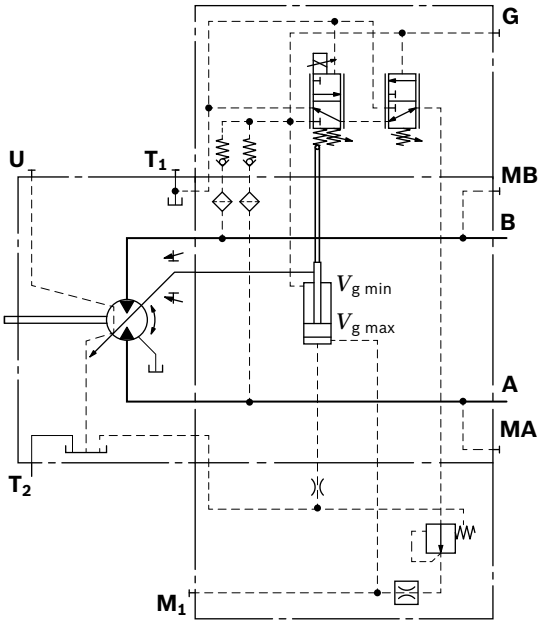
The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

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)**



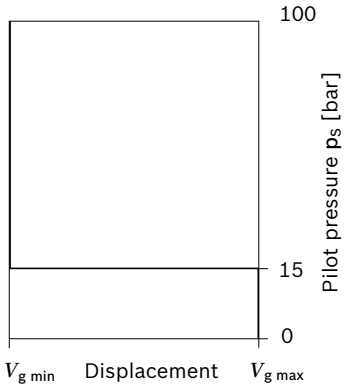
HZ – Two-point control, hydraulic

The two-point hydraulic 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 necessary 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 pressures up to 530 bar (NG60 to 215) resp. 500 bar (NG280) can occur at port **G**.
- 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 150 to 280

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

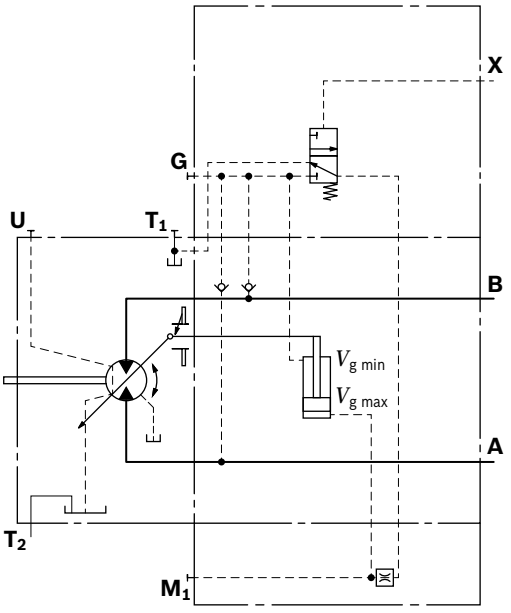
Standard for sizes 60 to 115

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

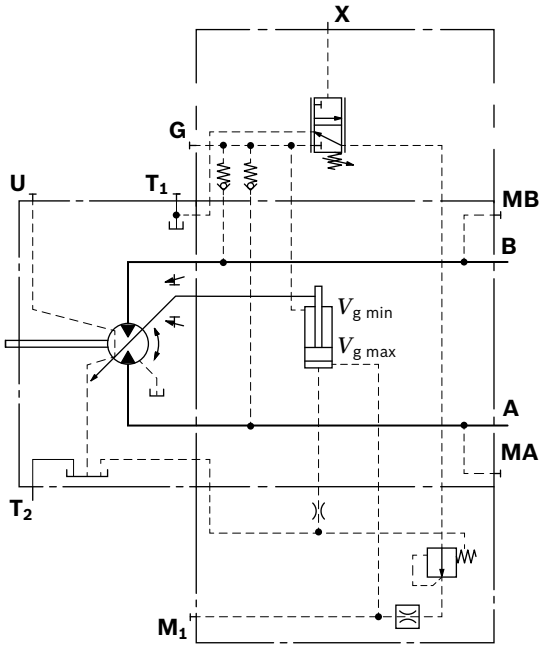
▼ **Throttle pin overview**

Size	60	85	115	150	170	215
Groove size [mm]	0.30	0.30	0.30	0.55	0.55	0.65

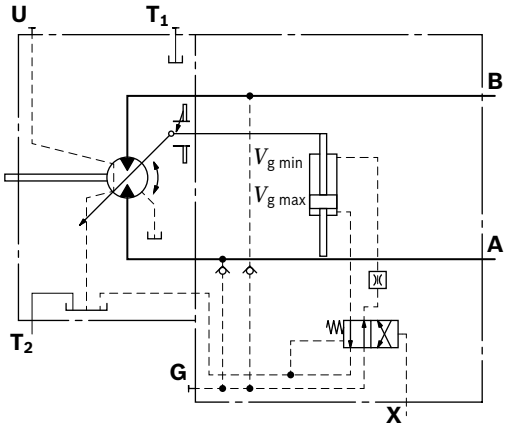
▼ **Circuit diagram HZ5 size 150 to 215 (negative control)**



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



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



EZ – Two-point control, electric

The two-point electric control, type EZ, allows the motor 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 necessary 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 pressures up to 530 bar (NG60 to 215) resp. 500 bar (NG280) can occur at port **G**.

Stroking time damping

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

Standard for sizes 150 to 280

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

Standard for sizes 60 to 115

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

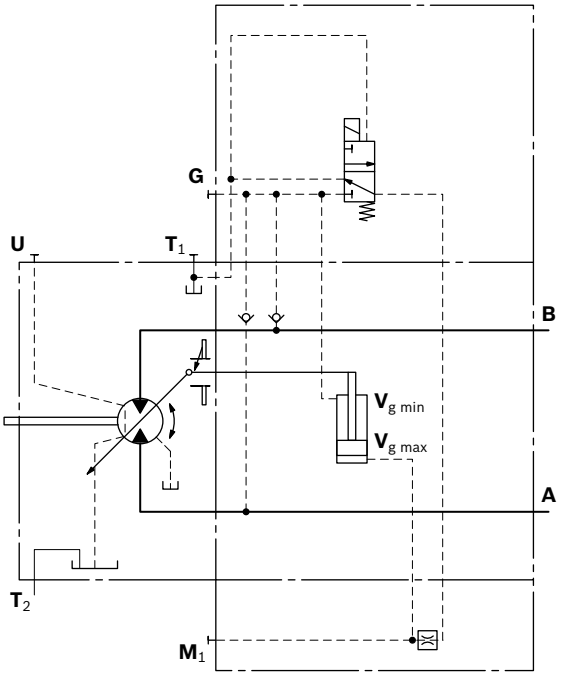
▼ **Throttle pin overview**

Size	60	85	115	150	170	215
Groove size [mm]	0.30	0.30	0.30	0.55	0.55	0.65

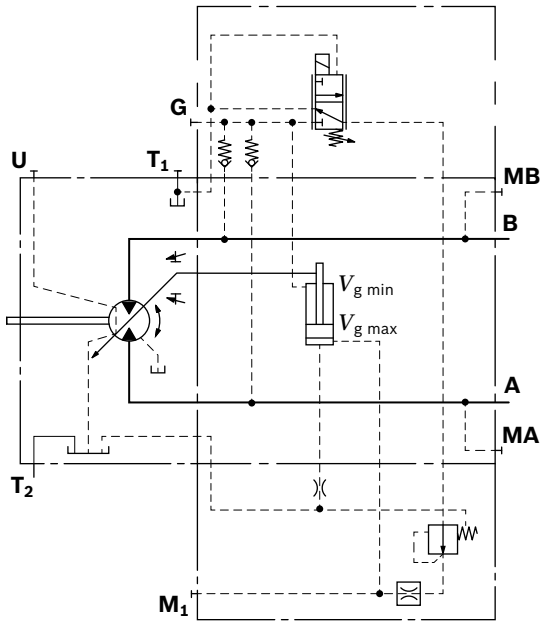
Sizes 150 to 280

Technical data, solenoid with ø37	EZ5	EZ6
Voltage	12 V (±20%)	24 V (±20%)
Position $V_{g\,max}$	de-energized	de-energized
Position $V_{g\,min}$	energized	energized
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 70		

▼ **Circuit diagram EZ5, EZ6 size 60 to 215 (negative control)**



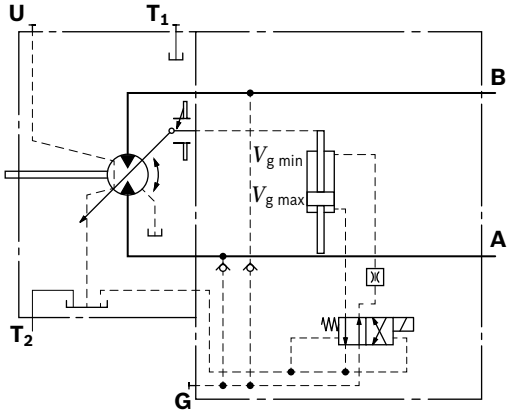
▼ **Circuit diagram EZ5, EZ6 size 280 (negative control)**



Sizes 60 to 115

Technical data, solenoid with ø45	EZ7	EZ8
Voltage	12 V (±20%)	24 V (±20%)
Position $V_{g\,max}$	de-energized	de-energized
Position $V_{g\,min}$	energized	energized
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 70		

▼ **Circuit diagram EZ7, EZ8 size 60 to 215 (negative control**



HA – Automatic high-pressure related control

The automatic high-pressure related control adjusts the displacement automatically depending on the working pressure.
The displacement of the A6VM motor with HA control is $V_{g\,min}$ (maximum rotational speed and minimum torque). The control device measures internally the working pressure at **A** or **B** (no control line required) and upon reaching the set beginning of control, the controller swivels the motor with increasing working pressure from $V_{g\,min}$ to $V_{g\,max}$. The displacement is modulated between $V_{g\,min}$ and $V_{g\,max}$ depending on the load.

HA1, HA2 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 necessary 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 pressures up to 530 bar (NG60 to 215) resp. 500 bar (NG280) can occur at port **G**.
- The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in the case pressure causes an increase in the beginning of control (see page 7) 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 one-sided throttle pin, throttling occurs 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	150	170	215	280
Groove size [mm]	0.45	0.45	0.55	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)

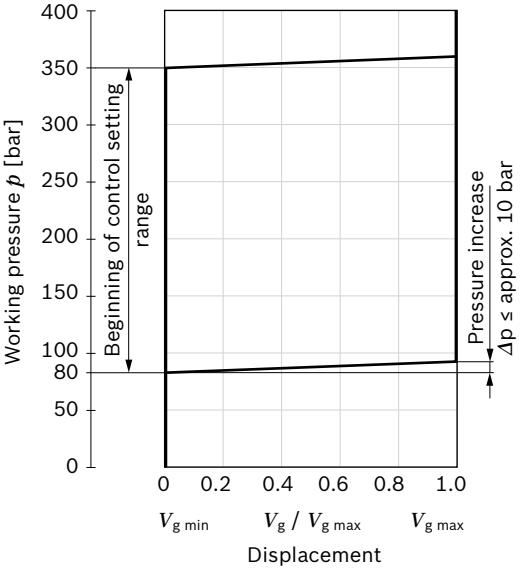
▼ **Throttle screw**

Size	60	85	115	150	170	215
Diameter [mm]	0.80	0.80	0.80	0.80	0.80	0.80

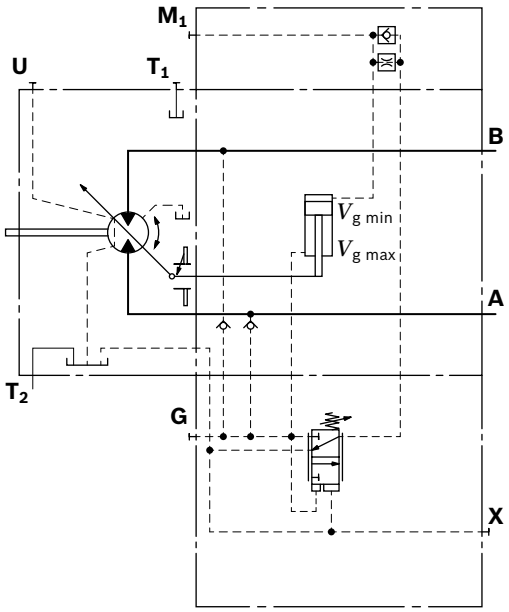
HA1 with minimum pressure increase, positive control

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

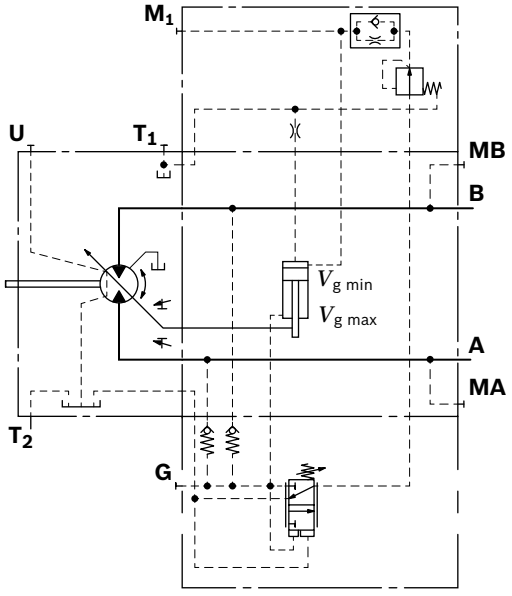
▼ **Characteristic curve HA1**



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



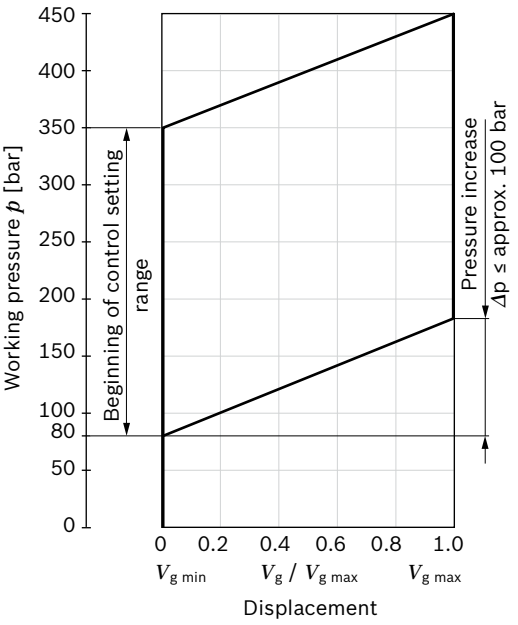
▼ **Circuit diagram HA1 size 280**



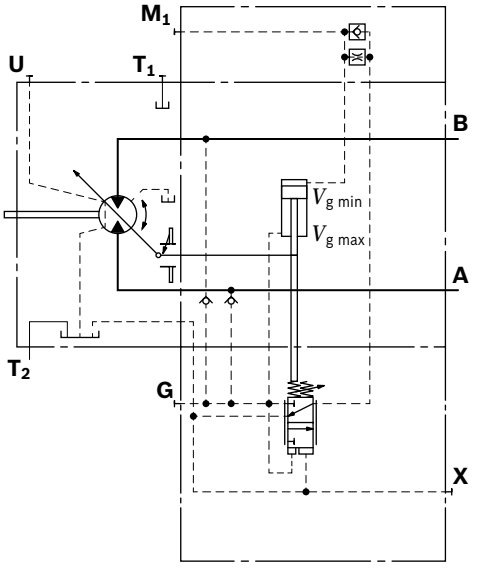
HA2 with pressure increase, positive control

A working pressure increase of Δp 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 Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 200 bar.

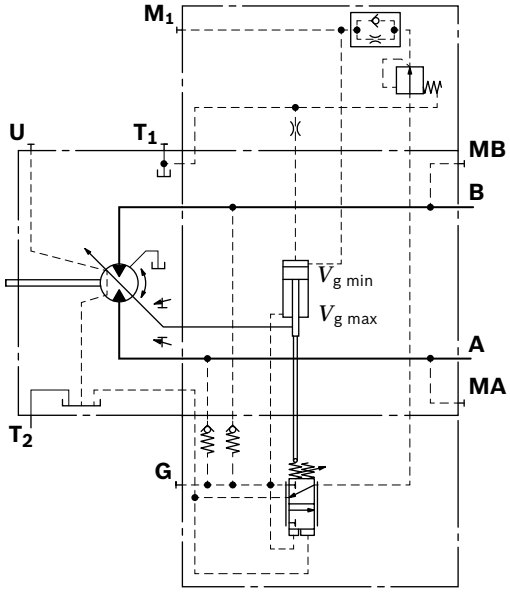
▼ **Characteristic curve HA2**



▼ **Circuit diagram HA2 size 60 to 215**



▼ **Circuit diagram HA2 size 280**



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**.

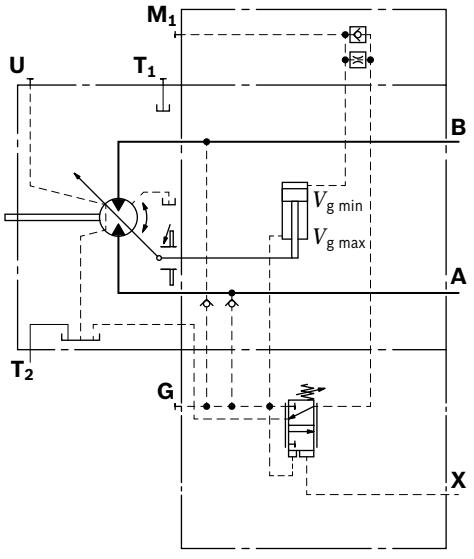
The beginning of control is reduced by 17 bar or by 23 bar for size 280 per 1 bar pilot pressure.

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

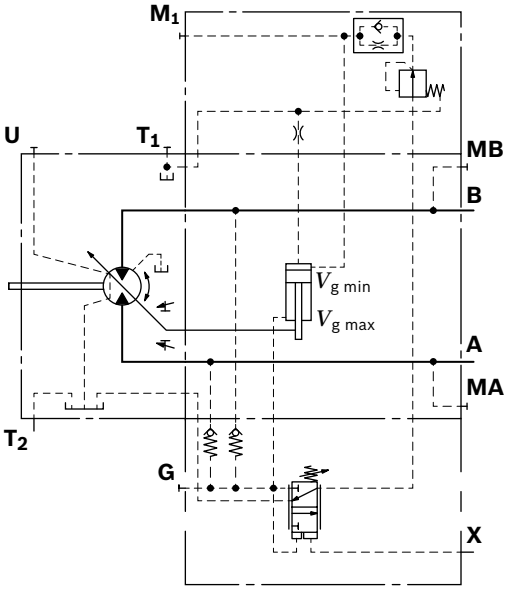
Notice

Maximum permissible pilot pressure 100 bar.

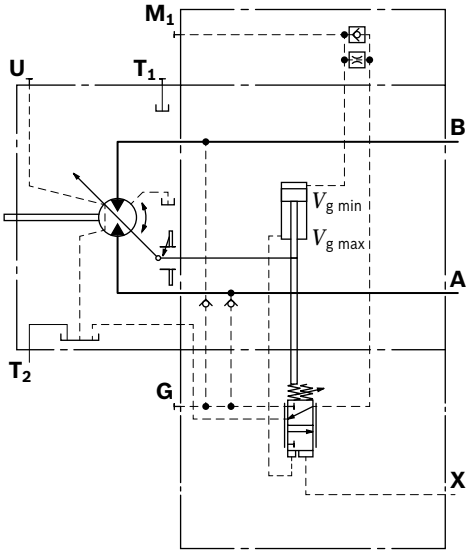
▼ **Circuit diagram HA1T3 size 60 to 215**



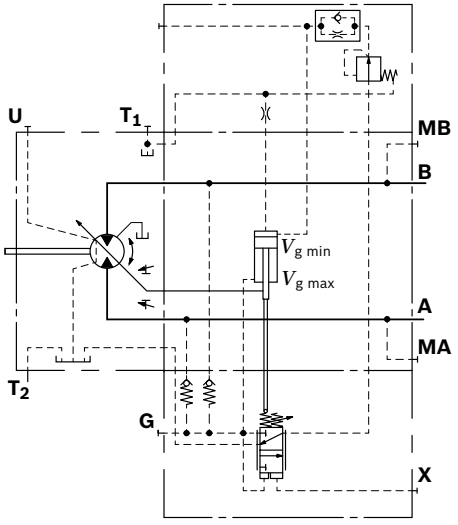
▼ **Circuit diagram HA1T3 size 280**



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



▼ **Circuit diagram HA2T3 size 280**

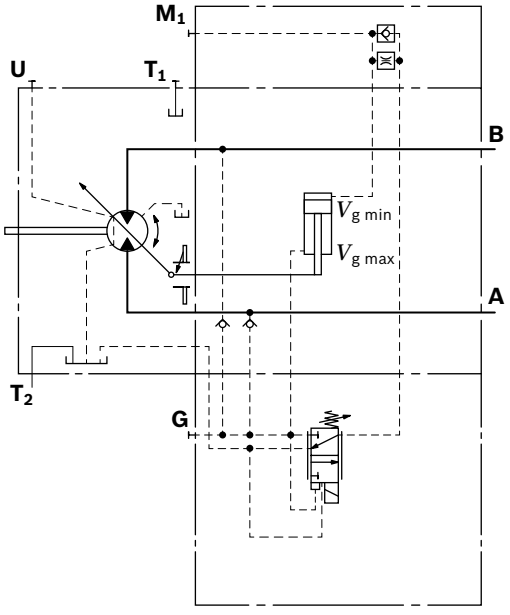


▼ HA.U1, HA.U2 electric override, two-point

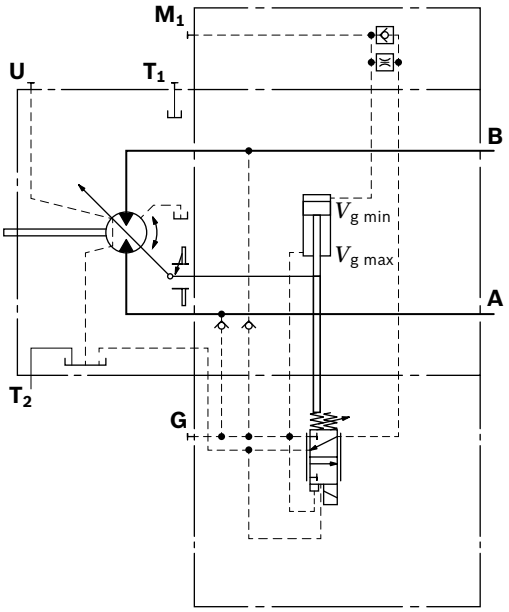
With the HA.U1 or HA.U2 control, the beginning of control can be overridden by an electric signal to a switching solenoid. When the override solenoid is energized, the variable motor swivels to maximum swivel angle, without intermediate position.
The beginning of control can be set between 80 and 300 bar (specify required setting in plain text when ordering).

Technical data, solenoid with ø45	U1	U2
Voltage	12 V (±20%)	24 V (±20%)
No override	de-energized	de-energized
Position $V_{g\,max}$	energized	energized
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 70		

▼ Circuit diagram HA1U1, HA1U2 size 60 to 215



▼ Circuit diagram HA2U1, HA2U2 size 60 to 215



HA.R1, HA.R2 electric override, electric travel direction valve

With the HA.R1 or HA.R2 control, the beginning of control can be overridden by an electric signal to switching solenoid **b**. When the override solenoid is energized, the variable motor swivels to maximum swivel angle, without intermediate position.

The travel direction valve ensures that the preselected pressure side of the hydraulic motor (**A** or **B**) is always connected to the HA control, and thus determines the swivel angle, even if the high-pressure side changes (e.g. travel drive during a downhill operation). This thereby prevents undesired swiveling of the variable motor to a larger displacement (jerky deceleration and/or braking characteristics).

Depending on the direction of rotation (direction of travel), the travel direction valve is actuated through the compression spring or the switching solenoid **a** (see page 28).

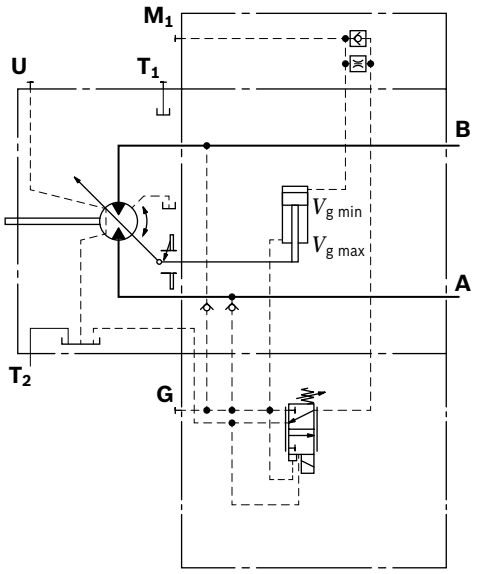
Electric override

Technical data, solenoid b with ø45	R1	R2
Voltage	12 V (±20%)	24 V (±20%)
No override	de-energized	de-energized
Position $V_{g\,max}$	energized	energized
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 70		

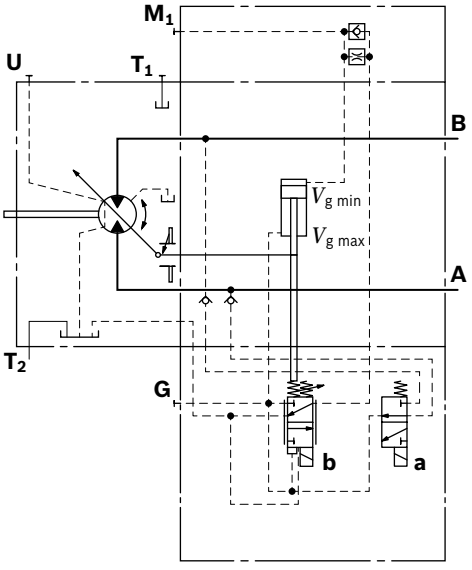
Travel direction valve, electric

Technical data, solenoid a with ø37		R1	R2
Voltage		12 V (±20%)	24 V (±20%)
Direction of rotation	Working pressure in		
Counterclockwise	**B**	energized	energized
Clockwise	**A**	de-energized	de-energized
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 70			

▼ **Circuit diagram HA1R1, HA1R2 size 60 to 215**



▼ **Circuit diagram HA2R1, HA2R2 size 60 to 215**



DA – Automatic control, speed related

The variable motor A6VM with automatic speed-related control is intended for use in hydrostatic travel drives in combination with the variable pump A4VG with DA control. A drive speed-related pilot pressure signal is generated by the A4VG variable pump, and that signal, together with the working pressure, regulates the swivel angle of the hydraulic motor.
Increasing drive speed, i.e. increasing pilot pressure, causes the motor to swivel to a smaller displacement (lower torque, higher rotational speed), depending on the working pressure.
If the working pressure exceeds the pressure command value of the controller, the variable motor swivels to a larger displacement (higher torque, lower rotational speed).

- Pressure ratio p_{St}/p_{HD} = 5/100 (NG60 to 215)
- Pressure ratio p_{St}/p_{HD} = 3/100 (NG280)

DA control is only suitable for certain types of travel drive systems and requires review of the motor and vehicle parameters to ensure that the motor is used correctly and that machine operation is safe and efficient. We recommend that all DA applications be reviewed by a Bosch Rexroth application engineer.
Our Sales department will provide you detailed information.

Notice
The beginning of control and the DA characteristic curve are influenced by case pressure. An increase in the case pressure causes a decrease / reduction in the beginning of control (see page 8) and thus a parallel displacement of the characteristic curve.

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
DA with throttle pin on one side, throttling occurs from $V_{g\,min}$ to $V_{g\,max}$. (see table)

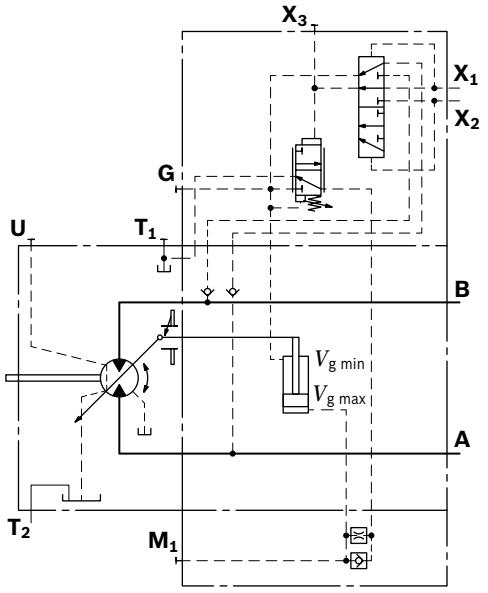
▼ **Throttle pin overview**

Size	60	85	115	150	170	215	280
Groove size [mm]	0.45	0.45	0.55	0.55	0.55	0.65	2×1.0

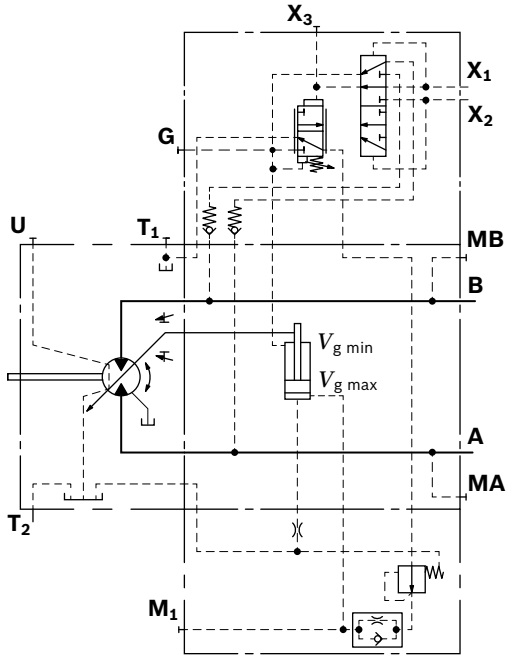
DA0, DA7
Hydraulic travel direction valve, negative control
Dependent on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressure connections X_1 or X_2.

Direction of rotation	Working pressure in	Pilot pressure in
Clockwise	**A**	X_1
Counterclockwise	**B**	X_2

▼ **Circuit diagram DA0 size 60 to 215**



▼ **Circuit diagram DA7 size 280**



DA1, DA2 Electric travel direction valve + electric $V_{g\,max}$ override, negative control

Depending on the direction of rotation (direction of travel), the travel direction valve is actuated through the compression spring or the switching solenoid **a**.
When switching solenoid **b** is energized, the control can be overridden and the motor can be swiveled to maximum displacement (high torque, lower rotational speed) (electric $V_{g\,max}$ override).

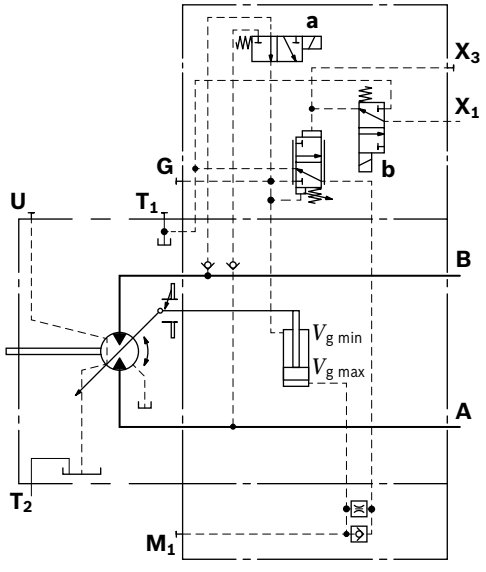
Travel direction valve, electric

Technical data, solenoid a with ø37		DA1	DA2
Voltage		12 V (±20%)	24 V (±20%)
Direction of rotation	Working pressure in		
Counterclockwise	**B**	de-energized	de-energized
Clockwise	**A**	energized	energized
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 70			

Electric override

Technical data, solenoid b with ø37	R1	R2
Voltage	12 V (±20%)	24 V (±20%)
No override	de-energized	de-energized
Position $V_{g\,max}$	energized	energized
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 70		

▼ **Circuit diagram DA1, DA2 size 60 to 215**



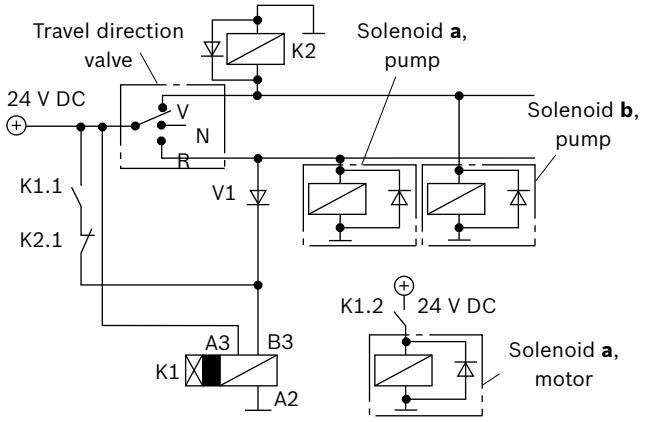
Electric travel direction valve (for DA, HA.R)

Application in travel drives in closed circuits. The travel direction valve of the motor is actuated by an electric signal that also switches the swivel direction of the travel drive pump (e.g. A4VG with DA control valve).
If the pump in the closed circuit is switched to the neutral position or into reverse, the vehicle may experience jerky deceleration or braking, depending on the vehicle weight and current travel speed.
When the travel direction valve of the pump (e.g. 4/3-way directional valve of the DA-control) is switched to

- the neutral position,the electric circuitry, which must be logically coordinated with the pump control system, causes the previous signal on the travel direction valve on the motor to be retained.
- Reversing, the electric circuitry causes the travel direction valve on the motor to switch to the other travel direction following a time delay (approx. 0.8 s) with respect to the pump.

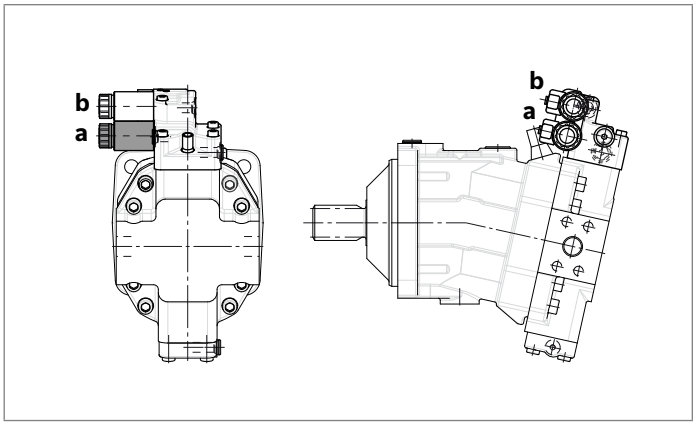
As a result, jerky deceleration or braking is prevented in both cases.

▼ **Circuit diagram, electric travel direction valve**

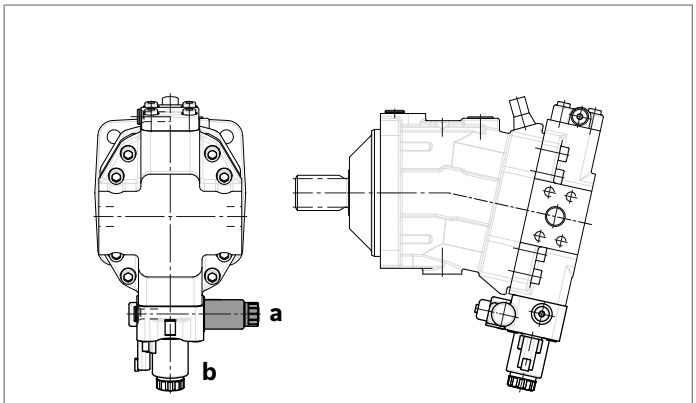


Notice
The shown diodes and relays are not included in the scope of delivery of the motor.

Control DA1, DA



▼ **Control, HA1R., HA2R.**

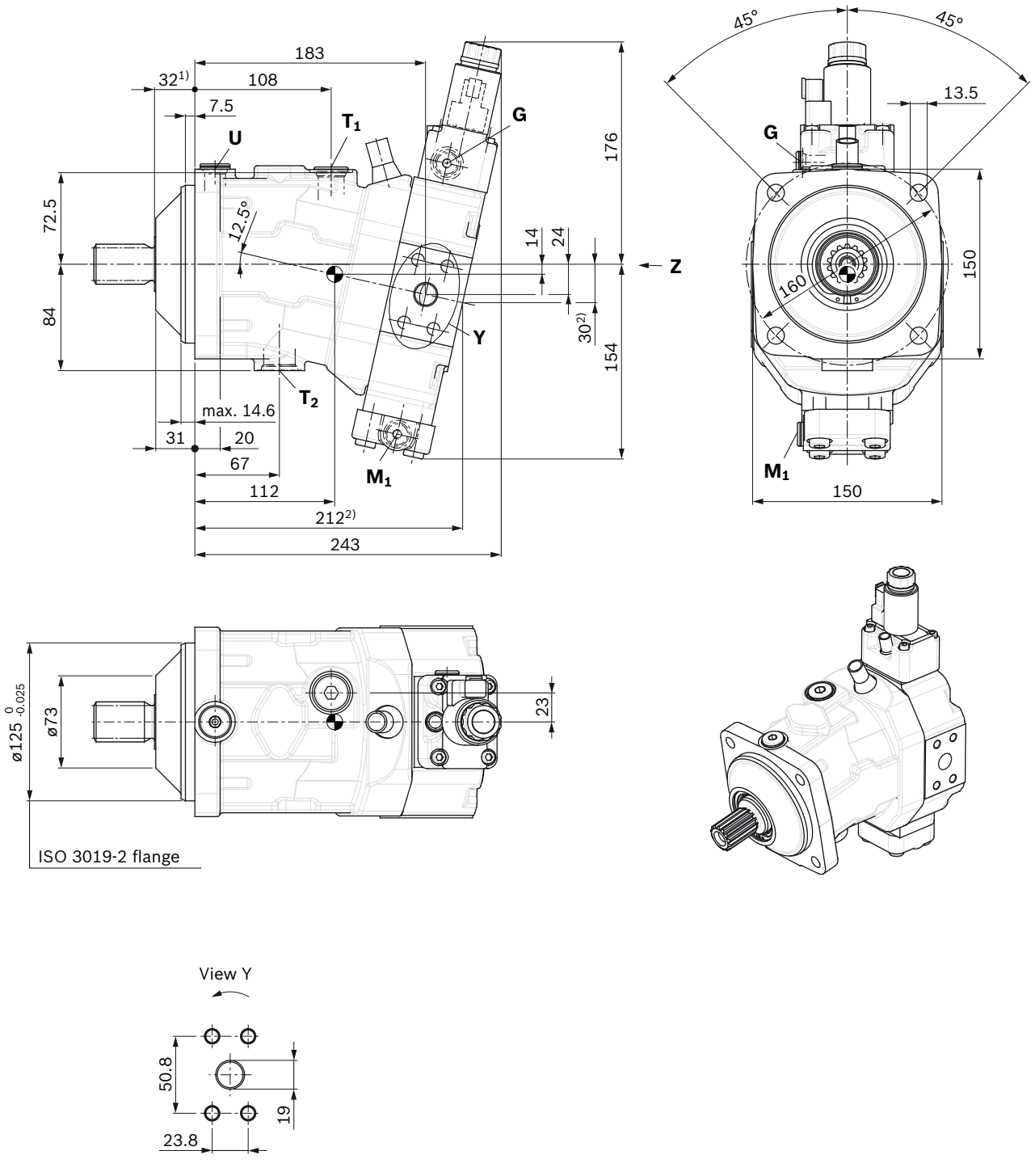


Switching solenoid **a** on travel direction valve

Dimensions, size 60

EP5, EP6 – Proportional electric control, negative control

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

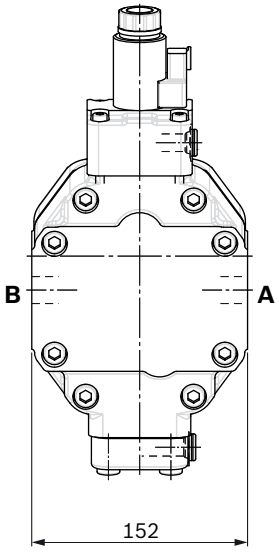


Center of gravity

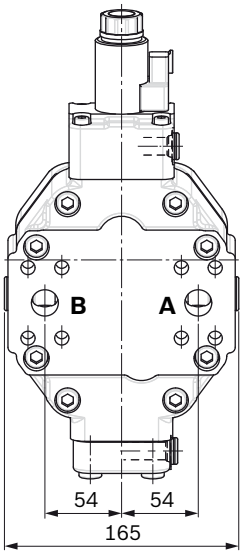
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

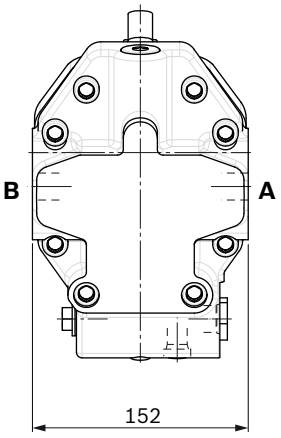
2 SAE working ports **A** and **B** at side, opposite



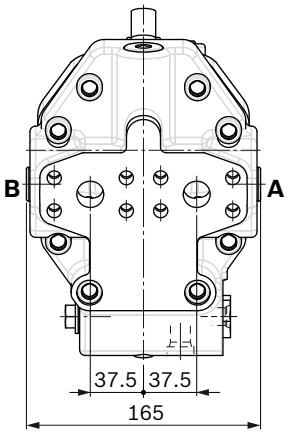
1 SAE working ports **A** and **B** at rear



2 SAE working ports **A** and **B** at side, opposite, only HZ7, EZ7/8

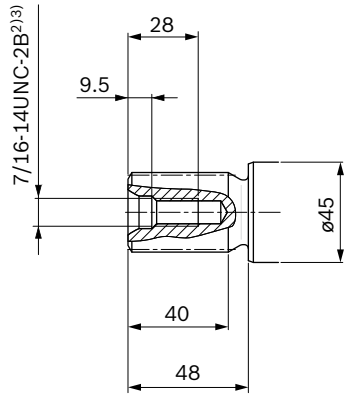


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



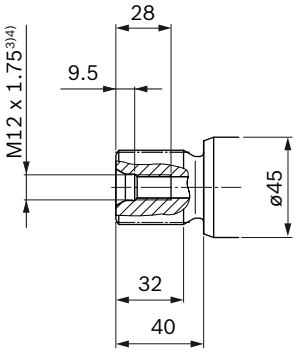
▼ **SAE J744 splined shaft**

S7 – 1 1/4 in 14T 12/24DP[1)]



▼ **DIN 5480 splined shaft**

Z8 – W35×2×16×9g

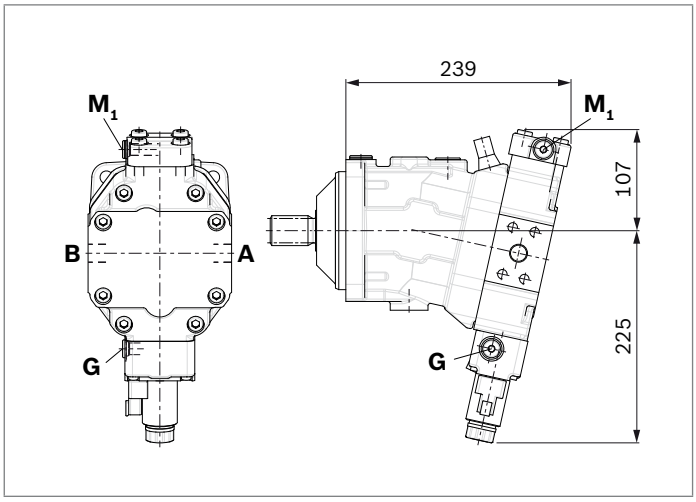


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For notes on tightening torques, see the instruction manual.
4) Center bore according to DIN 332 (thread according to DIN 13)

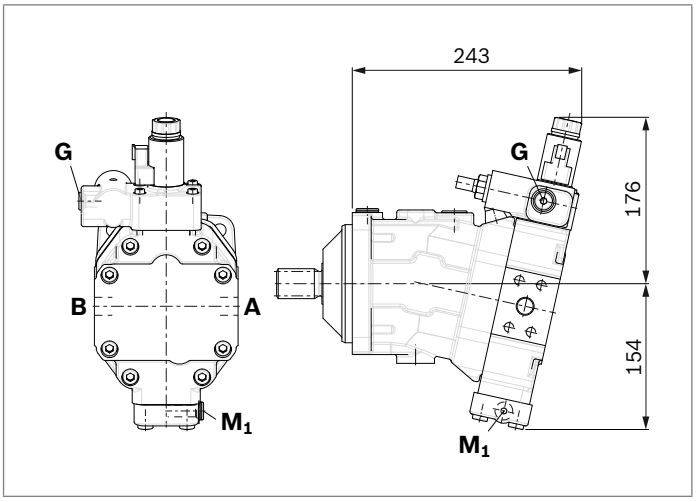
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	3/4 in M10 × 1.5; 17 deep	530	O
T_1	Drain port	ISO 6149[5]	M22 × 1.5; 15.5 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M27 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

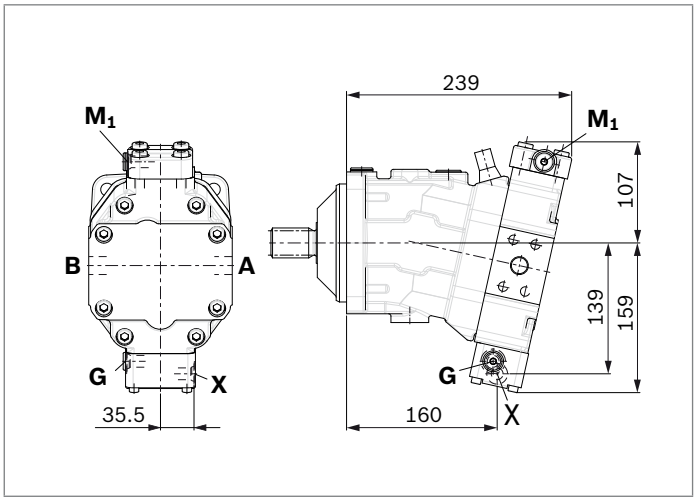
▼ **EP1, EP2** – Proportional electric control, positive control



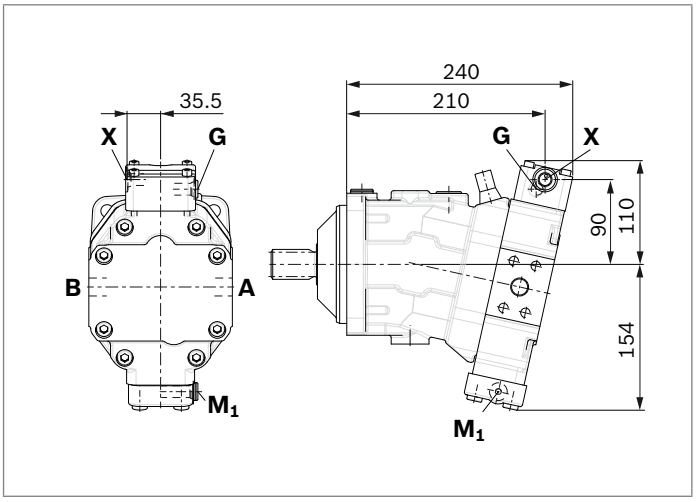
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



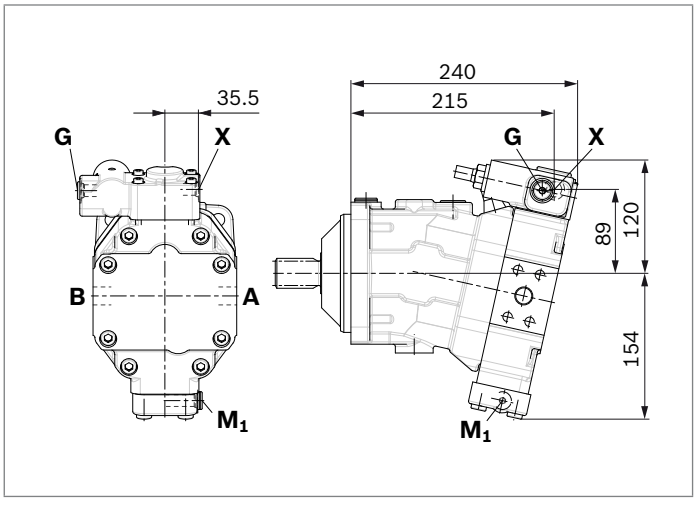
▼ **HP1, HP2** – Proportional hydraulic control, positive control



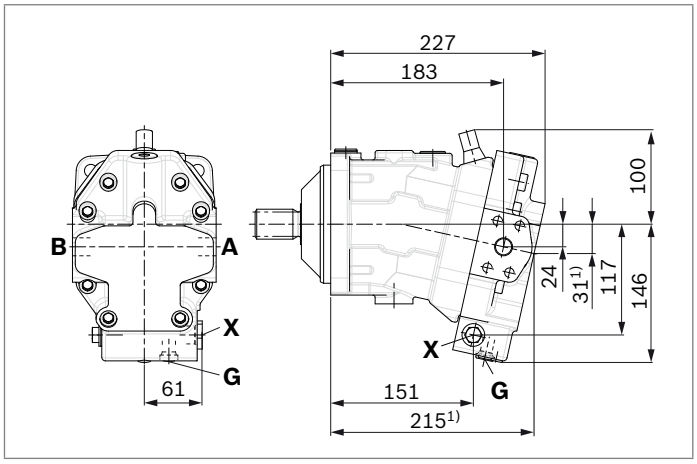
▼ **HP5, HP6** – Proportional hydraulic control, negative control



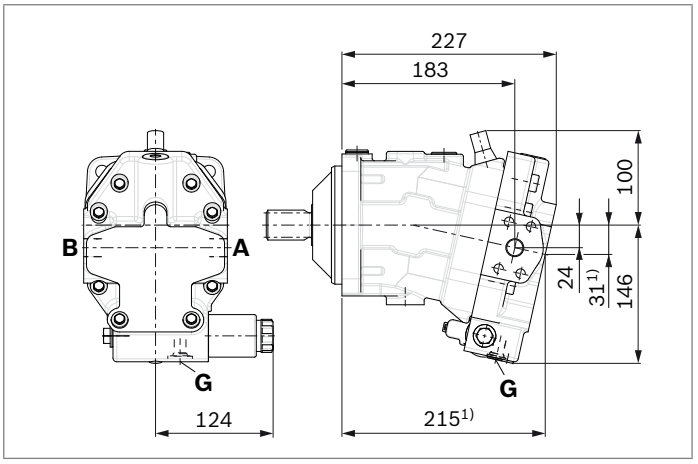
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



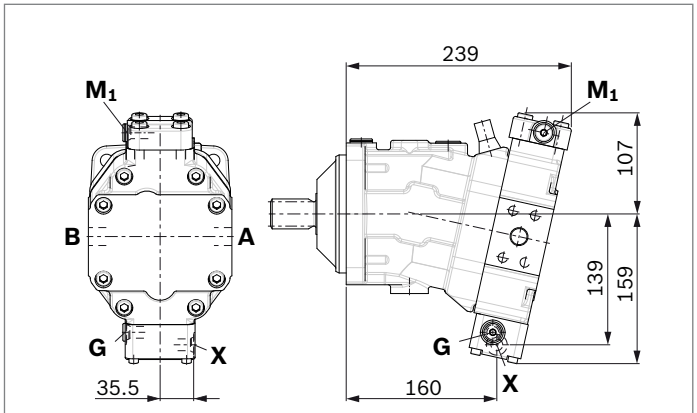
▼ **HZ7** – Two-point hydraulic control, negative control



▼ **EZ7, EZ8** – Two-point electric control, negative control



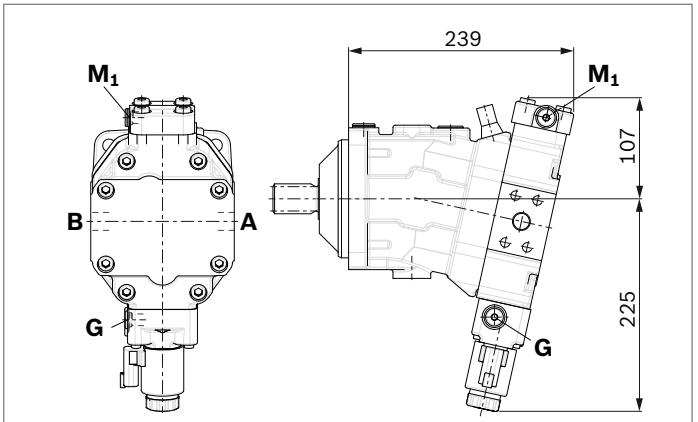
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



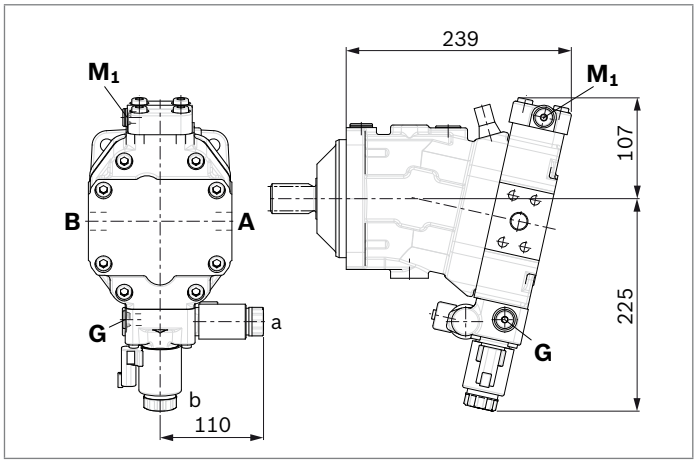
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point

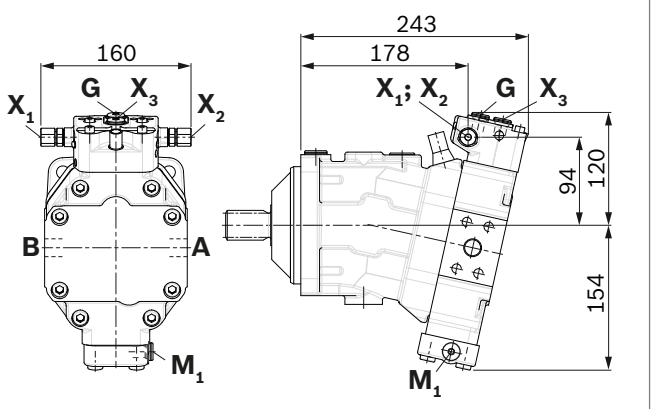


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



1) Port plate 1 - SAE working ports **A** and **B** at rear

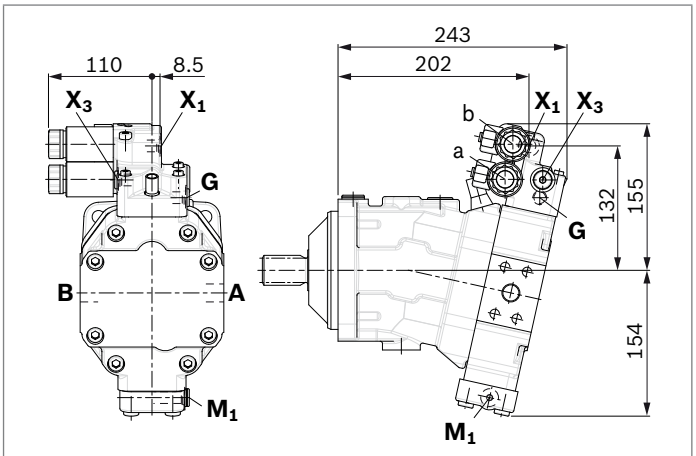
▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1

Use assembled fitting!

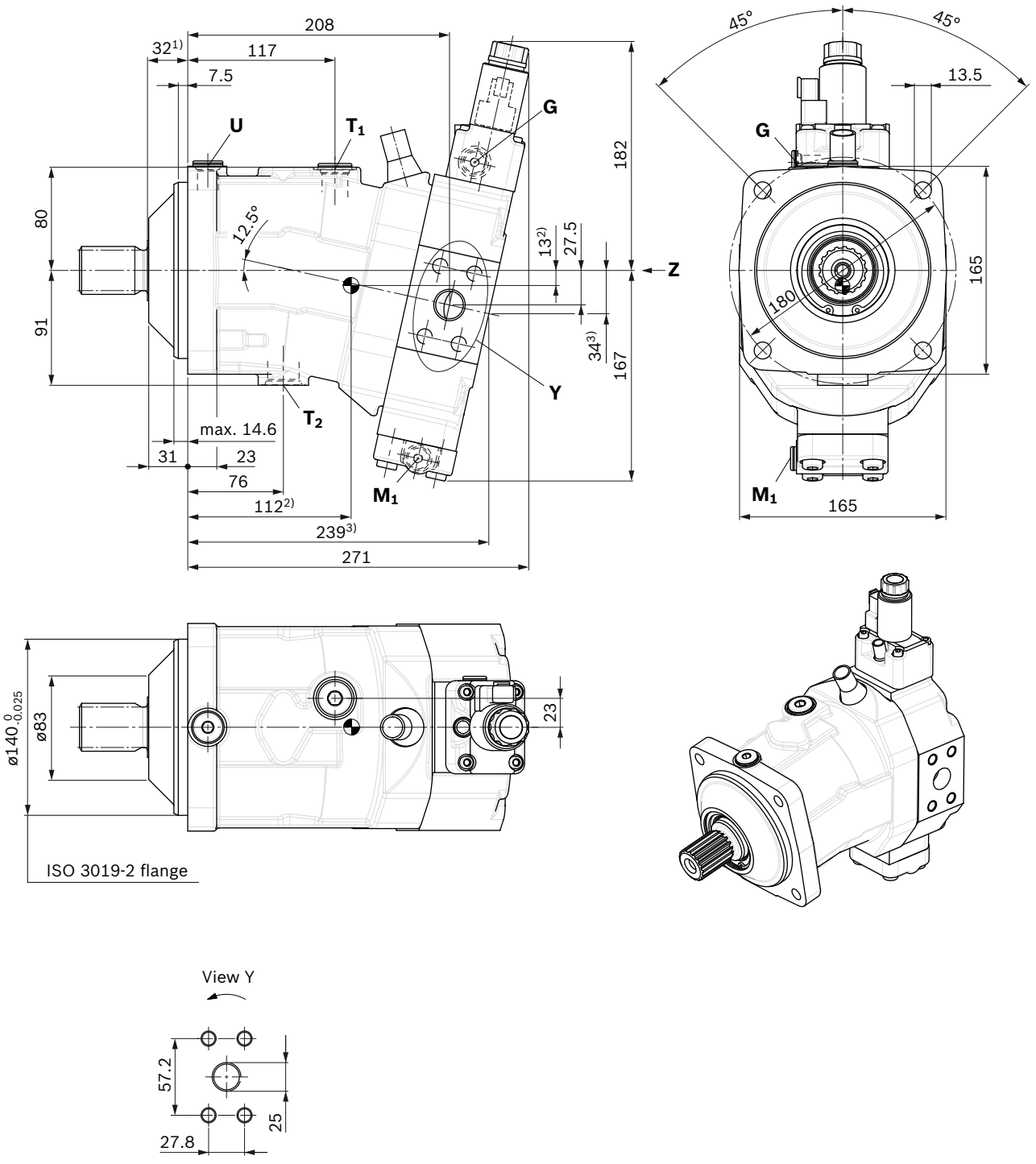
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 85

EP5, EP6 – Proportional electric control, negative control

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

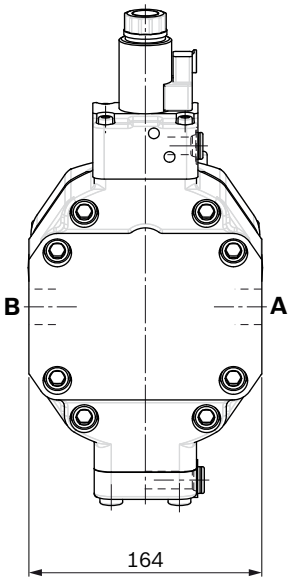


Center of gravity

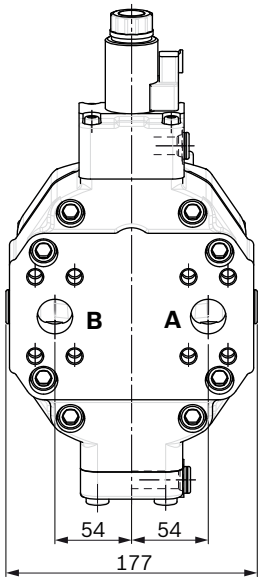
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

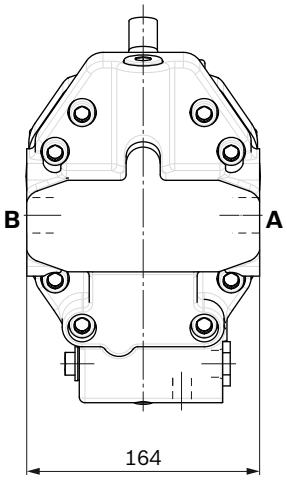
2 SAE working ports **A** and **B** at side, opposite



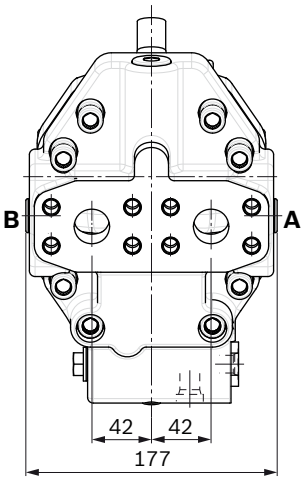
1 SAE working ports **A** and **B** at rear



2 SAE working ports **A** and **B** at side, opposite, only HZ7, EZ7/8

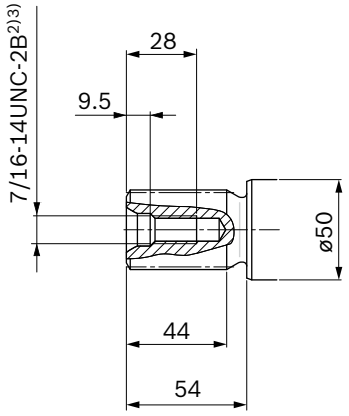


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



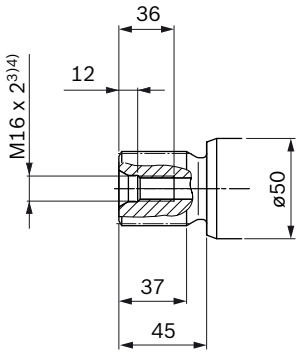
▼ **SAE J744 splined shaft**

S9 – 1 1/2 in 17T 12/24DP[1)]



▼ **DIN 5480 splined shaft**

Z9 – W40×2×18×9g

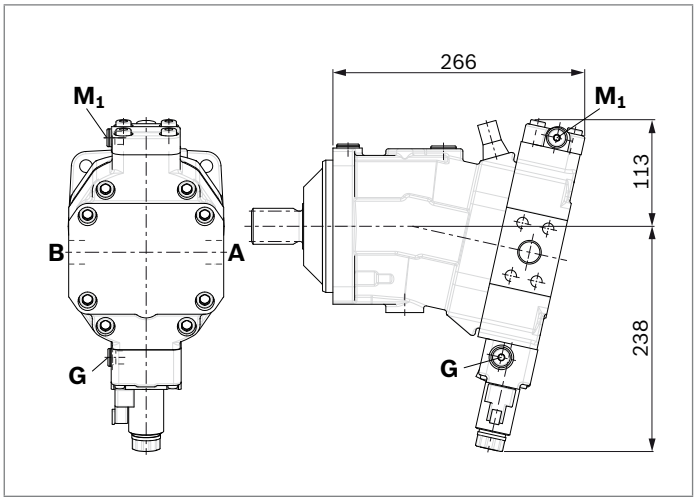


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

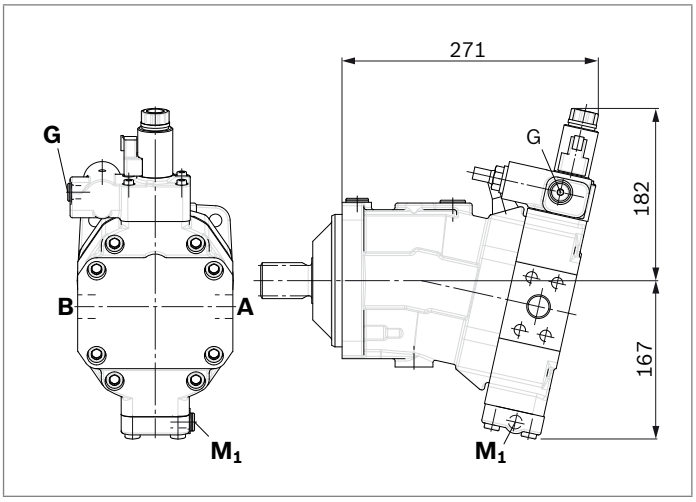
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 in M12 × 1.75; 17 deep	530	O
T_1	Drain port	ISO 6149[5]	M22 × 1.5; 15.5 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M27 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = must be connected (comes plugged)
X = plugged (in normal operation)

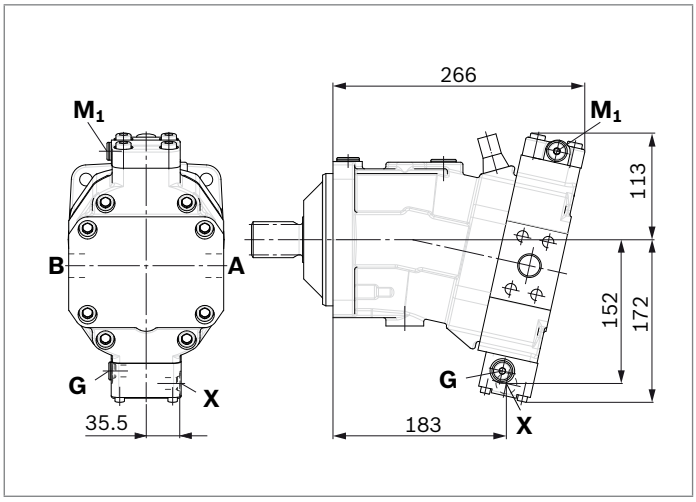
▼ **EP1, EP2** – Proportional electric control, positive control



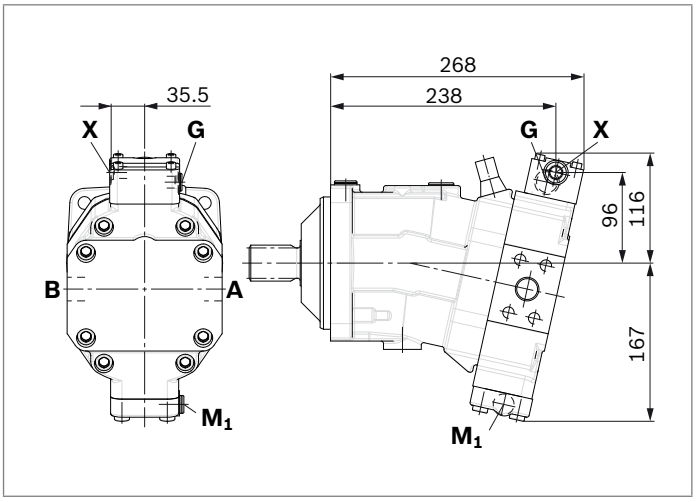
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



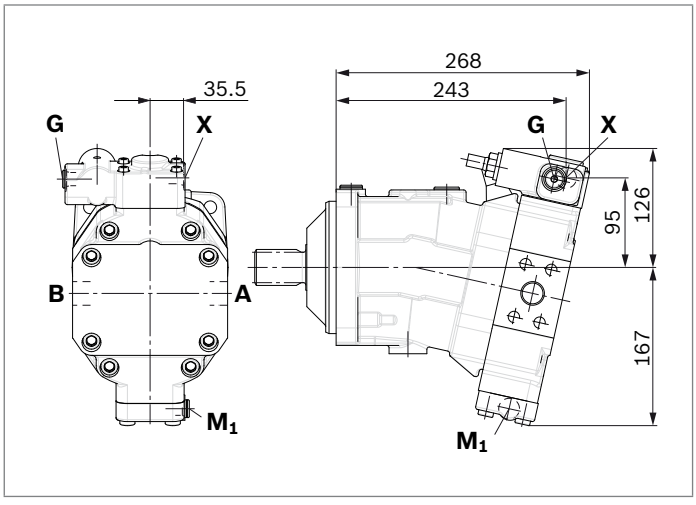
▼ **HP1, HP2** – Proportional hydraulic control, positive control



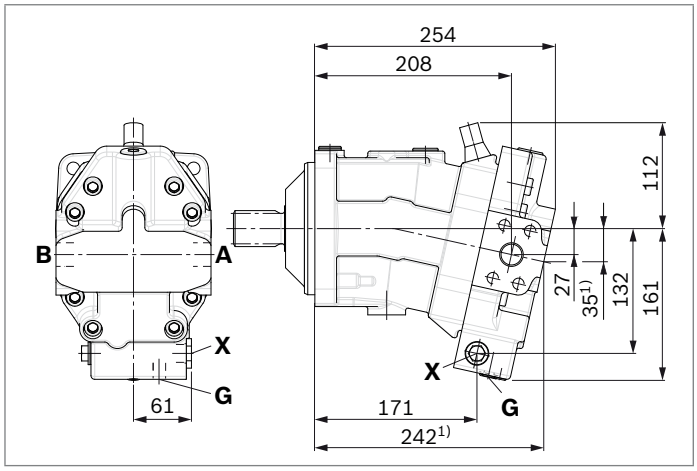
▼ **HP5, HP6** – Proportional hydraulic control, negative control



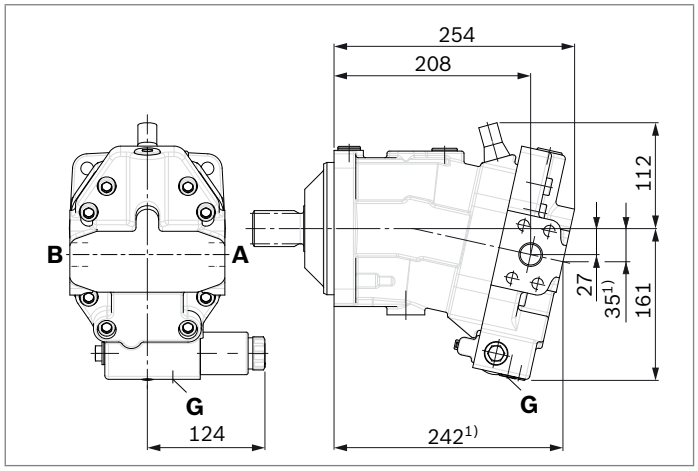
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



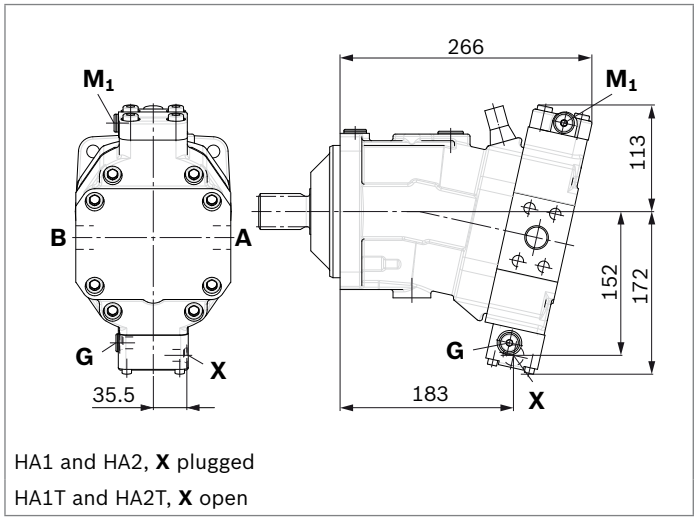
▼ **HZ7** – Two-point hydraulic control, negative control



▼ **EZ7, EZ8** – Two-point electric control, negative control



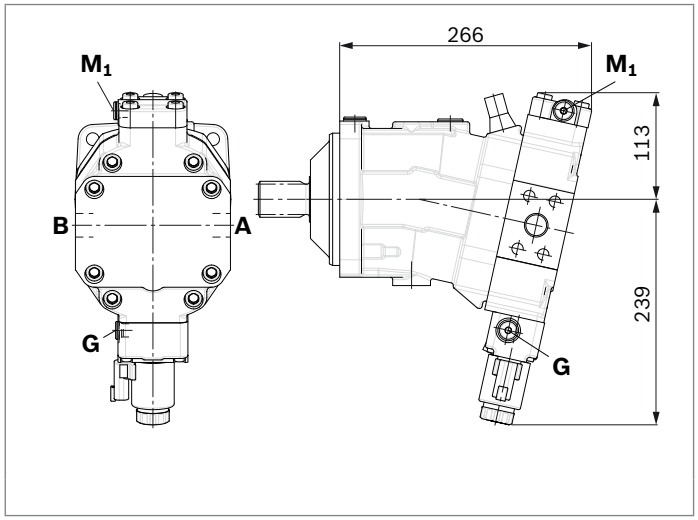
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



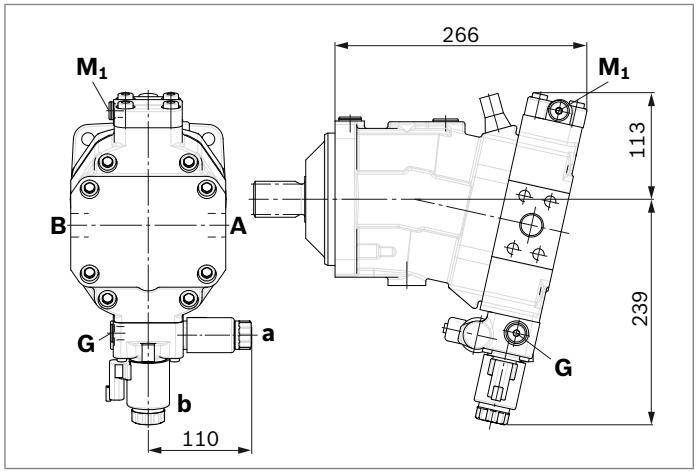
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point

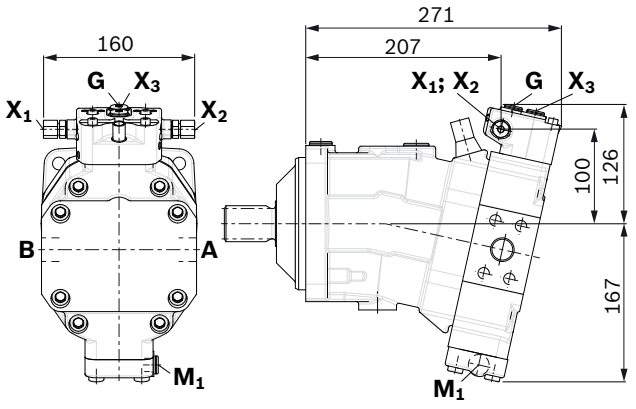


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



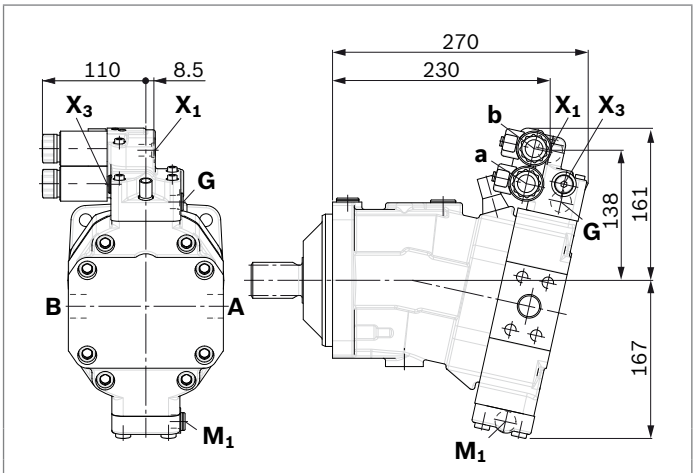
1) Port plate 1 - SAE working ports **A** and **B** at rear

▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

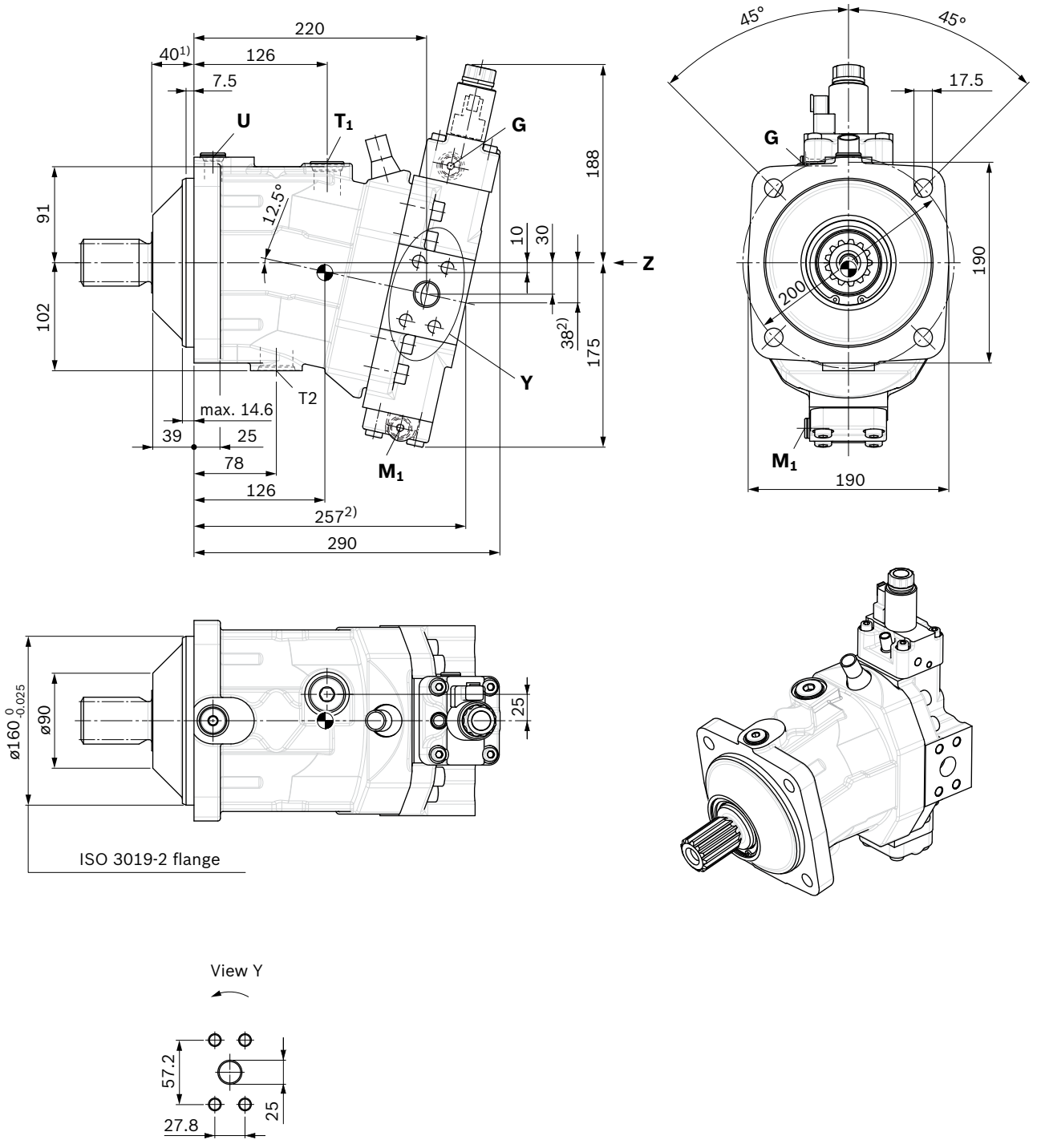
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 115

EP5, EP6 – Proportional electric control, negative control

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

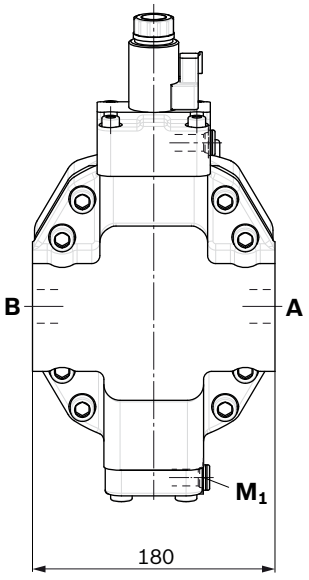


Center of gravity

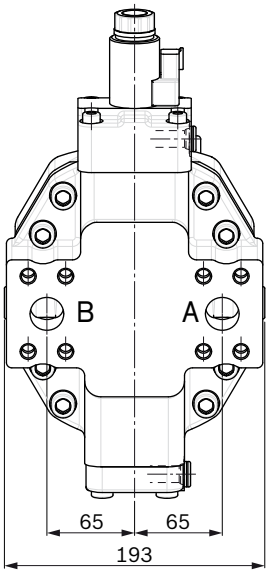
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

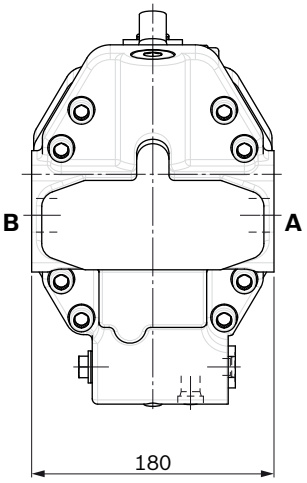
2 SAE working ports **A** and **B** at side, opposite



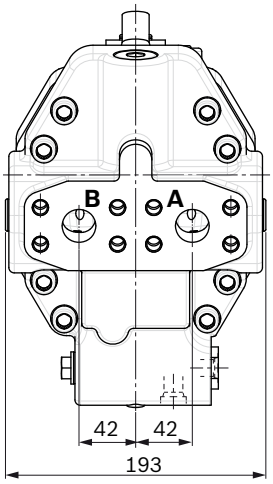
1 SAE working ports **A** and **B** at rear



2 SAE working ports **A** and **B** at side, opposite, only HZ7, EZ7/8

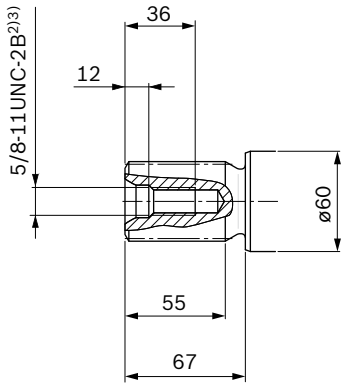


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



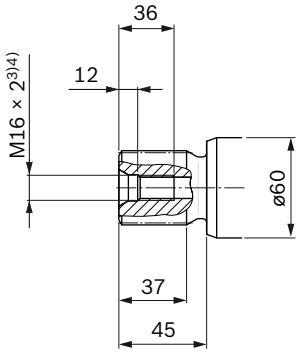
▼ SAE J744 splined shaft

T1 – 1 3/4 in 13T 8/13DP[1)]



▼ DIN 5480 splined shaft

Z9 – W40×2×18×9g

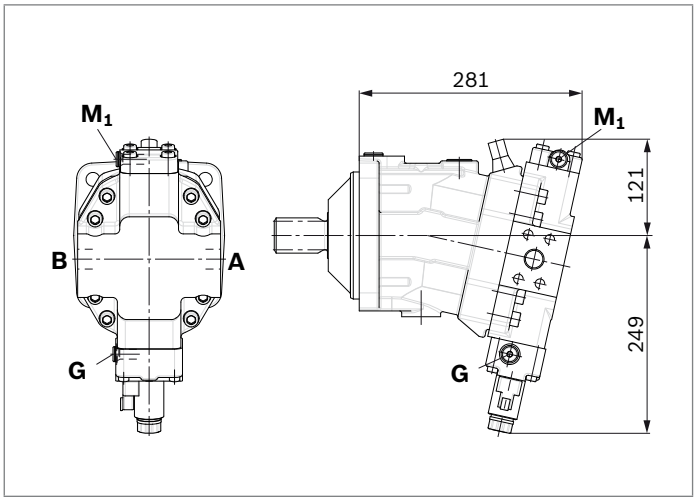


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

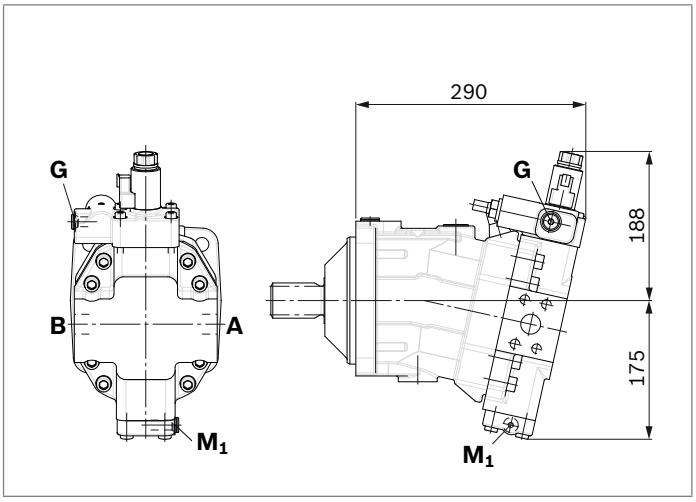
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 in M12 × 1.75; 17 deep	530	O
T_1	Drain port	ISO 6149[5]	M27 × 2; 19 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M33 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

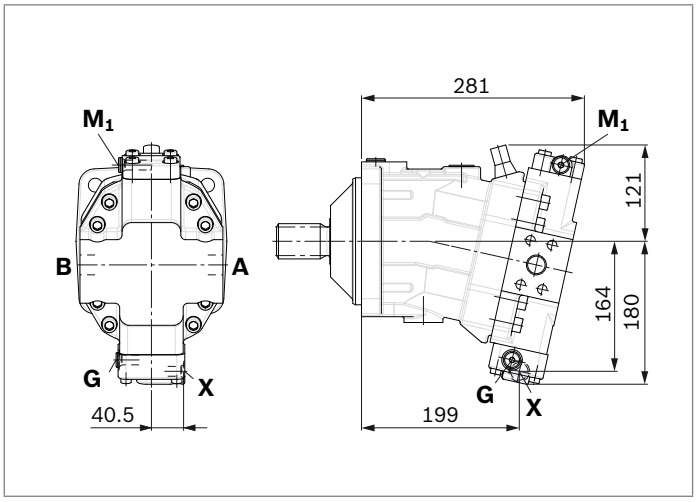
▼ **EP1, EP2** – Proportional electric control, positive control



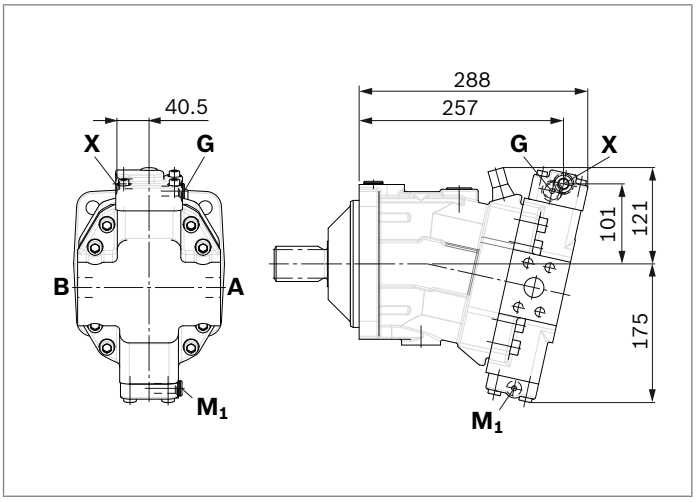
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



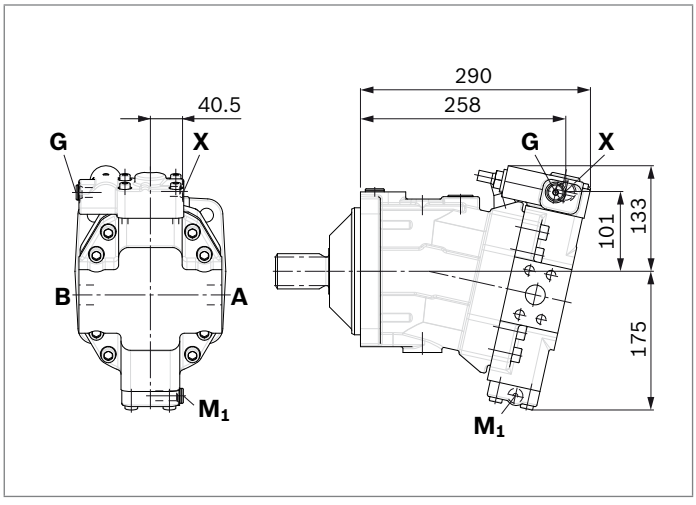
▼ **HP1, HP2** – Proportional hydraulic control, positive control



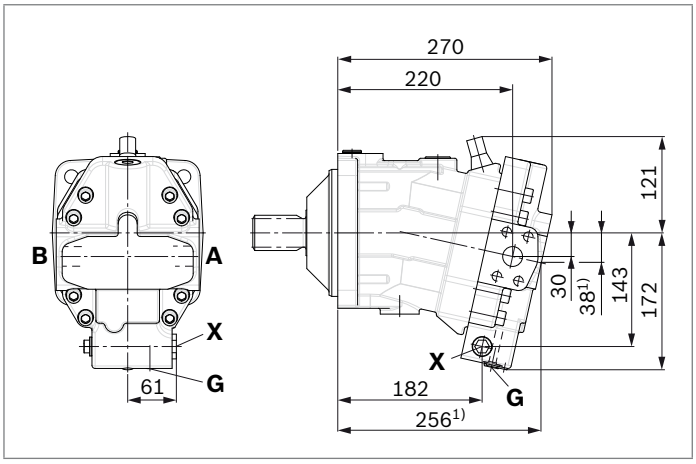
▼ **HP5, HP6** – Proportional hydraulic control, negative control



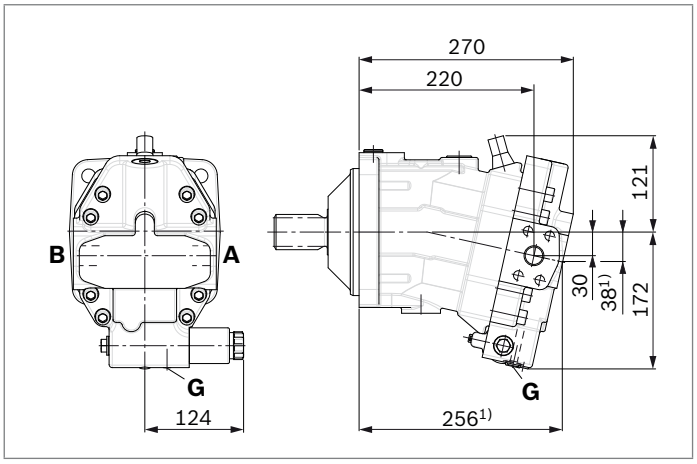
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



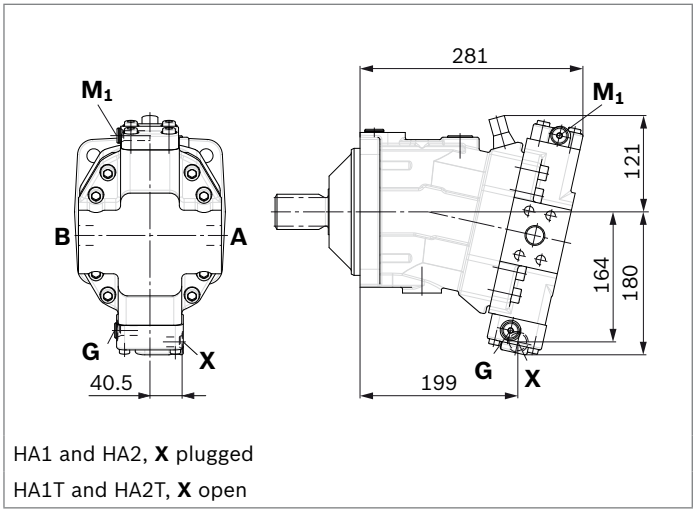
▼ **HZ7** – Two-point hydraulic control, negative control



▼ **EZ7, EZ8** – Two-point electric control, negative control

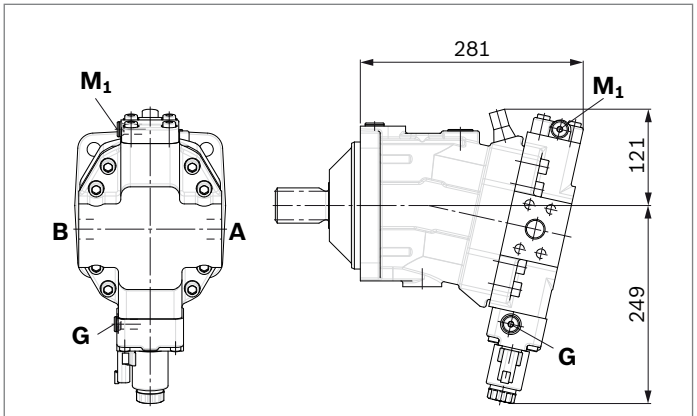


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

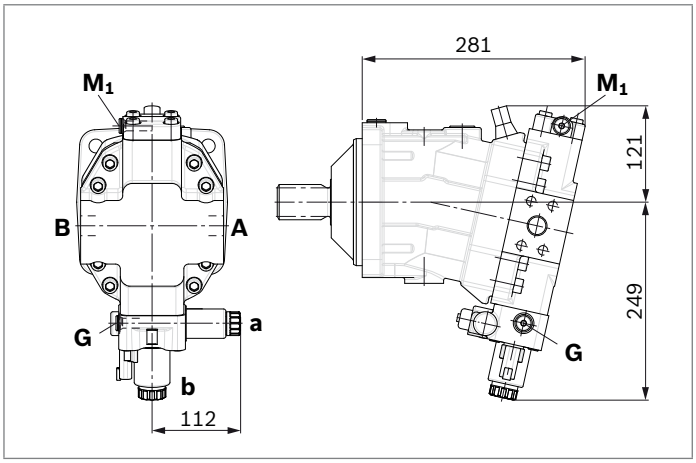


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point

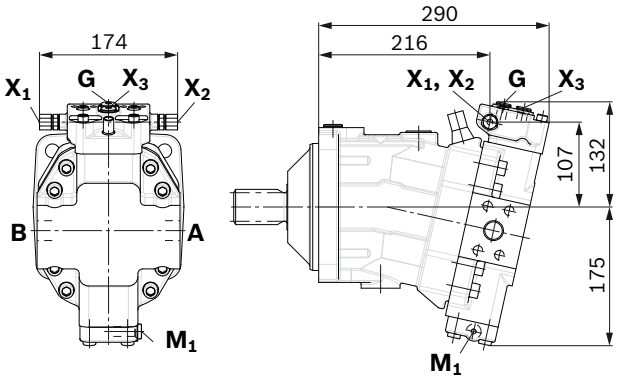


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



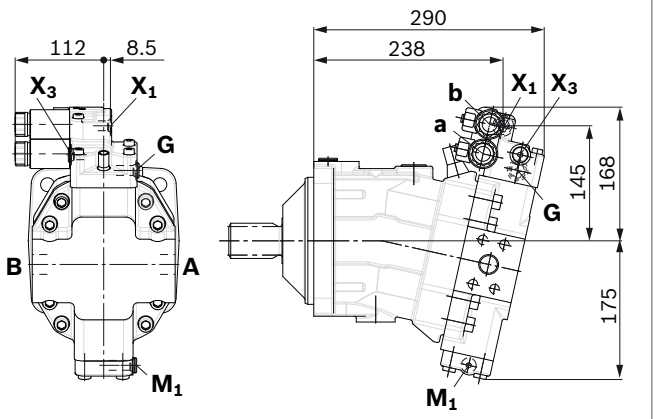
1) Port plate 1 - SAE working ports **A** and **B** at rear

▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

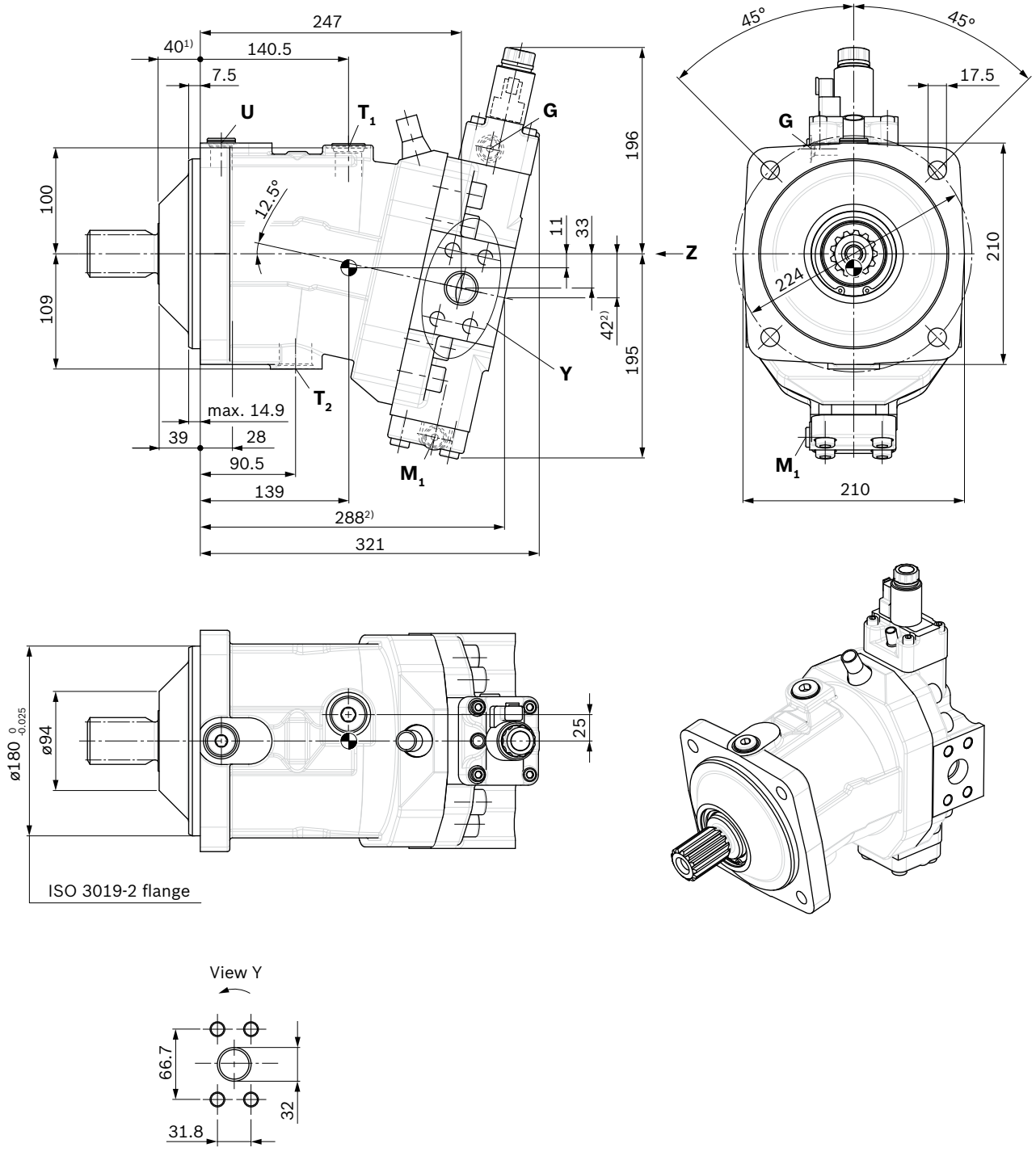
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 150

EP5, EP6 – Proportional electric control, negative control

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

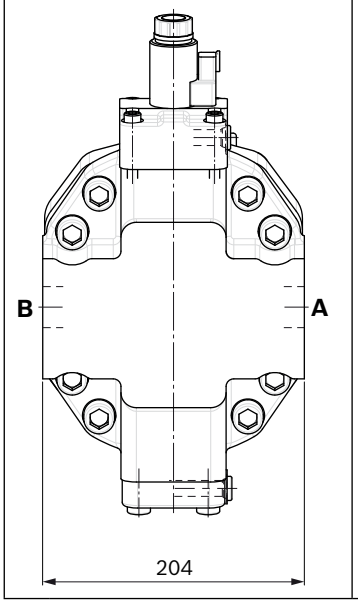


Center of gravity

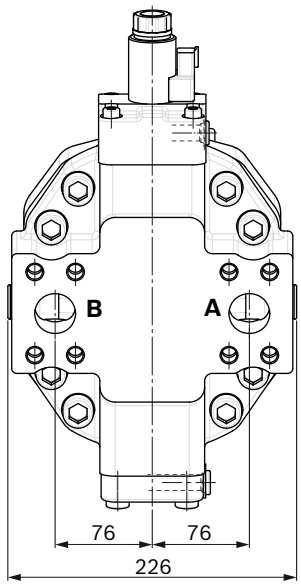
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

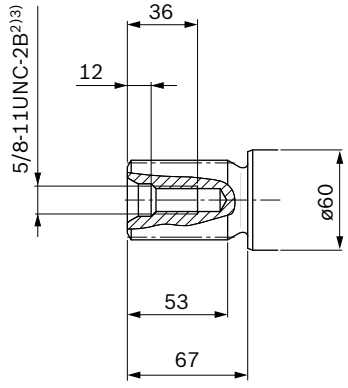


1 SAE working ports **A** and **B** at rear



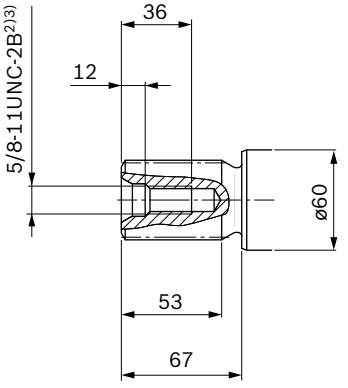
▼ **SAE J744 splined shaft**

T1 – 1 3/4 in 13T 8/16DP[1)]



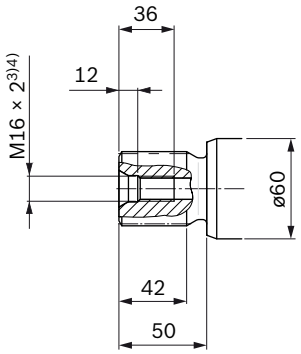
▼ **SAE J744 splined shaft**

T2 – 2 in 15T 8/16DP[1)]



▼ **DIN 5480 splined shaft**

A1 – W45×2×21×9g

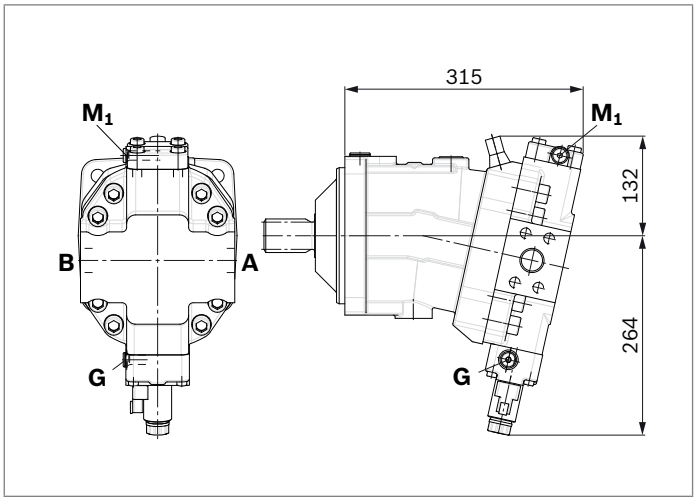


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

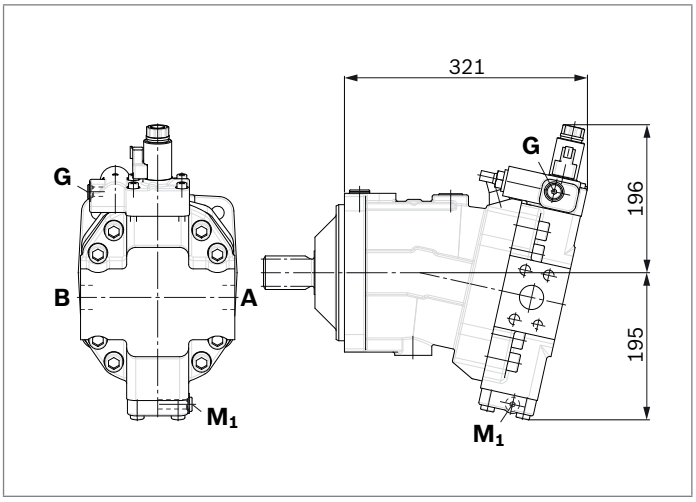
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
T_1	Drain port	ISO 6149[5]	M27 × 2; 19 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M33 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

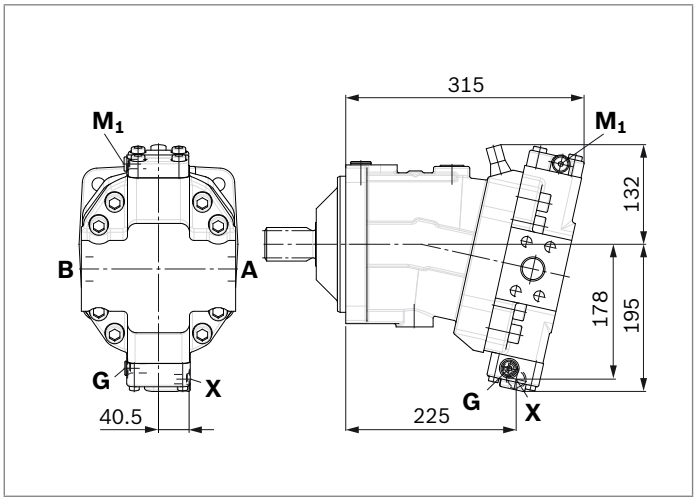
▼ **EP1, EP2** – Proportional electric control, positive control



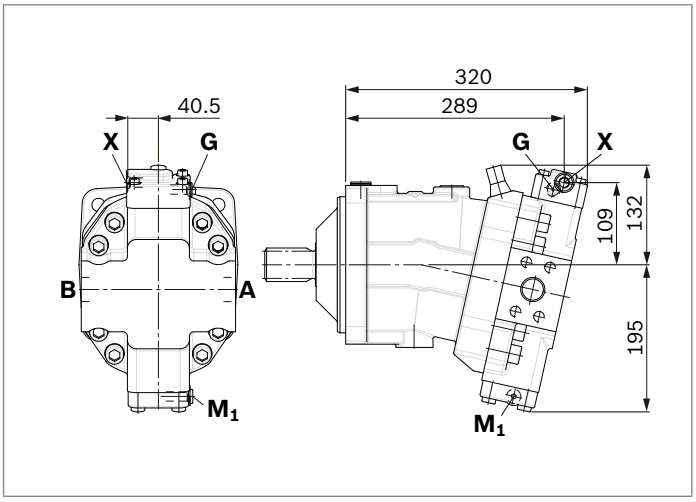
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



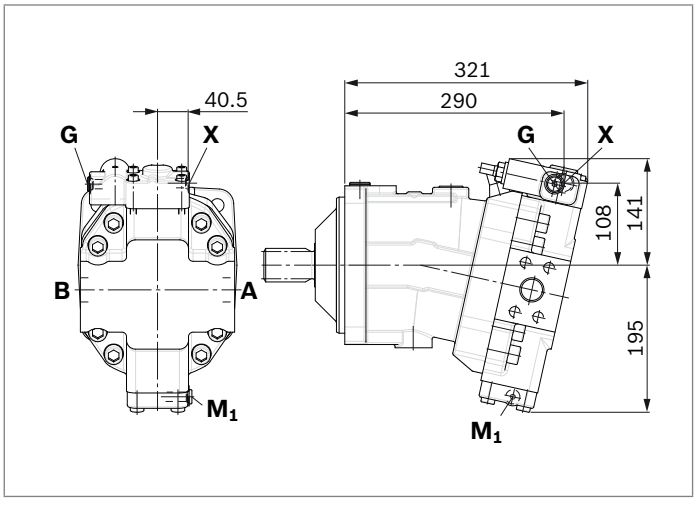
▼ **HP1, HP2** – Proportional hydraulic control, positive control



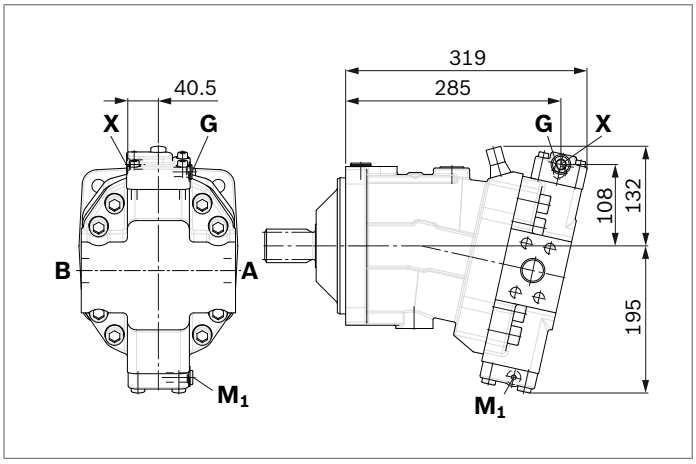
▼ **HP5, HP6** – Proportional hydraulic control, negative control



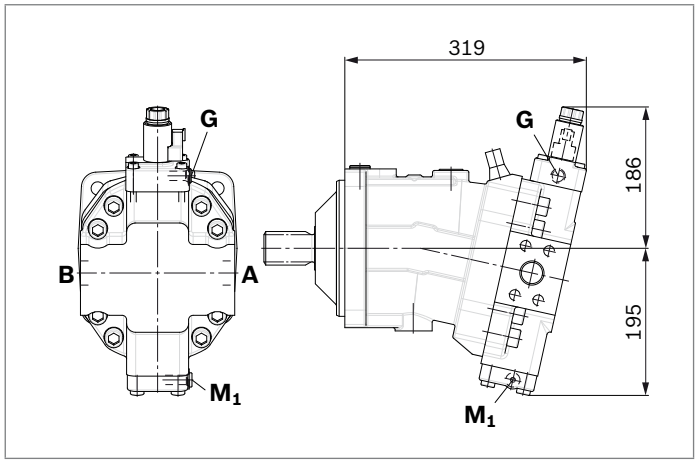
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



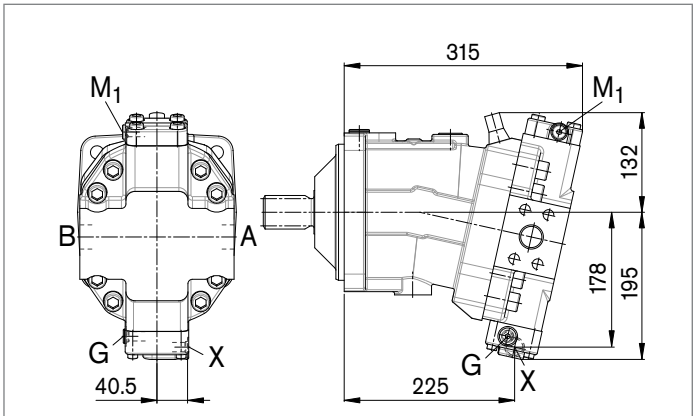
▼ **HZ5** – Two-point hydraulic control, negative control



▼ **EZ5, EZ6** – Two-point electric control, negative control



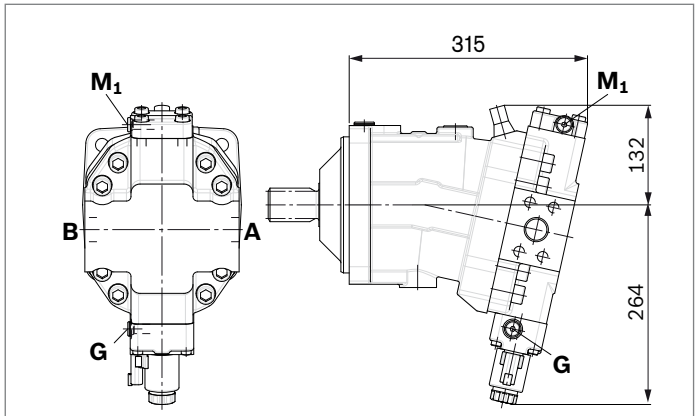
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



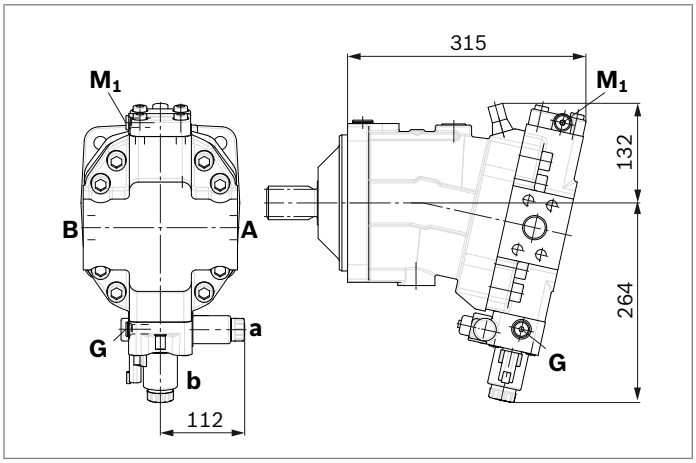
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

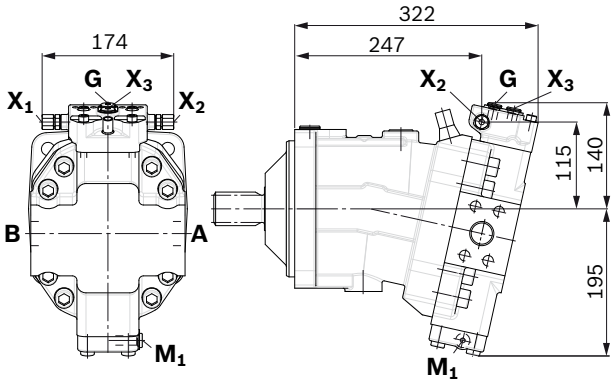
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve

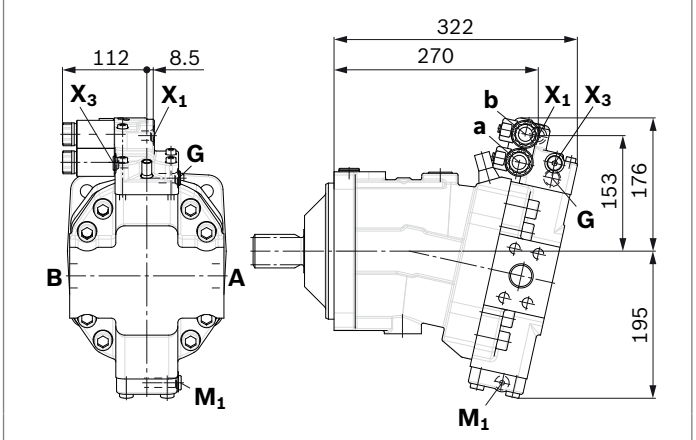


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

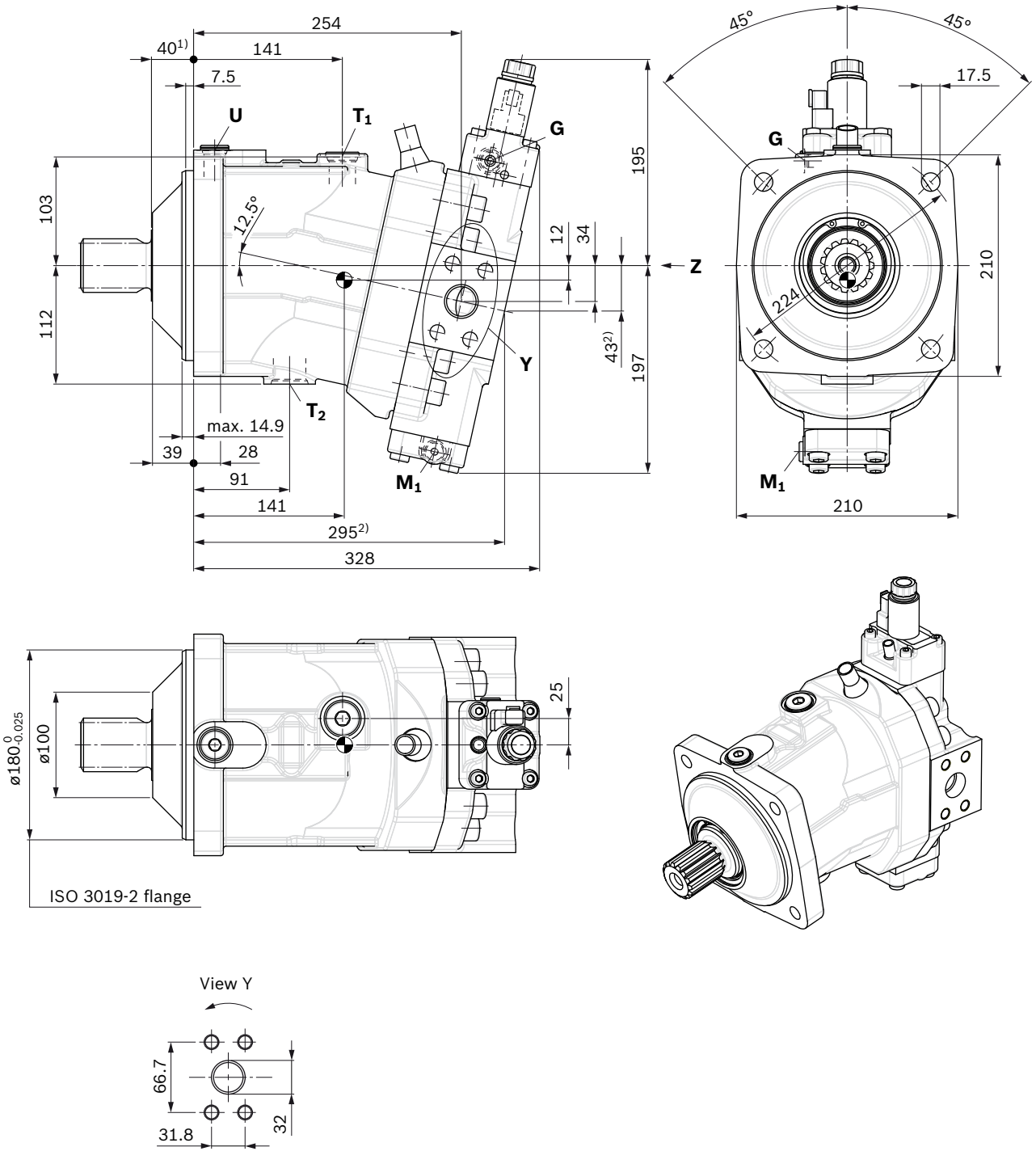
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 170

EP5, EP6 – Proportional electric control, negative control

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

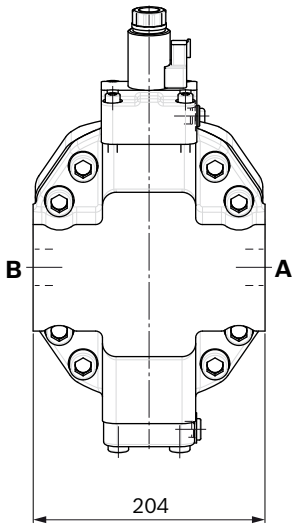


Center of gravity

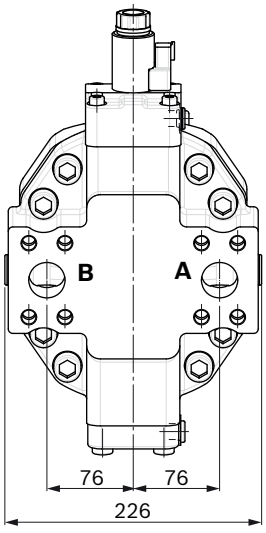
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

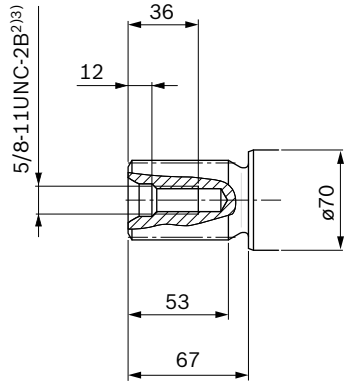


1 SAE working ports **A** and **B** at rear



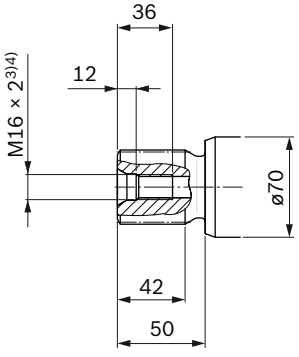
▼ **SAE J744 splined shaft**

T2 – 2 in 15T 8/16DP[1)]



▼ **DIN 5480 splined shaft**

A1 – W45×2×21×9g

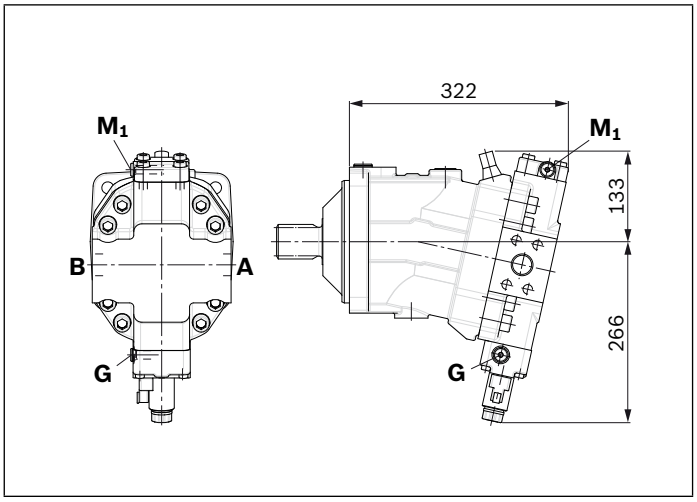


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

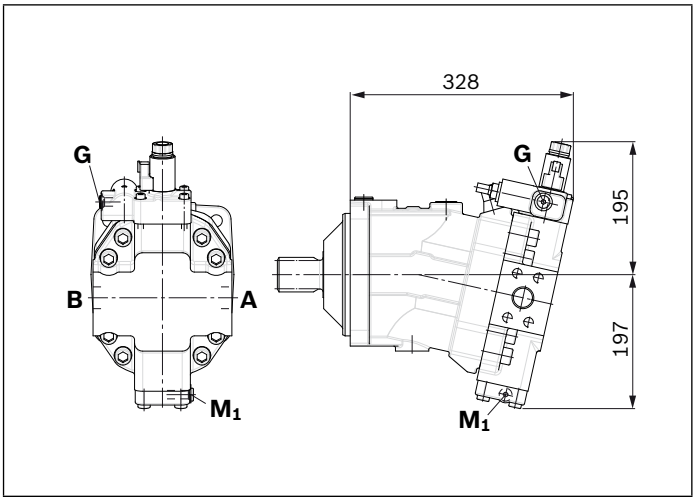
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
T_1	Drain port	ISO 6149[5]	M27 × 2; 19 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M33 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

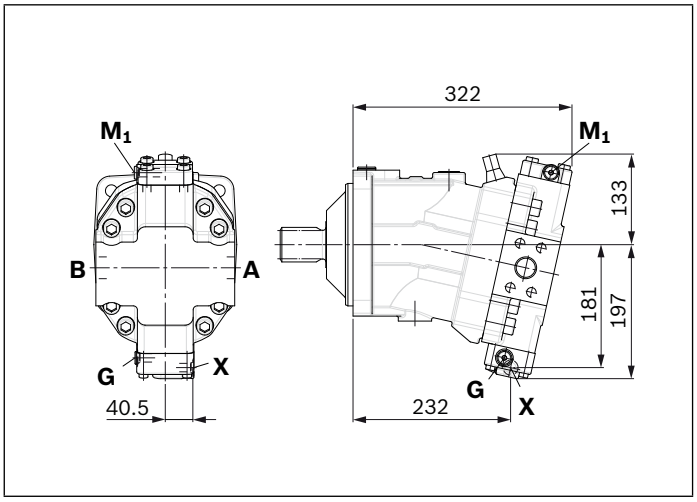
▼ **EP1, EP2** – Proportional electric control, positive control



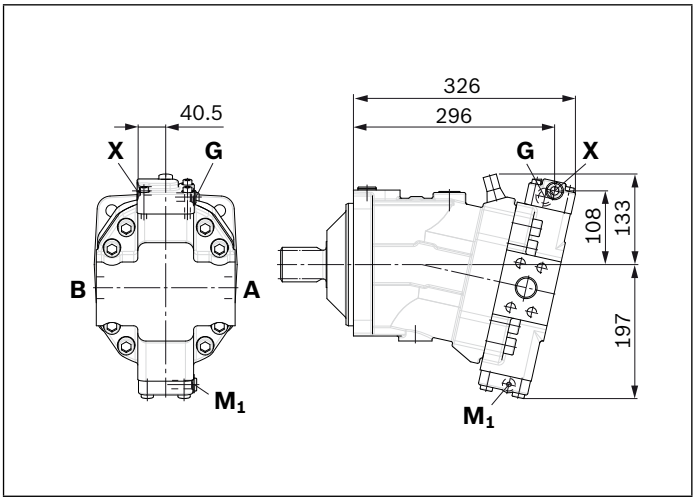
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



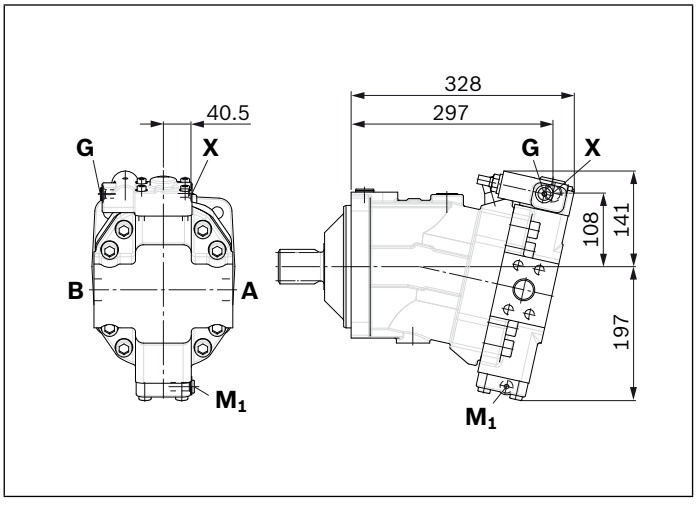
▼ **HP1, HP2** – Proportional hydraulic control, positive control



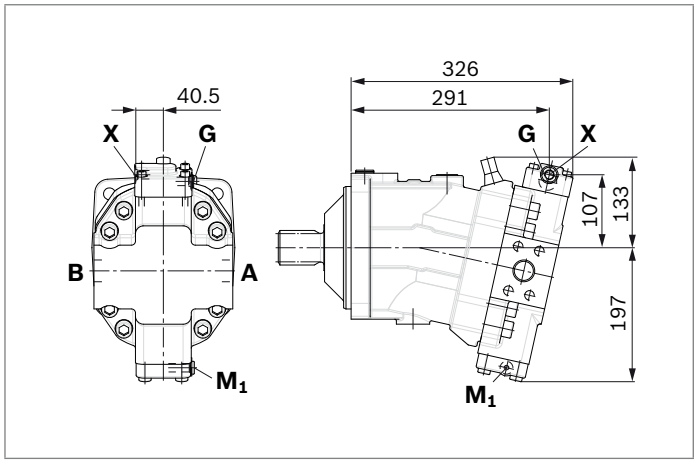
▼ **HP5, HP6** – Proportional hydraulic control, negative control



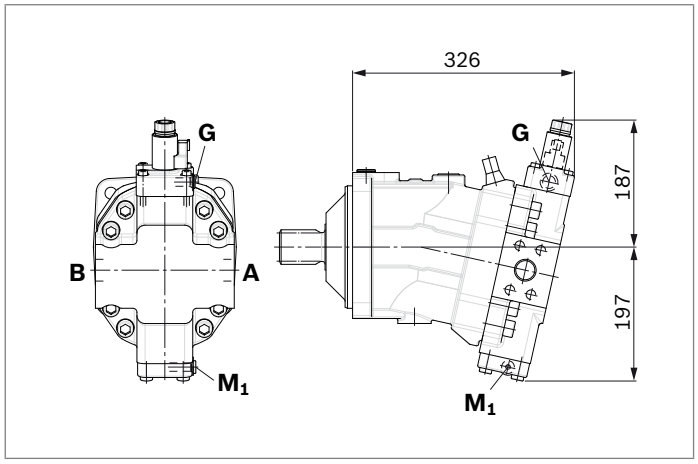
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



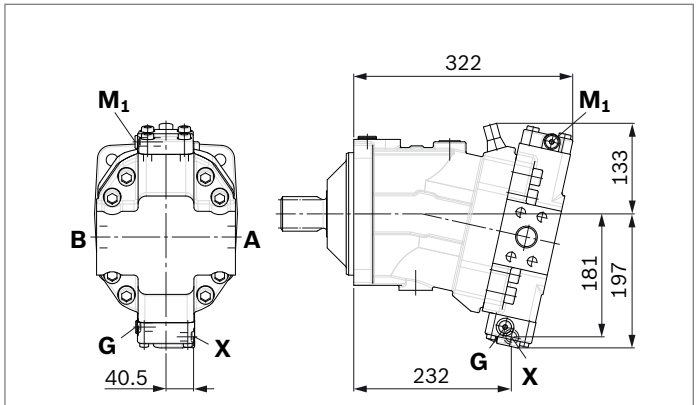
▼ **HZ5** – Two-point hydraulic control, negative control



▼ **EZ5, EZ6** – Two-point electric control, negative control



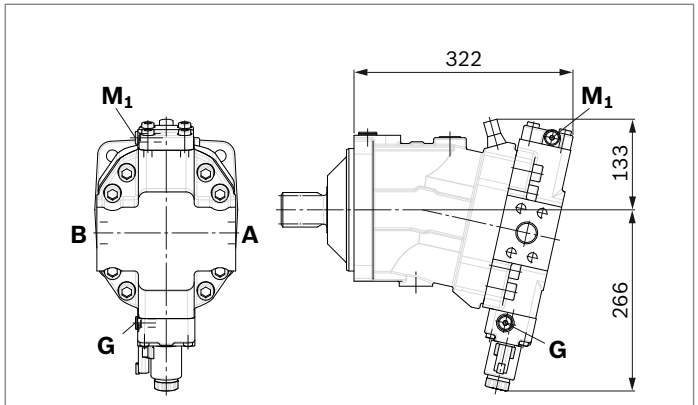
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



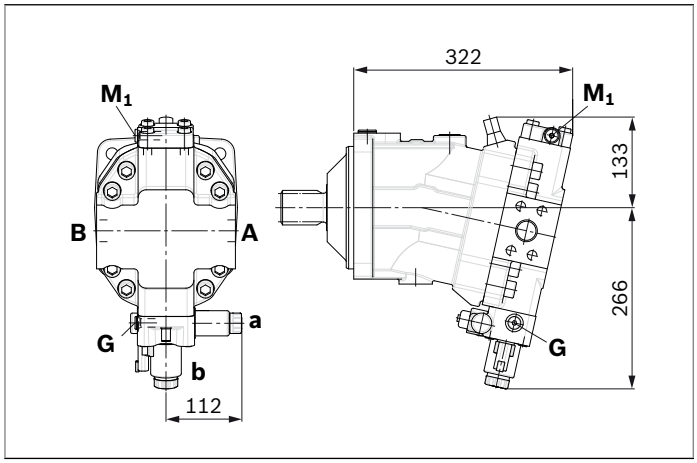
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

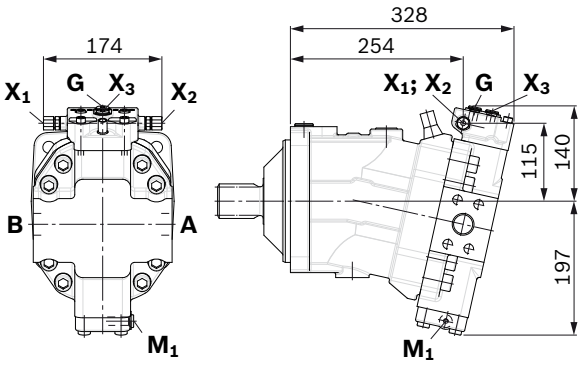
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve

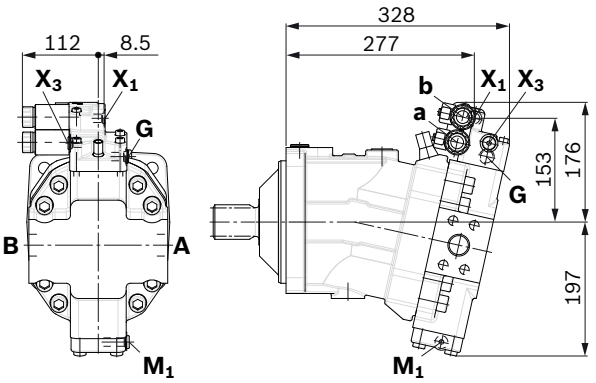


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

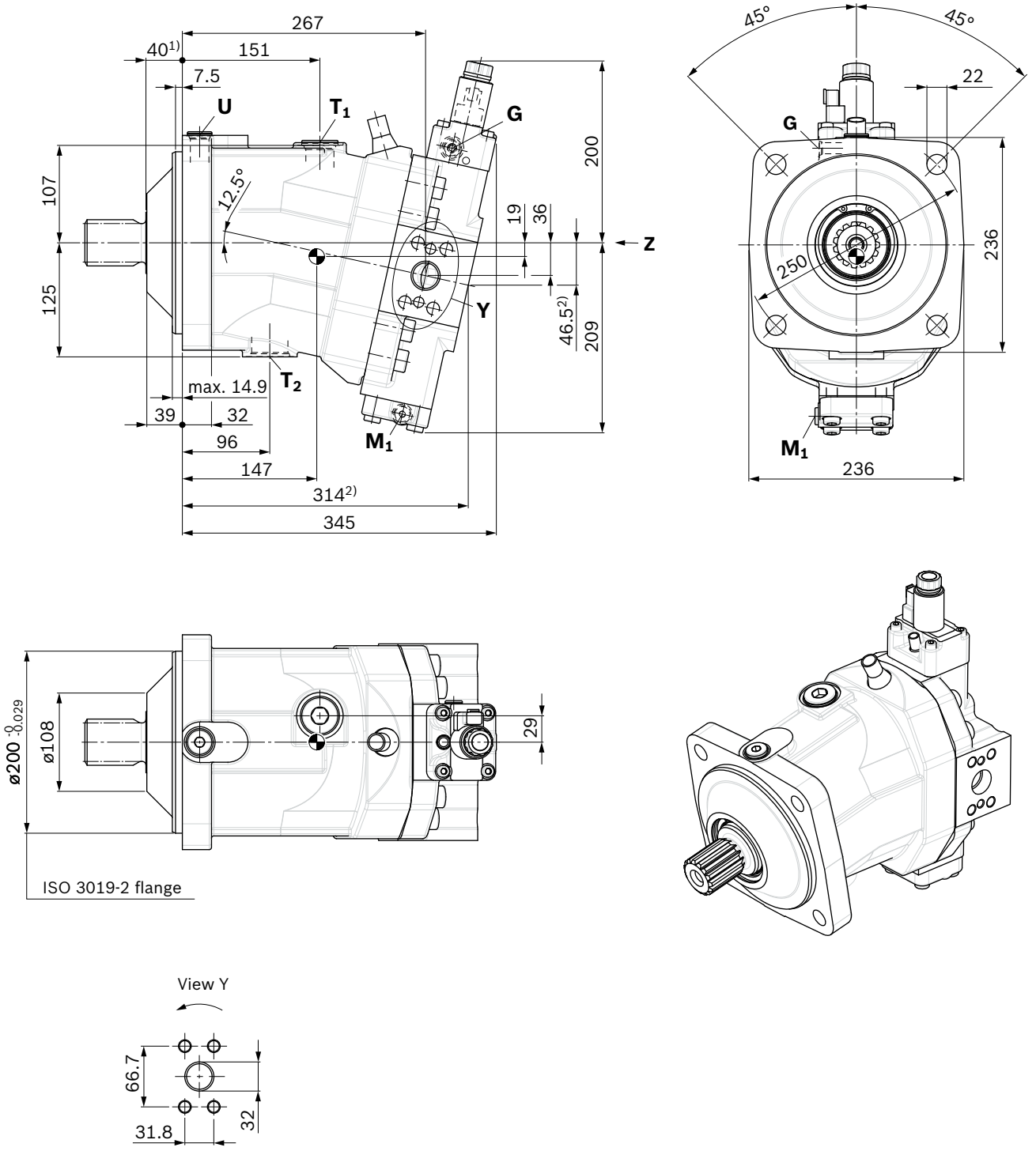
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 215

EP5, EP6 – Proportional electric control, negative control

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



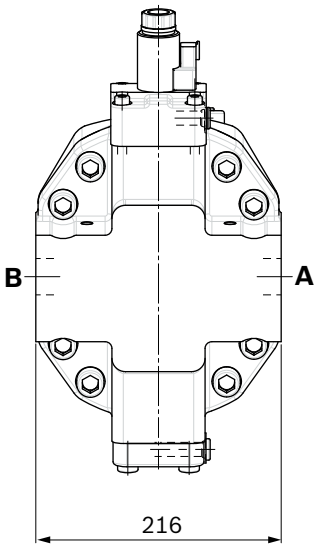
Center of gravity

1) To shaft collar

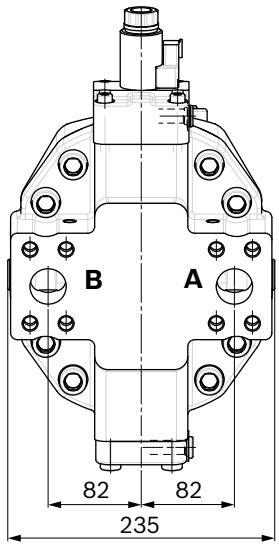
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

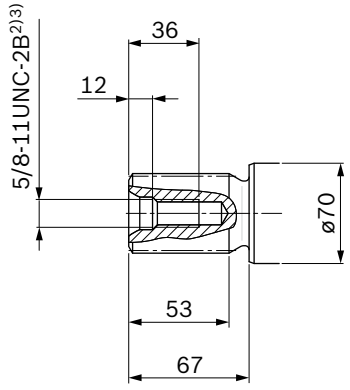


1 SAE working ports **A** and **B** at rear



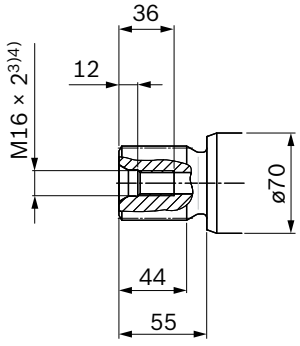
▼ **SAE J744 splined shaft**

T2 – 2 in 15T 8/16DP[1)]



▼ **DIN 5480 splined shaft**

A2 – W50×2×24×9g

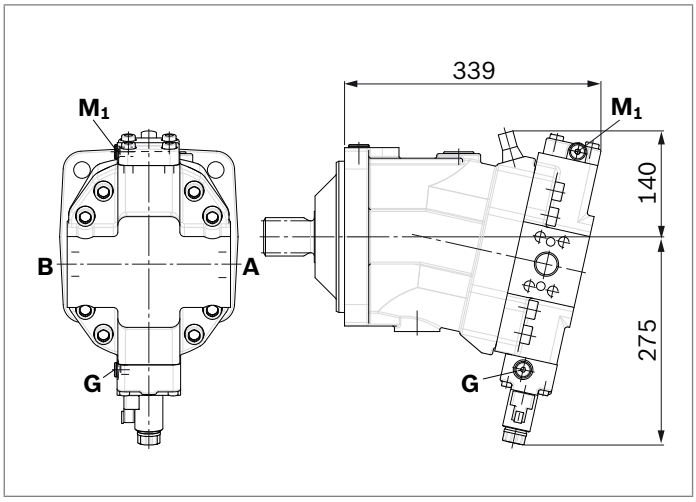


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

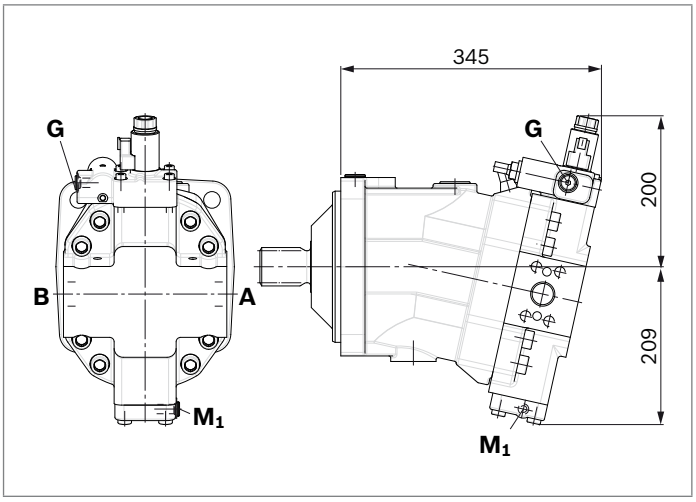
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
T_1	Drain port	ISO 6149[5]	M33 × 2; 19 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M42 × 2; 19.5 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[5]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA1, DA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Control pressure measuring port	ISO 6149[5]	M14 × 1.5; 11.5 deep	530	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

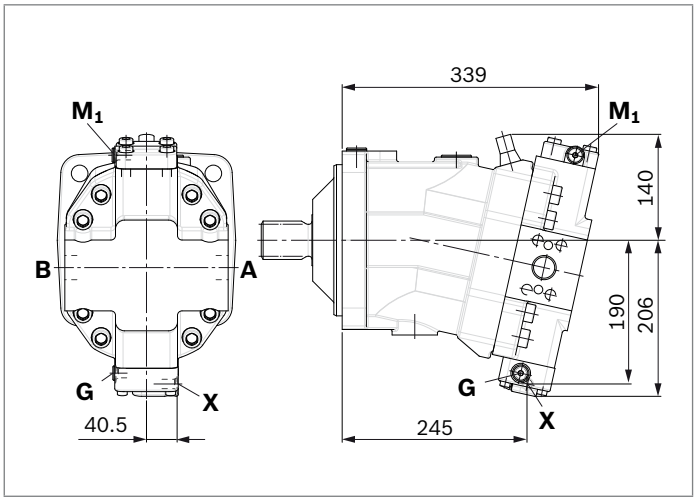
▼ **EP1, EP2** – Proportional electric control, positive control



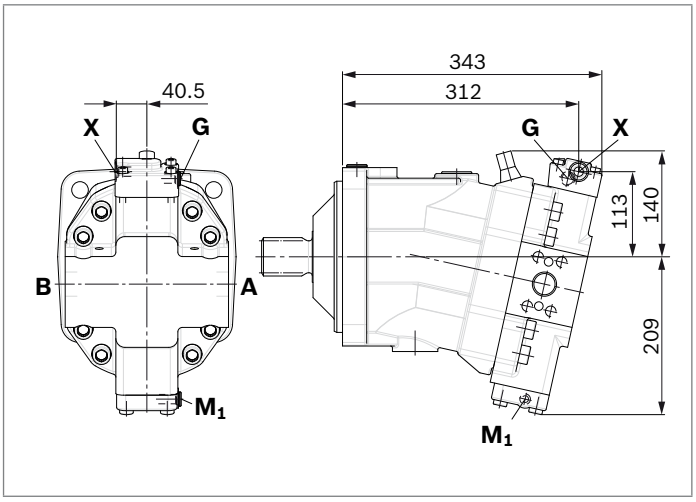
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



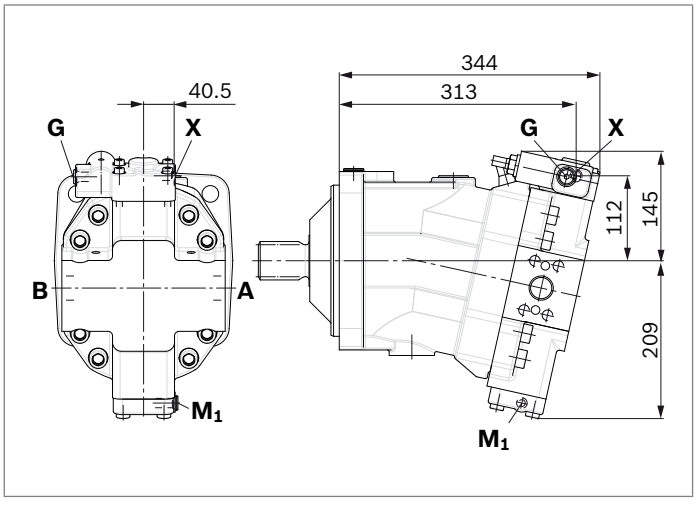
▼ **HP1, HP2** – Proportional hydraulic control, positive control



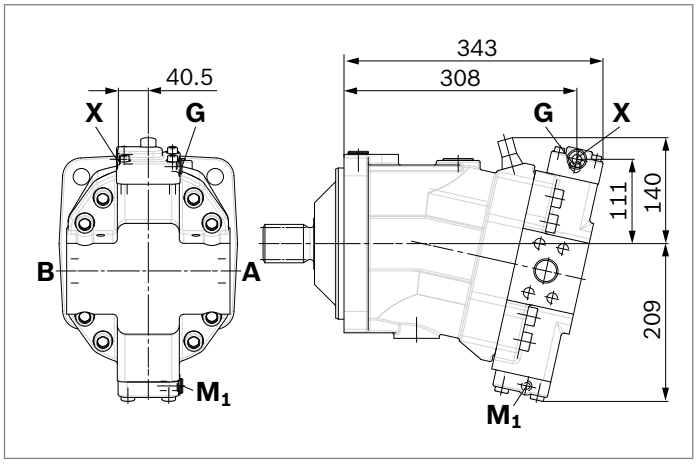
▼ **HP5, HP6** – Proportional hydraulic control, negative control



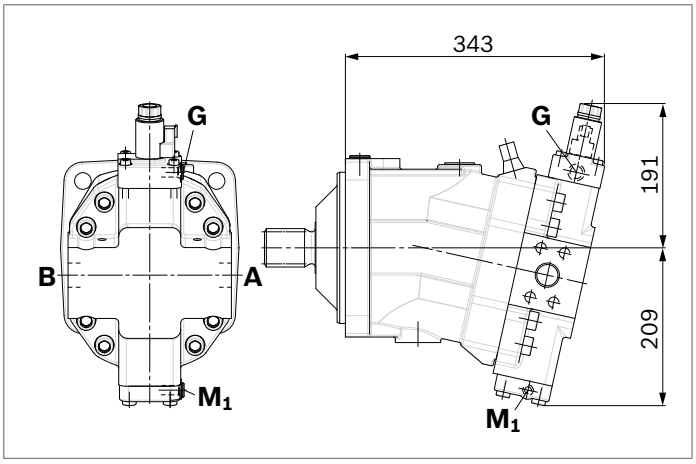
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



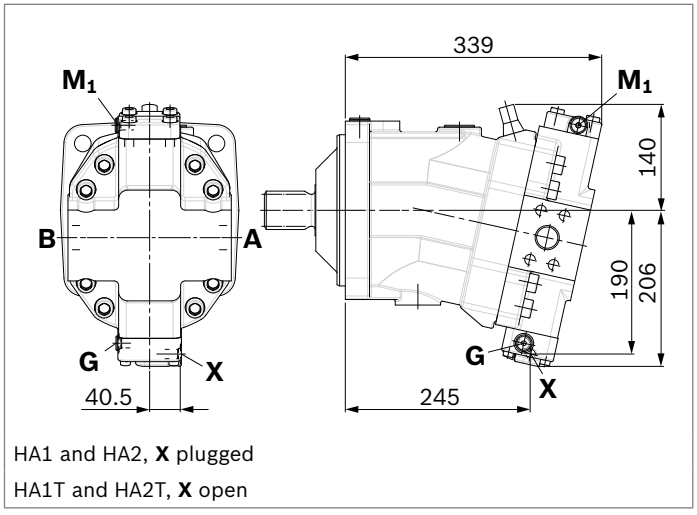
▼ **HZ5** – Two-point hydraulic control, negative control



▼ **EZ5, EZ6** – Two-point electric control, negative control



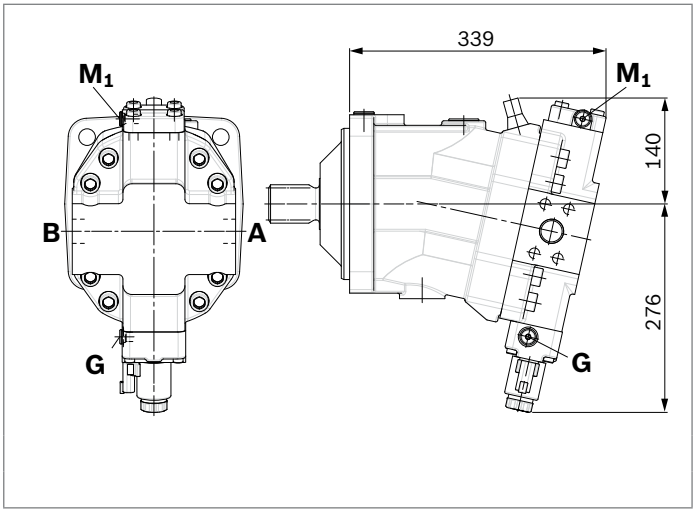
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



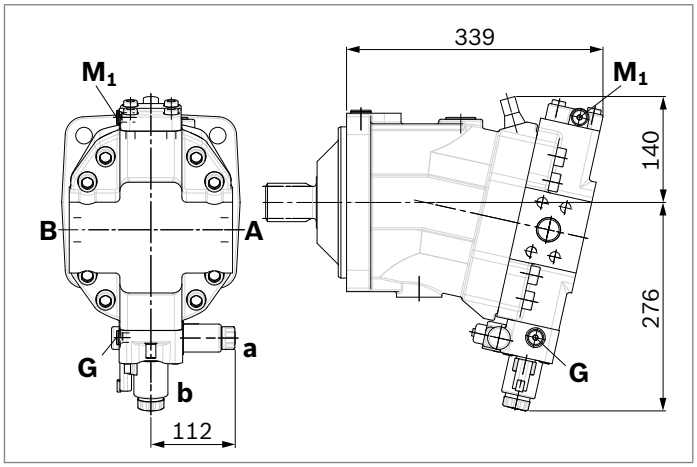
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

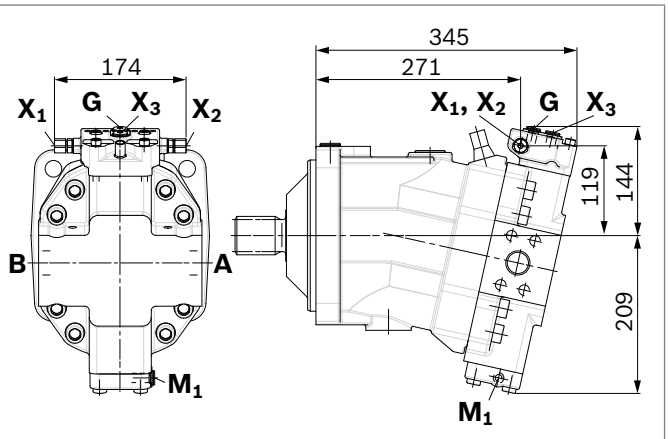
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve

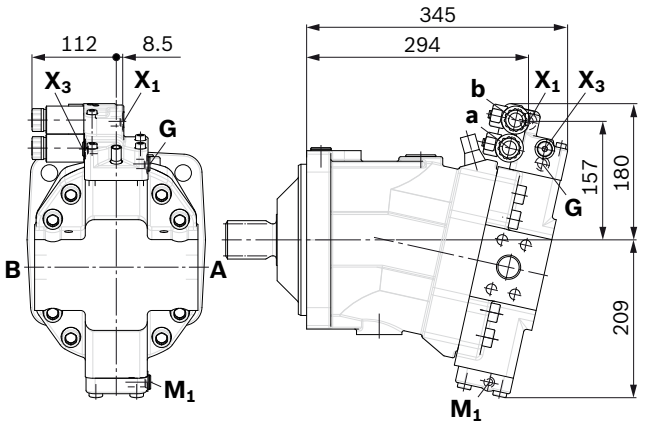


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



X$_1$, **X**$_2$ Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

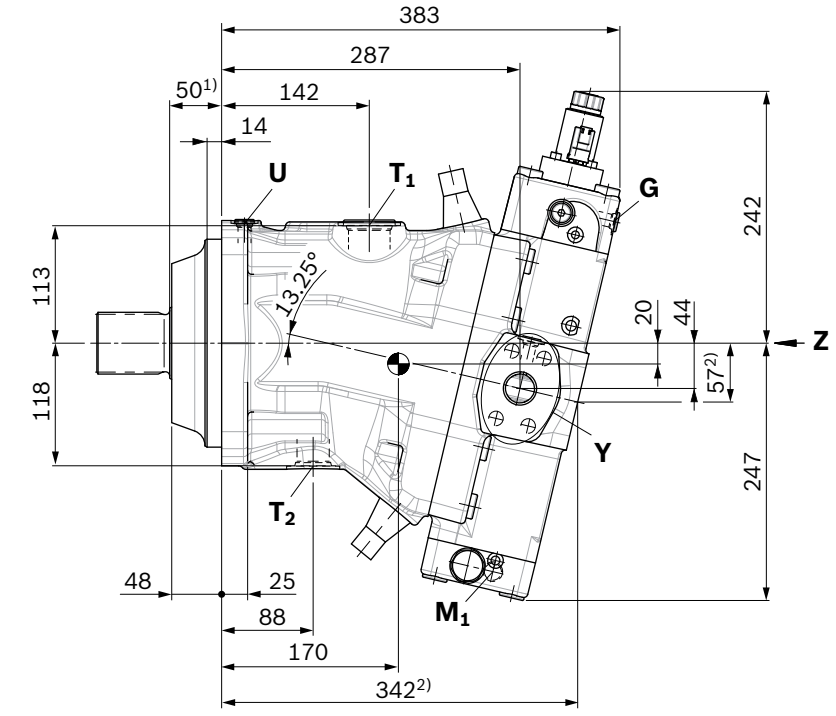
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override

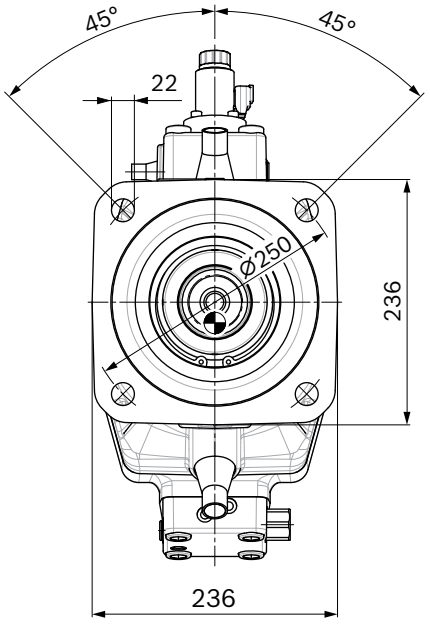


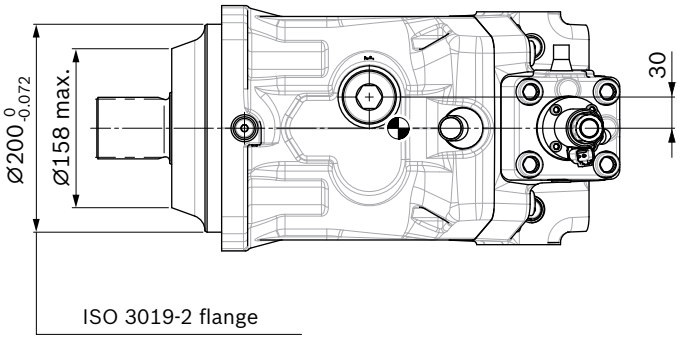
Dimensions, size 280

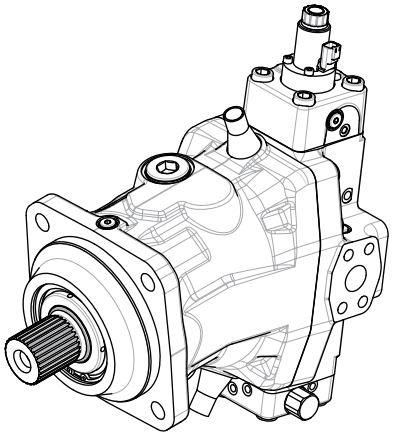
EP5, EP6 – Proportional electric control, negative control

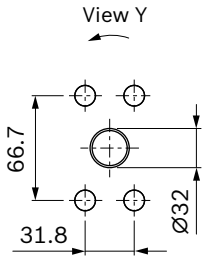
Port plate 2 — SAE working ports **A** and **B** at side, opposite









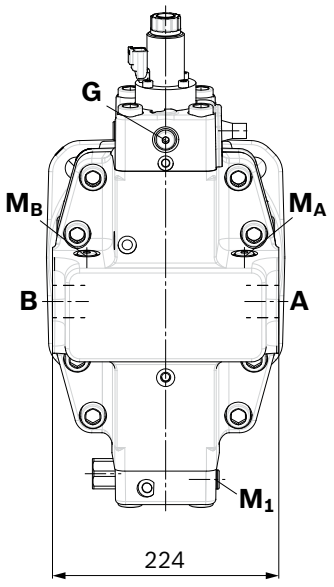


Center of gravity

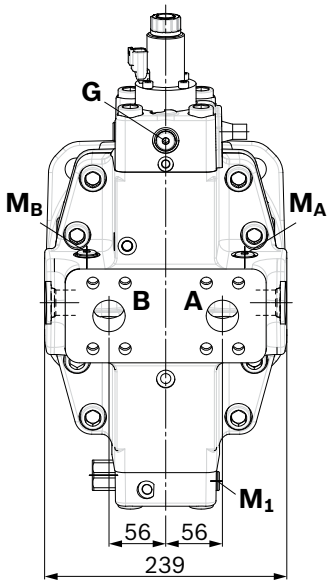
1) To shaft collar
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

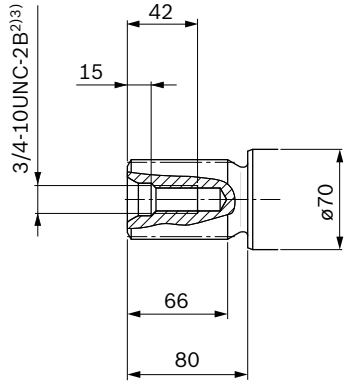


1 SAE working ports **A** and **B** at rear



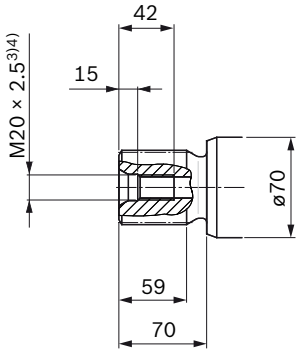
▼ **SAE J744 splined shaft**

T3 – 2 1/4 in 17T 8/16DP[1)]



▼ **DIN 5480 splined shaft**

A4 – W60×2×28×9g

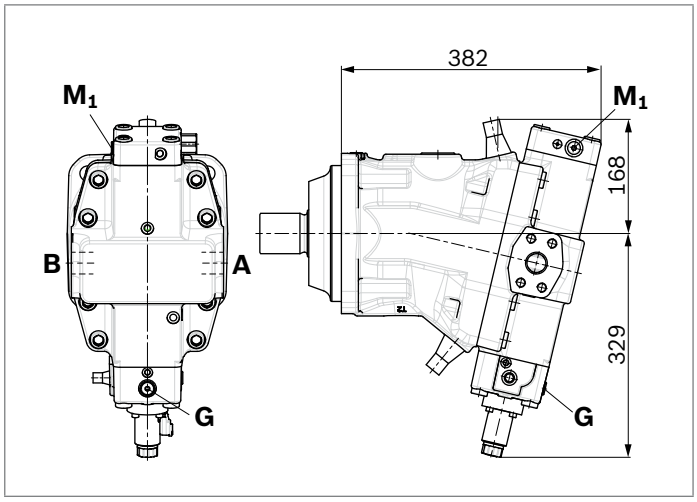


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For information on tightening torques, see the instruction manual.
4) DIN 332 center bore (DIN 13 thread)

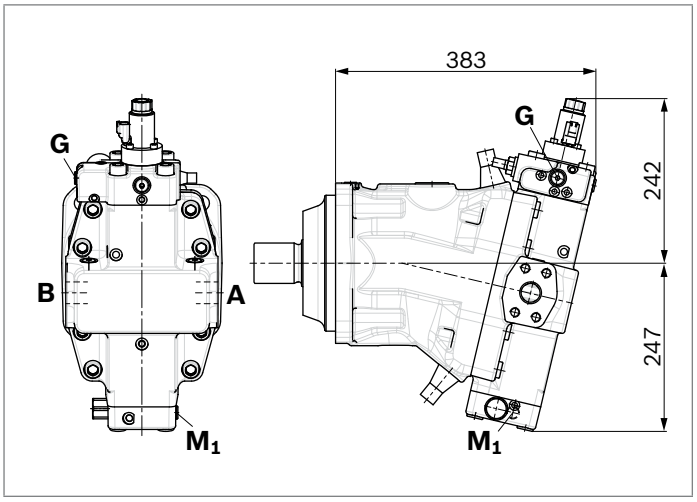
Ports		Standard	Size[1]	p_{max} [bar][2]	State[6]
A, B	Working port Fastening thread A/B	SAE J518[3] DIN 13	1 1/4 in M14 × 2; 19 deep	500	O
T_1	Drain port	ISO 6149[5]	M42 × 2; 19.5 deep	3	X[4]
T_2	Drain port	ISO 6149[5]	M33 × 2; 19 deep	3	O[4]
G	Synchronous control	ISO 6149[5]	M14 × 1.5; 11.5 deep	500	X
U	Bearing flushing port	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[5]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA7)	ISO 8434-1	SDSC-L8×M12-F	40	O
X_1	Pilot pressure port (HP.D)	ISO 6149[5]	M14 × 1.5; 11.5 deep	100	X
X_3	Pilot pressure port (DA7)	ISO 6149[5]	M14 × 1.5; 11.5 deep	40	X
M_1	Measuring port, control pressure	ISO 6149[5]	M14 × 1.5; 11.5 deep	500	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149[5]	M14 × 1.5; 11.5 deep	500	X

1) For information on tightening torques, see the instruction manual.
2) Momentary pressure peaks can occur depending on application. 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, **T_1** or **T_2** must be connected (see also installation instructions on page 86).
5) The countersink may be deeper than specified in the standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

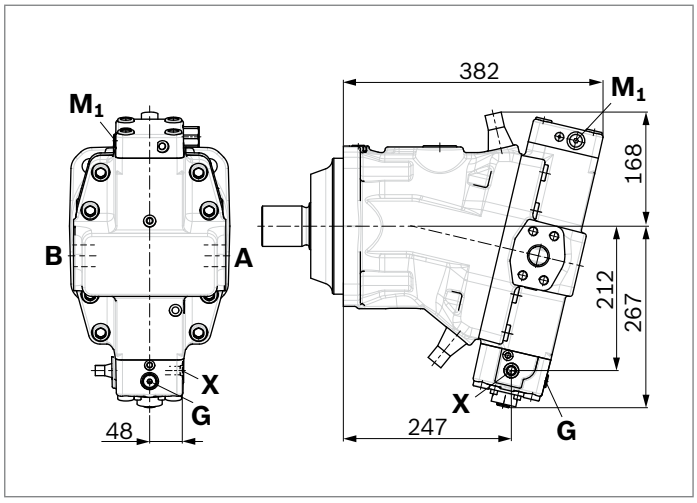
▼ **EP1, EP2** – Proportional electric control, positive control



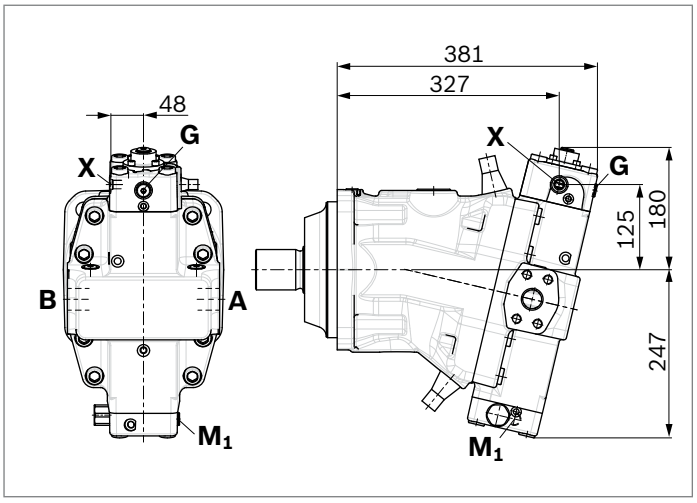
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



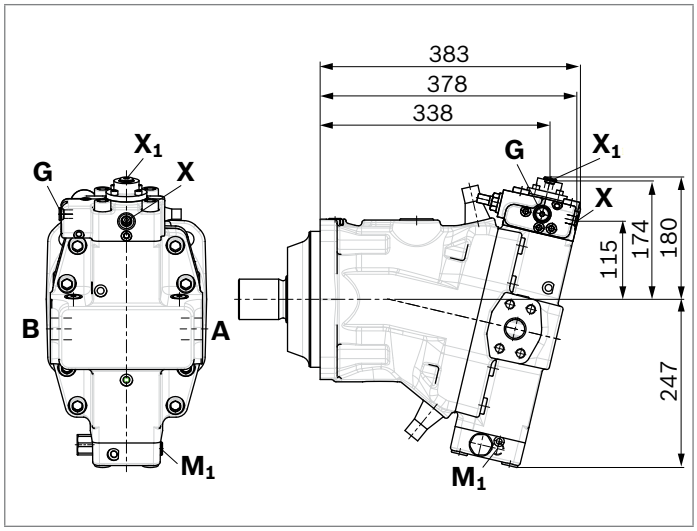
▼ **HP1, HP2** – Proportional hydraulic control, positive control



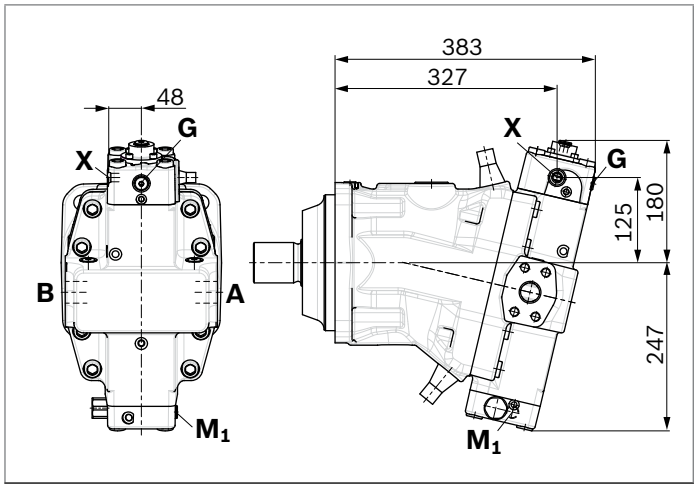
▼ **HP5, HP6** – Proportional hydraulic control, negative control



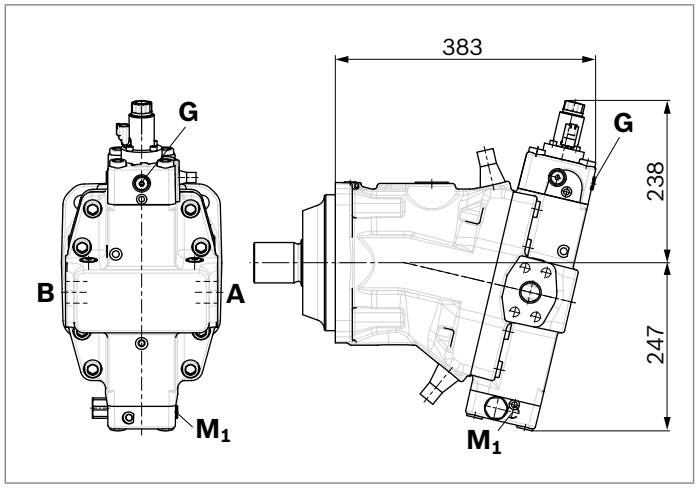
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



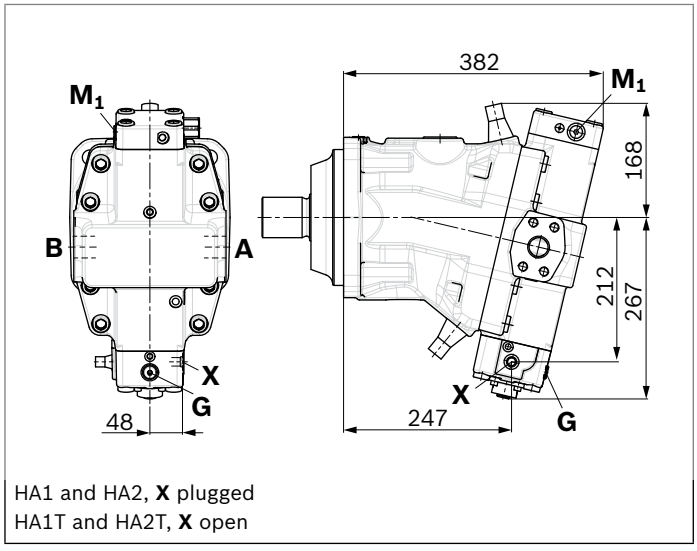
▼ **HZ5** – Two-point hydraulic control, negative control



▼ EZ5, EZ6 – Two-point electric control, negative control

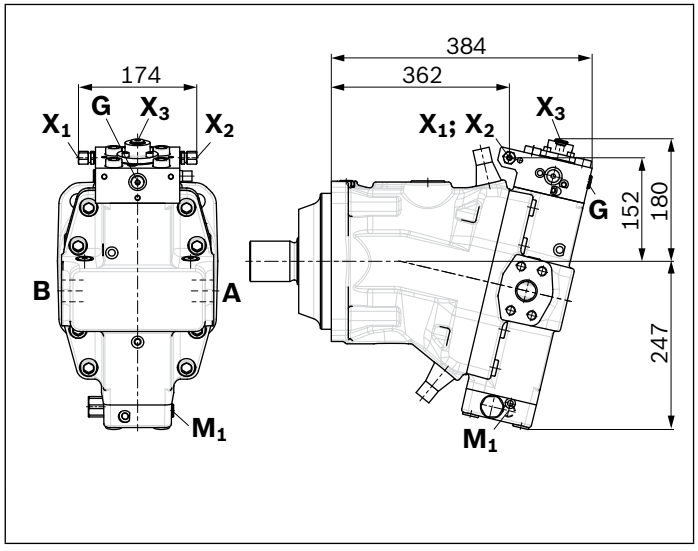


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

▼ **DA7** – Automatic speed related control, negative control, with hydraulic travel direction valve



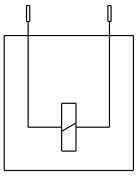
Connector for solenoids

DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode.
There is the following type of protection with the mounted 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.

Neutral position switch

The neutral position switch NLS electronically detects the neutral position of the A6VM, thereby ensuring the torque freedom of the motor. The use of the NLS in a transmission control provides a faster switching cycle in the drive. In addition, the switch reliability is improved and thereby the service life of the drive increased.
Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the NLS data sheet 95152.

Technical data

Type		NLS
Recommended operating voltage		5 V
Maximum voltage	not actuated	32 V
	actuated	11.5 V
Minimum permissible current		0 mA
Maximum permissible current		10 mA
Maximum switching cycle number		1 million
Contact type		normally open contact (open in non-actuated state)
Type of protection (with mating connector plugged)		IP67/IP69K
Temperature range of sensor (medium and ambient temperature)[1]		–40 °C ... 125 °C
Temperature range of thread seal ring FKM[1]		–15 °C ... 125 °C
Pressure resistance	nominal	3 bar
	max. (momentary peaks)	10 bar[2]

Notice
The minimum swivel angle is dependent on the $V_{g\,min}$-stop

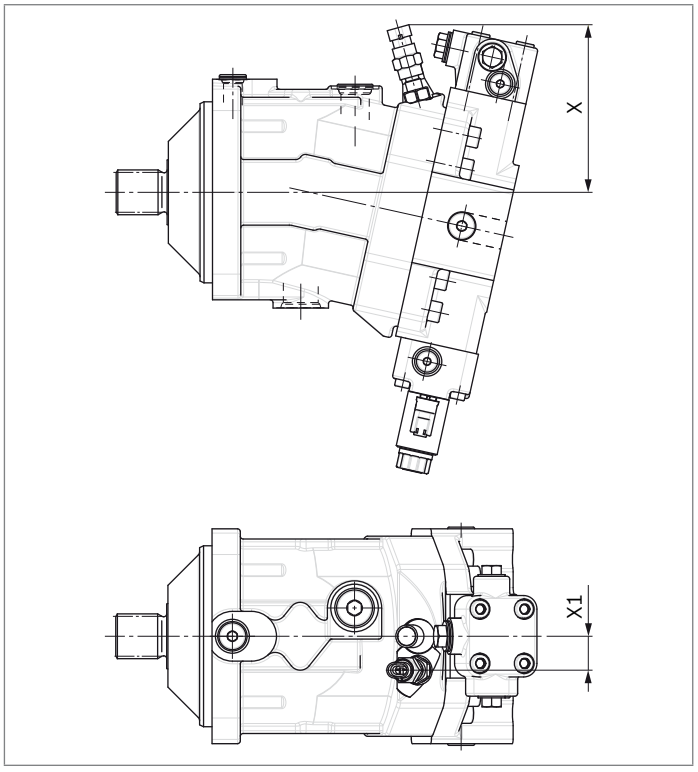
▼ Mating connector

Consisting of	Material number
1 housing	282080
1 socket contact	282403-1

The mating connector is not included in the scope of delivery.
This mating connector can be ordered from AMP.

▼ Dimensions

Version “N” with neutral position switch mounted



Size	Adjustable angle		X [mm]		X1 [mm]
	min.	max.	at min angle	at max angle	
85	0°	2°	144.7	141.4	28.0
115	0°	4°	148.1	140.4	30.0
150	0°	1°	153.1	150.9	30.0
170	0°	0°		153.1	30.0
215	0°	0°		159.1	30.0

1) Observe the permissible temperature range of the axial piston motor.
2) Observe the permissible viscosity range of the axial piston motor. At oil viscosities >1800 mm²/s, the switch may be unintentionally actuated by case pressure peaks of >10 bar.

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 valvee)

- 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
- Size 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 bar and ν = 10 mm²/s
(p_{ND} = low pressure, p_G = case pressure)

Notices

- Port **S**a only for sizes 150 to 280
- For a flushing flow of 35 l/min[1)] 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 flushingvalve for size 115

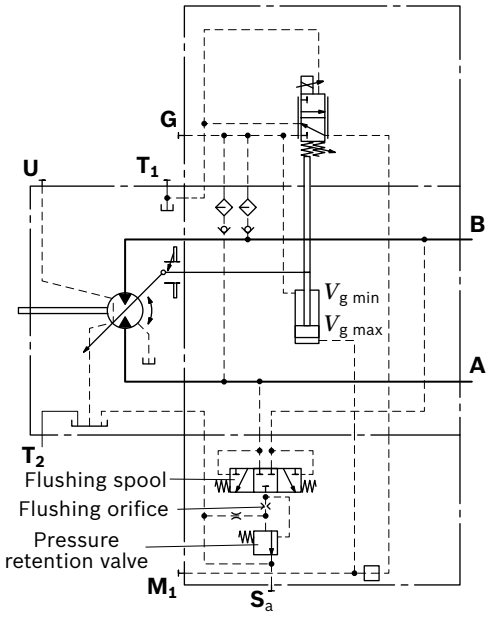
Material number of orifice	ø [mm]	q_v [l/min]	Code
R909431310	2.8	18	I
R909435172	3.5	27	K
R909449967	5.0	31	L

1) For size 280 please contact us

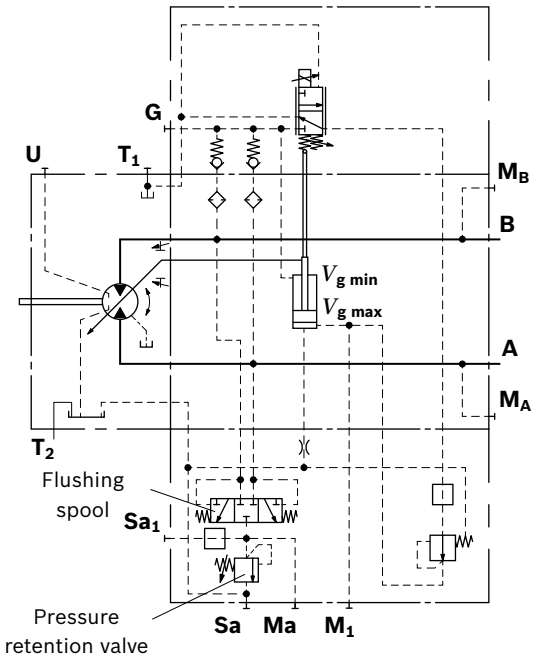
Large flushing valve for sizes 150 to 215

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

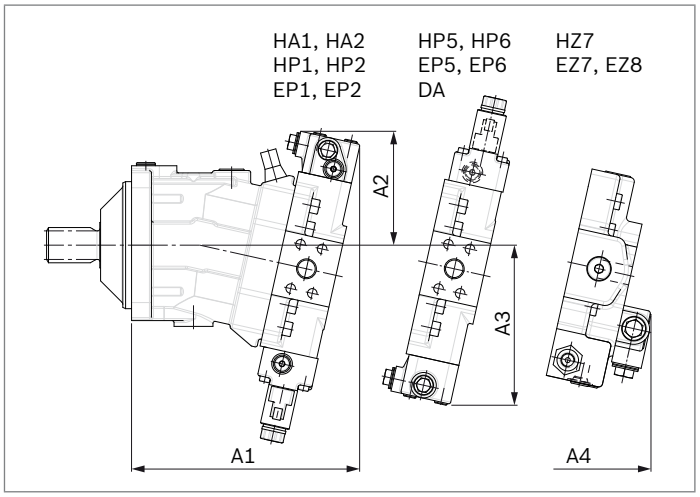
▼ **Circuit diagram EP, sizes 60 to 215**



▼ **Circuit diagram EP, size 280**

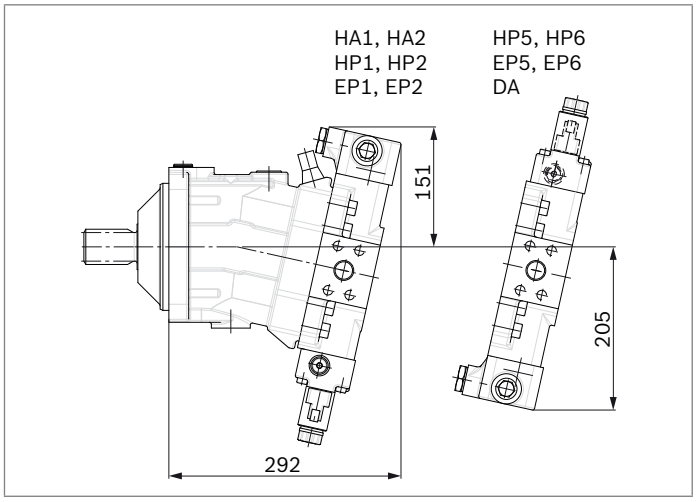


▼ Dimensions of sizes 60 to 115 (small flushing valve)



NG	A1	A2	A3	A4
60	245	137	183	236
85	273	142	194	254
115	287	143	202	269

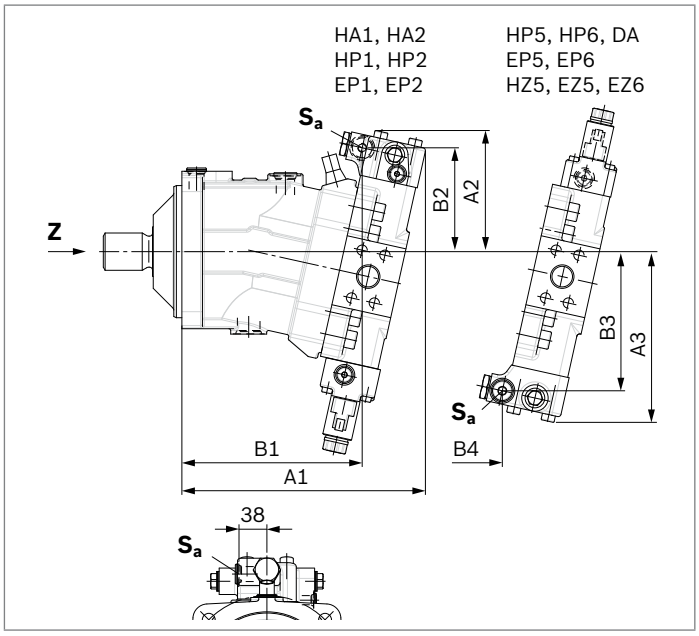
▼ Dimensions of size 115 (medium flushing valve)



NG	S_a [1)]	S_{a1} [1)]	M_a [1)]
150	M22 × 1.5; 15.5 deep		
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

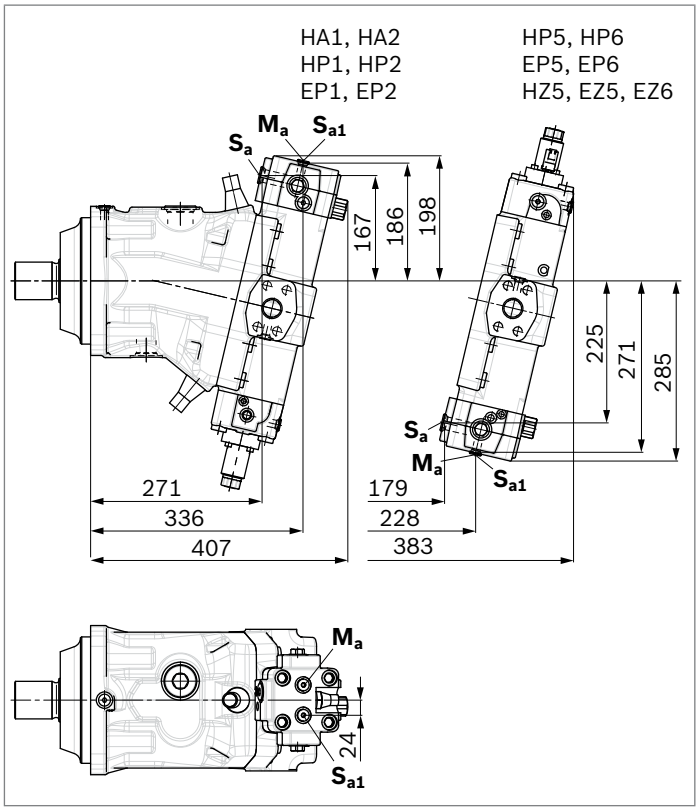
1) ISO 6149, ports plugged (in normal operation). For notes on tightening torques, see instruction manual. The countersink may be deeper than specified in the standard.

▼ Dimensions for sizes 150 to 215 (large flushing valve)



NG	A1	B1	A2	B2	A3	B3	B4
150	325	239	165	142	230	187	166
170	332	246	165	142	233	190	172
215	349	263	172	148	244	201	185

▼ 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 level specified for the relevant counterbalance valve, the counterbalance valve 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/71MWV0N4S 97W0-0 + 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 notes on the counterbalance valve in the data sheets 95522 (BVD), 95525 (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 mm^2/s)

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

Motor	Without valve		Limited values when using pressure relief valves and BVD/BVE							
			PRV[1]				BVD[2]/BVE[3]			
NG	p_{nom}/p_{max} [bar]	$q_{V\ max}$ [l/min]	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	32		400					
115		410				8	25 (BVD/BVE)		320	8W
150		494					25 (BVD)			
170		533								
150		494	–	300/460	550	5	25 (BVE)	350/420	320	5W
170		533								
215		628					25 (BVD/BVE)			
215		628				9	32 (BVD/BVE)	350/400	628	9W
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

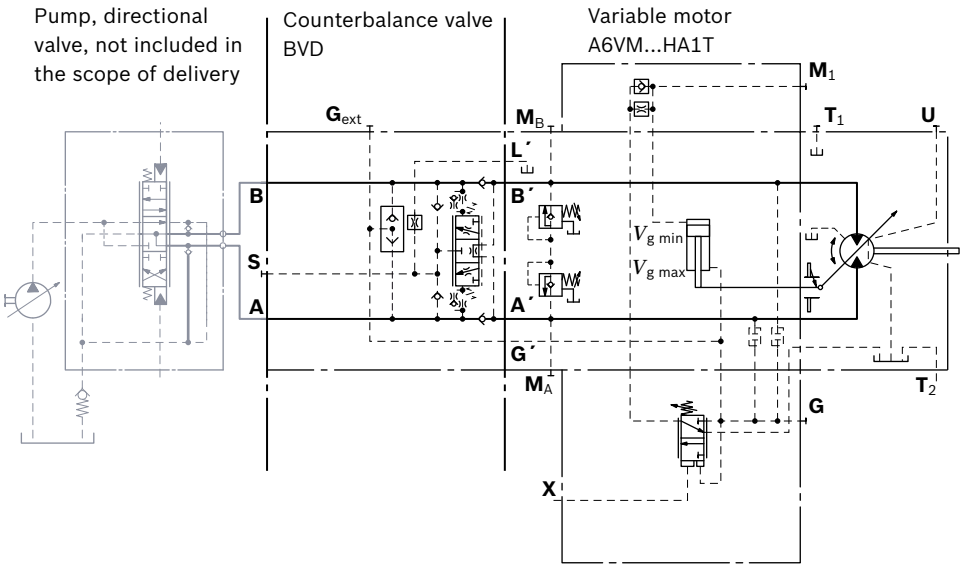
Counterbalance valve for travel drives BVD...F

Application option

- Travel drive for wheeled excavators (BVD and BVE)

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

A6VM085HA1T30004A/71MWV0N4S97W0-0 + BVD20F27S/41B–V03K16D0400S12



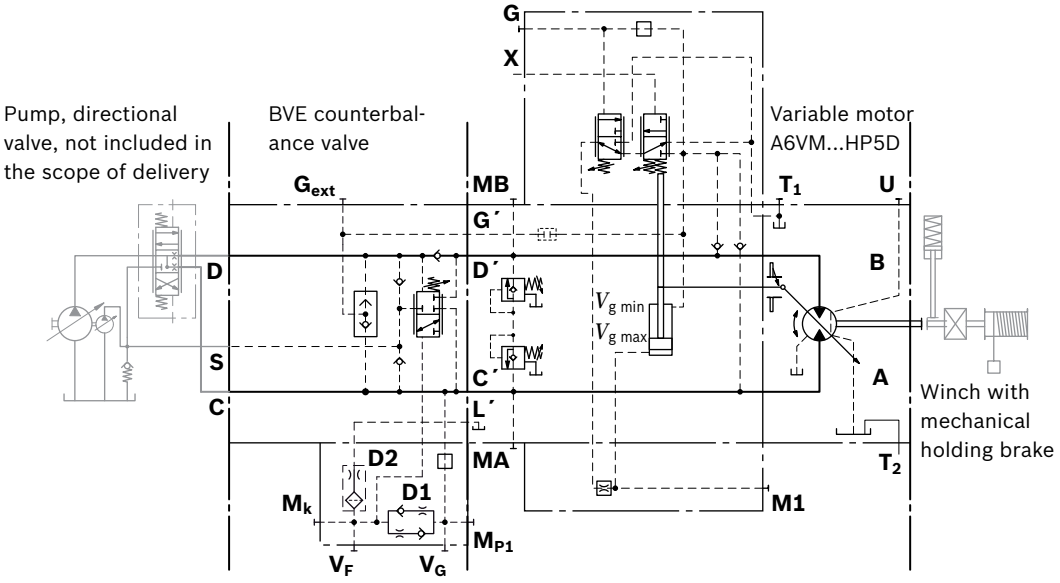
Counterbalance valve for winches and track drive BVD...W and BVE

Application option

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

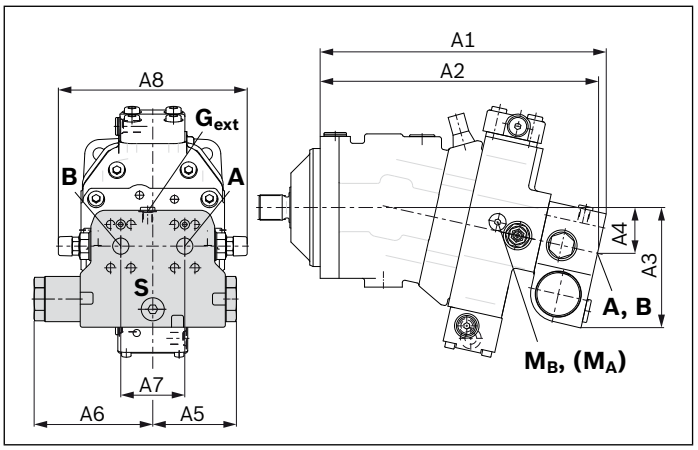
▼ **Example circuit diagram for winch drive in cranes**

A6VM085HP5D10001A/71MWV0N4S97W0-0 + BVE25W38S/51ND-V100K00D4599T30S00-0

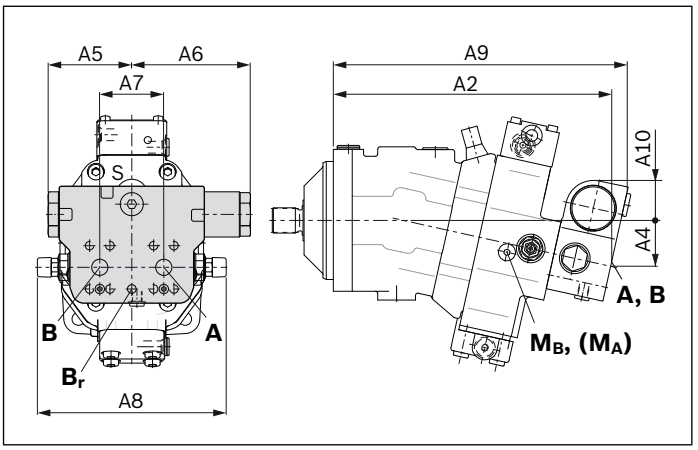


Dimensions

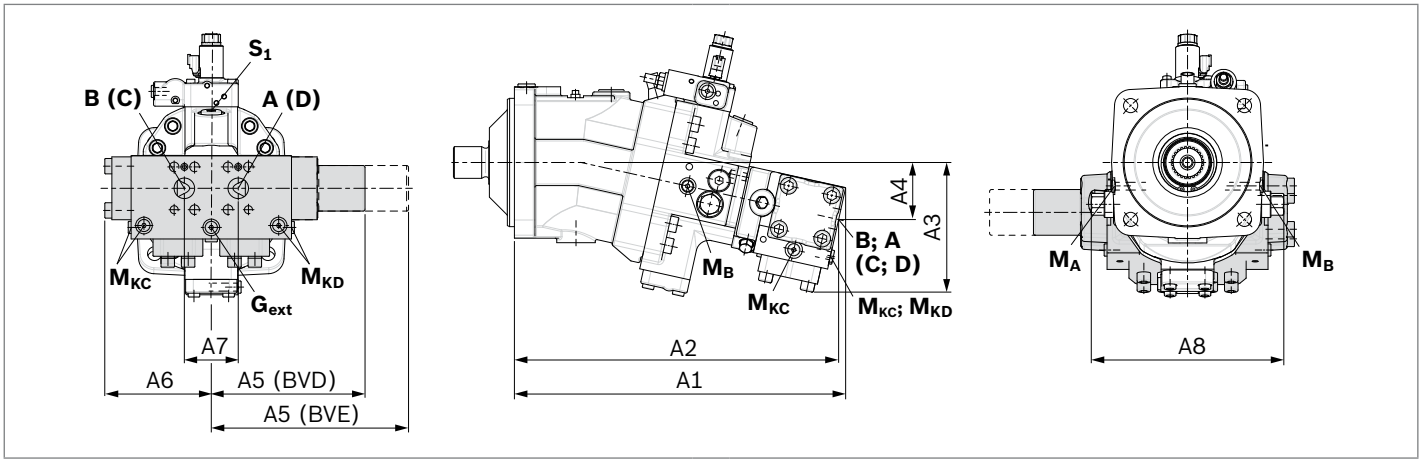
▼ **A6VM...HA, HP1, HP2 or EP1, EP2 with BVD/BVE 20/25**



▼ **A6VM...HP5, HP6 or EP5, EP6[1] with BVD/BVE 20/25**



▼ **A6VM...HA, HP1, HP2 or EP1, EP2 with BVD/BVE 32**



A6VM	Counterbalance valve											
NG...plate	Type	Ports	Dimensions									
		A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
60...7	BVD20...17	3/4 in	311	302	143	50	98	139	75	222	326	50
85...7	BVD20...27	1 in	340	331	148	55	98	139	75	222	355	46
115...7	BVD20...28	1 in	362	353	152	59	98	139	84	234	377	41
115...8	BVD25...38	1 1/4 in	380	370	165	63	120.5	175	84	238	395	56
150...8	BVD25...38	1 1/4 in	411	401	168	67	120.5	175	84	238	426	53
170...8	BVD25...38	1 1/4 in	417	407	170	68	120.5	175	84	238	432	51
215...5	BVD25...38	1 1/4 in	448	438	176	74	120.5	175	84	299	463	46
215...9	BVD32...38	1 1/4 in	516	505	202	89	240	166	84	299	–	46
280...9	BVD32...38	on request										
115...8	BVE25...38	1 1/4 in	380	370	171	63	137	214	84	238	397	63
150...5	BVE25...38	1 1/4 in	411	401	175	67	137	214	84	238	423	59
170...5	BVE25...38	1 1/4 in	417	407	176	68	137	214	84	238	432	59
215...5	BVE25...38	1 1/4 in	448	438	182	74	137	214	84	299	463	52
215...9	BVE32...38	1 1/4 in	516	505	202	89	307	166	84	299	–	46
280...9	BVE32...38	on request										

Ports		Version	A6VM plate	Standard	Size[2]	P_{max} [bar][3]	State[5]
A, B	Working line			SAE J518	see table above	420	O
S, S_1	Boost port	BVD20, BVD32		DIN 3852[4]	M22 × 1.5; 14 deep	30	X
		BVD25, BVE25		DIN 3852[4]	M27 × 2; 16 deep	30	X
B_r	Brake release port, reduced high pressure	L	7	DIN 3852[4]	M12 × 1.5; 12.5 deep	30	O
			8	DIN 3852[4]	M12 × 1.5; 12 deep	30	O
G_{ext}	Brake release port, high pressure	S		DIN 3852[4]	M12 × 1.5; 12.5 deep	420	X
$M_{A,}$ M_B	Measuring port, pressure A, B			ISO 6149[4]	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 counterbalance spool	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 do not correspond with the port designation of the A6VM motor.
The designation of the ports on the installation drawing of the motor is binding!
2) For information on tightening torques, see the instruction manual.
3) Momentary pressure peaks can occur depending on application. Keep this in mind when selecting measuring devices and fittings.
4) The countersink may be deeper than specified in the standard.
5) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

Integrated BVI counterbalance valve

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 level specified for the relevant counterbalance valve, the counterbalance valve 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 150 and 170.
- The counterbalance valve must be ordered additionally. Order example: A6VM150HP6000001A/71MWV0R4A 16Y0-0 + BVI540603002-0
- 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 mm^2/s)

Type code

01	02	03	04	05		06
BVI					**–**	

Counterbalance valve

01	Counterbalance valve integrated	**BVI**

Brake piston 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)	without disable function	**1**
	With brake release valve (standard HP, EP)	with disable function	**2**

Standard/special version

06	Standard version	**0**
	Special version	**S**

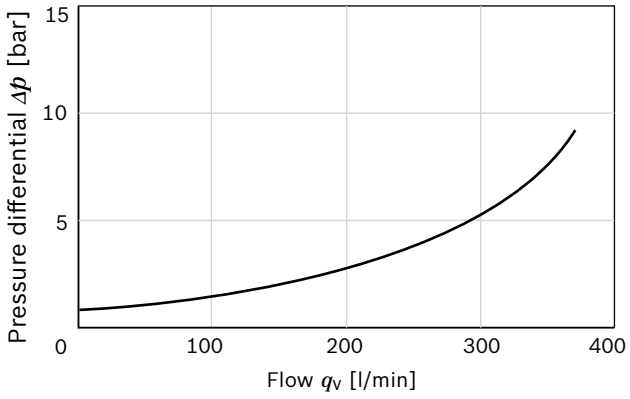
Technical data

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

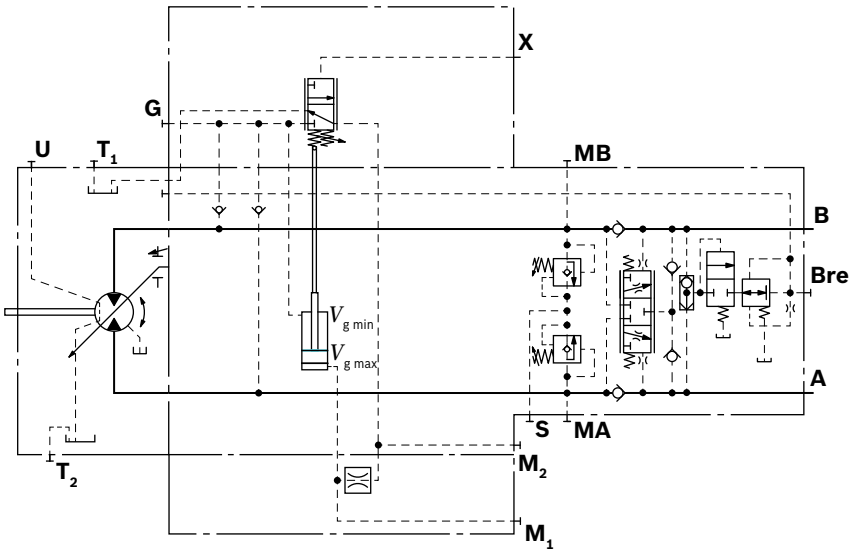
Permissible inlet flow or pressure when using pressure relief valve and BVI

Motor NG	Without restrictions Standard plate (1 + 2)		Limited values Plate with integrated counterbalance valve (6)	
				BVI + PRV
	p_{nom}/p_{max} [bar]	$q_{V\,max}$ [l/min]	p_{nom}/p_{max} [bar]	q_V [l/min]
150	450/530	410	350/420	400
170		533		

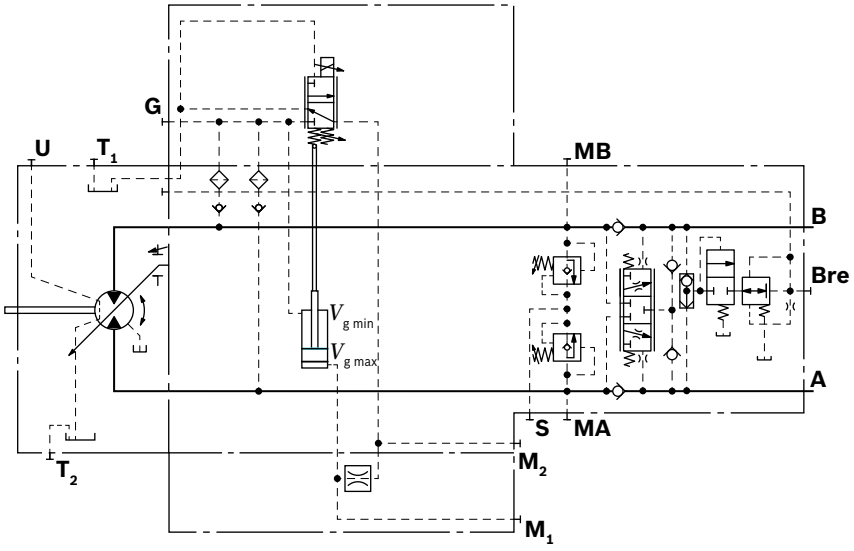
▼ Boost characteristic



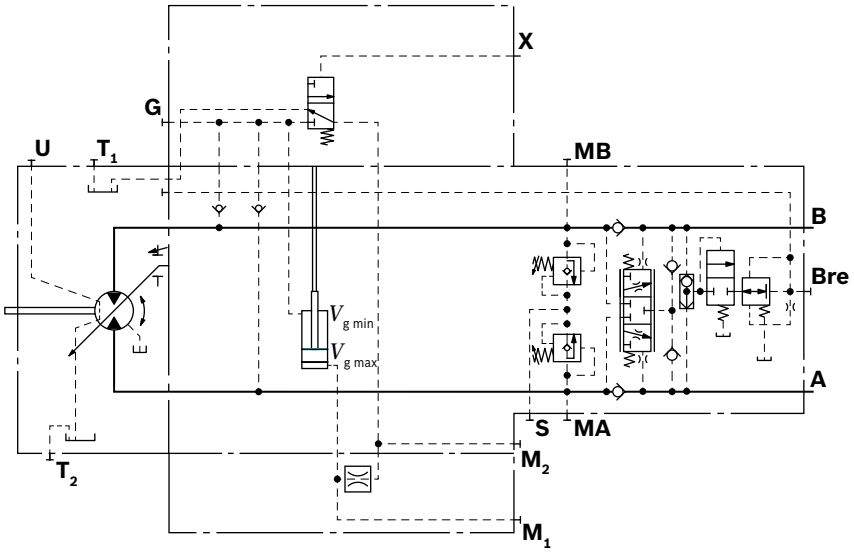
▼ **Circuit diagram HP5**



▼ **Circuit diagram EP5**



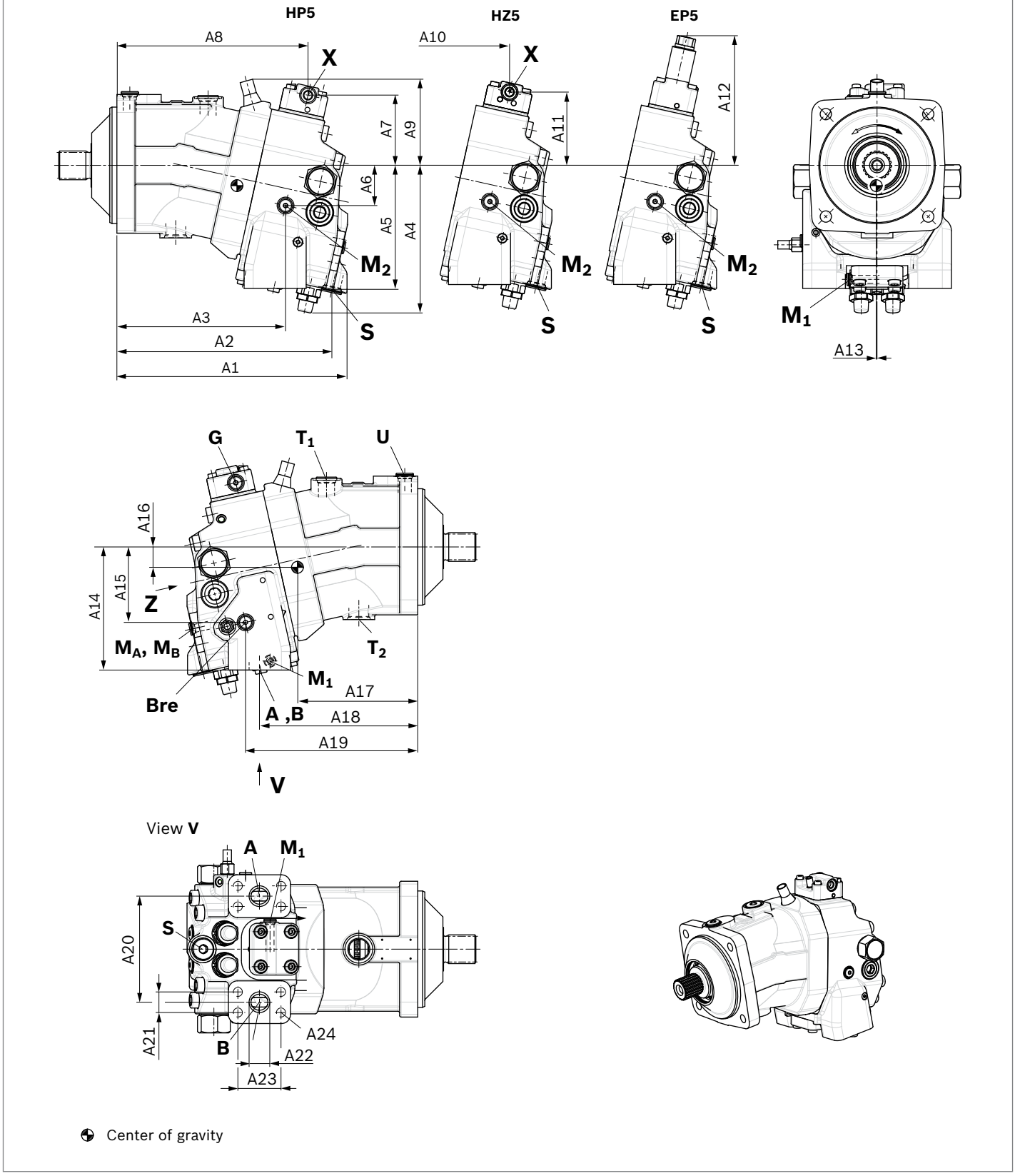
▼ **Circuit diagram HZ5**



Integrated BVI counterbalance valve dimensions

HP5 – Two-point control, hydraulic

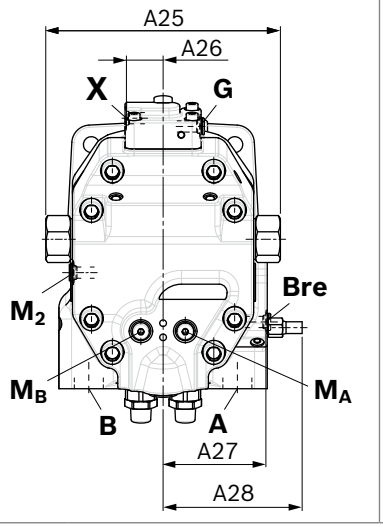
Port plate 6, with integrated BVI counterbalance valve — SAE working ports **A** and **B** at bottom



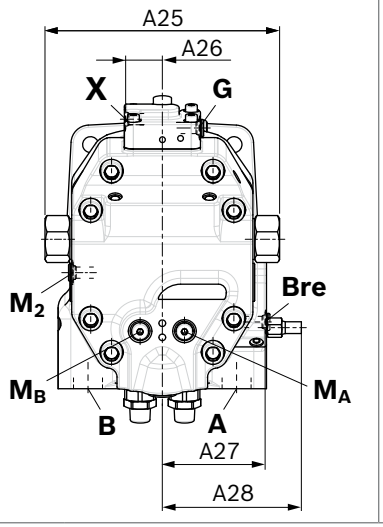
Center of gravity

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

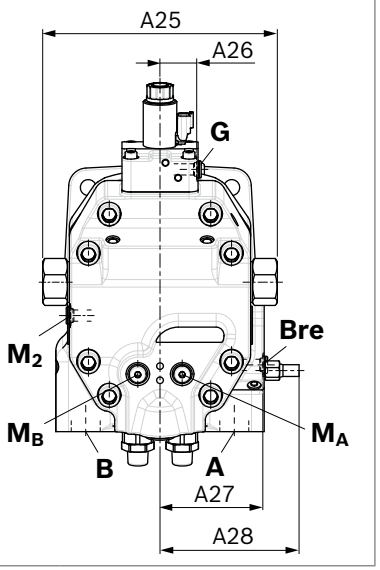
HP5



HZ5



EP5



A6VM NG	Port	Dimensions												
	A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
150	1 1/4 in	350	326	254	227	190	61	109	289	max. 134	285	108	196	1.0
170	1 1/4 in	357	332	261	228	192	62	108	296	max. 135	291	107	195	1.0

A6VM NG	Dimensions													
	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24 (DIN 13)	A25	A26	A27	A28
150	189	115	25	170	238	260	164	31.8	32	66.7	M14 × 2; 19 deep	259	40.5	113.5	154
170	190	117	29	191	245	266	164	31.8	32	66.7	M14 × 2; 19 deep	259	40.5	113.5	154

Ports	Working line SAE J518[1)]	Drain port ISO 6149[2)]	Drain port ISO 6149[2)]	Bearing flushing port ISO 6149[2)]	Pilot pressure port ISO 6149[2)]	Boost pressure supply ISO 6149[2)]
NG	A, B	T_1	T_2	U	X	S
150	see table above	M27 × 2; 19 deep	M33 × 2; 19 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
170		M27 × 2; 19 deep	M33 × 2; 19 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
p_{max} [bar][3)]	420	3	3	3	100	30
State[5)]	O	X[4)]	O[4)]	X	O	X

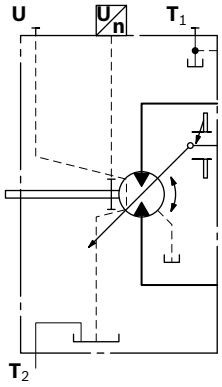
Ports	Measuring port pressure A / pressure B	Control pressure measuring port	Measuring port, stroking chamber	Brake release, external	Synchronous control ISO 6149[2)]
NG	M_A, M_B	M_1	M_2	Bre	G
150	M14 × 1.5; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep
170	M14 × 1.5; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep
p_{max} [bar][3)]	420	420	420	30	420
State[5)]	X	X	X	X/O	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) Momentary pressure peaks can occur depending on application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 39).
5) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

Speed sensor

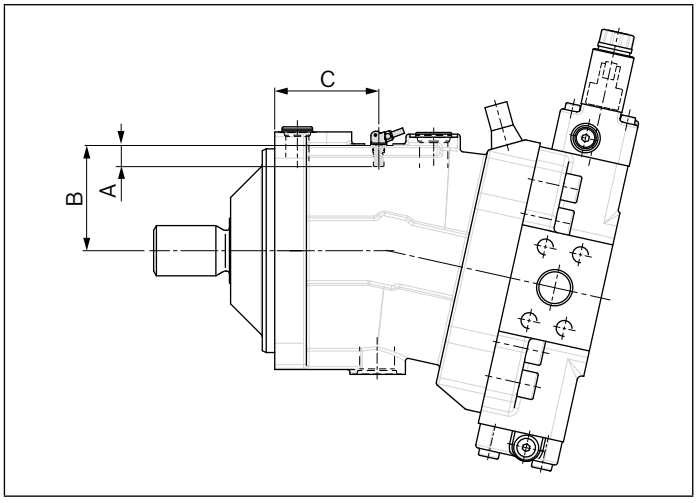
Version A6VM...U (“prepared for speed sensor”, i.e. without sensor) is equipped with a spline on the rotary group.
A signal proportional to motor speed can be generated with the mounted speed sensor HDD/DSA/DSM. The HDD/DSA/DSM sensor measures the rotational speed and direction of rotation.
Type code, technical data, dimensions and parameters for the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95132[1)] (DSM), 95133 (DSA) or 95135 (HDD).
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 A6VM variable motor complete with mounted sensor.

▼ **Circuit diagram EP**

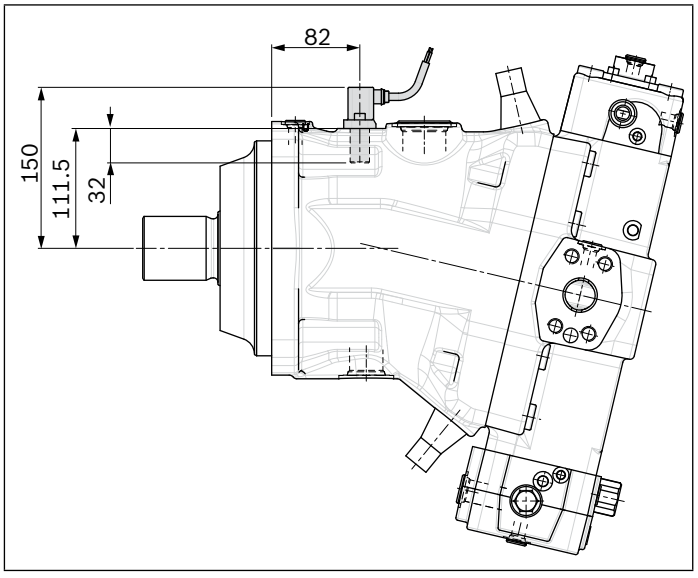


▼ **Dimensions**

Size 60 to 215 version “V”, with mounted speed sensor



Size 280 version “H”, with mounted speed sensor



Size	60	85	115	150	170	215	280
Number of teeth	54	58	67	72	75	80	78
A Insertion depth (tolerance -0.25)	18.4	18.4	18.4	18.4	18.4	18.4	32
B Contact surface	75	79	88	93	96	101	111.5
C	66.2	75.2	77.2	91.2	91.7	95.2	82

1) Maximum permissible signal frequency of DSM sensor must be observed with high motor speeds

Setting range for displacement

	60				85				115				150			
	$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)		$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)		$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)		V_{gmax} (cm³/rev)		$V_{g\,min}$ (cm³/rev)	
	from	to	from	to	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	9.0	115.6	115.6	0.0	24.0	152.1	152.1	0.0	44.0
	without screw		M10 × 60 R909154690		without screw		M12 × 60 R909083530		without screw		M12 × 70 R909085976		without screw		M12 × 80 R909153075	
B	62.0	62.0	> 15.0	30.5	85.2	85.2	> 9.0	28.0	115.6	115.6	> 24.0	47.5	152.1	152.1	> 44.0	69.0
	without screw		M10 × 70 R909153779		without screw		M12 × 70 R909085976		without screw		M12 × 80 R909153075		without screw		M12 × 90 R909154041	
C	62.0	62.0	> 30.5	43.0	85.2	85.2	> 28.0	47.0	115.6	115.6	> 47.5	71.0	152.1	152.1	> 69.0	99.0
	without screw		M10 × 80 R909154058		without screw		M12 × 80 R909153075		without screw		M12 × 90 R909154041		without screw		M12 × 100 R909153975	
D	x		x		85.2	85.2	> 47.0	59.0	115.6	115.6	> 71.0	80.0	152.1	152.1	> 99.0	106.0
					without screw		M12 × 90 R909154041		without screw		M12 × 100 R909153975		without screw		M12 × 110 R909154212	
E	< 62.0	47.5	0.0	15.0	< 85.2	77.0	0.0	9.0	< 115.6	93.5	0.0	24.0	< 152.1	111.0	0.0	44.0
	M10 × 60 R909154690		M10 × 60 R909154690		M12 × 60 R909083530		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075	
F	< 62.0	47.5	> 15.0	30.5	< 85.2	77.0	> 9.0	28.0	< 115.6	93.5	> 24.0	47.5	< 152.1	111.0	> 44.0	69.0
	M10 × 60 R909154690		M10 × 70 R909153779		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041	
G	< 62.0	47.5	> 30.5	43.0	< 85.2	77.0	> 28.0	47.0	< 115.6	93.5	> 47.5	71	< 152.1	111.0	> 69.0	99.0
	M10 × 60 R909154690		M10 × 80 R909154058		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975	
H	x		x		< 85.2	77.0	> 47.0	59.0	< 115.6	93.5	> 71.0	80.0	< 152.1	111.0	> 99.0	106.0
					M12 × 60 R909083530		M12 × 90 R909154041		M12 × 70 R909085976		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 110 R909154212	
J	< 47.5	33.0	0.0	15.0	< 77.0	58.0	0.0	9.0	< 93.5	71.0	0.0	24.0	< 111.0	87.0	0.0	44.0
	M10 × 70 R909153779		M10 × 60 R909154690		M12 × 70 R909085976		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075	
K	< 47.5	33.0	> 15.0	30.5	< 77.0	58.0	> 9.0	28.0	< 93.5	71.0	> 24.0	47.5	< 111.0	87.0	> 44.0	69.0
	M10 × 70 R909153779		M10 × 70 R909153779		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 90 R909154041	
L	< 47.5	33.0	> 30.5	43.0	< 77.0	58.0	> 28.0	47.0	< 93.5	71.0	> 47.5	71.0	< 111.0	87.0	> 69.0	99.0
	M10 × 70 R909153779		M10 × 80 R909154058		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 100 R909153975	
M	x		x		< 77.0	58.0	> 47.0	59.0	< 93.5	71.0	> 71.0	80.0	< 111.0	87.0	> 99.0	106.0
					M12x70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 110 R909154212	

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

- $V_{g\,min}$ = ... cm³, $V_{g\,max}$ = ... cm³

Theoretical, maximum setting:

- for $V_{g\,min}$ = 0.7 × $V_{g\,max}$
- for $V_{g\,max}$ = 0.3 × $V_{g\,max}$

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

	170				215				280			
	$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)		$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)		$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)	
	from	to	from	to	from	to	from	to	from	to	from	to
A	171.8	171.8	0.0	35.0	216.5	216.5	0.0	44.5	–	–	–	–
	without screw		M12 × 80 R909153075		without screw		M12 × 80 R909153075		–		–	
B	171.8	171.8	> 35.0	63.5	216.5	216.5	> 44.5	80.0	–	–	–	–
	without screw		M12 × 90 R909154041		without screw		M12 × 90 R909154041		–		–	
C	171.8	171.8	> 63.5	98.0	216.5	216.5	> 80.0	115.0	–	–	–	–
	without screw		M12 × 100 R909153975		without screw		M12 × 100 R909153975		–		–	
D	171.8	171.8	> 98.0	120.0	216.5	216.5	> 115.0	150.0	–	–	–	–
	without screw		M12 × 110 R909154212		without screw		M12 × 110 R909154212		–		–	
E	< 171.8	139.0	0.0	35.0	< 216.5	175.0	0.0	44.5	280.1	230.0	0.0	55.0
	M12 × 80 R909153075		M10 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M16 x 100 R910909811		M16 x 100 R910909811	
F	< 171.8	139.0	> 35.0	63.5	< 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 x 100 R910909811		M16 x 100 R910909719	
G	< 171.8	139.0	> 63.5	98.0	< 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 x 100 R910909811		M16 x 120 R910909477	
H	< 171.8	139.0	> 98.0	120.0	< 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 x 100 R910909811		M16 x 130 R910900271	
J	< 139.0	112.0	0.0	35.0	< 175.0	141.0	0.0	44.5	< 230.0	188.0	0.0	55.0
	M12 × 90 R909154041		M12 x 80 R909153075		M12 x 90 R909154041		M12 x 80 R909153075		M16 x 110 R910909719		M16 x 100 R910909811	
K	< 139.0	112.0	> 35.0	63.5	< 175.0	141.0	> 44.5	80.0	< 230.0	188.0	> 55.0	98.0
	M12 x 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M16 x 110 R910909719		M16 x 110 R910909719	
L	< 139.0	112.0	> 63.5	98.0	< 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 x 110 R910909719		M16 x 120 R910909477	
M	< 139.0	112.0	> 98.0	120.0	< 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 x 110 R910909719		M16 x 130 R910900271	

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

- $V_{g\,min}$ = ... cm³, $V_{g\,max}$ = ... cm³

Theoretical, maximum setting:

- for $V_{g\,min}$ = 0.7 × $V_{g\,max}$
- for $V_{g\,max}$ = 0.3 × $V_{g\,max}$

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.
Particularly in the installation position “drive shaft upwards”, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T**$_1$, **T**$_2$).

If a shared drain line is used for several units, make sure that the respective case pressure 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 operational conditions, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To achieve favorable noise values, decouple all connecting 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

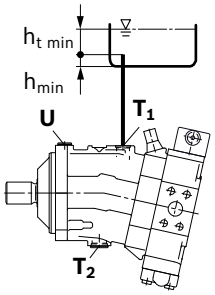
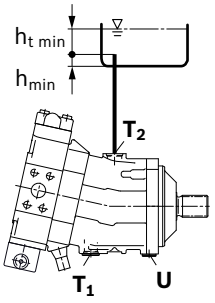
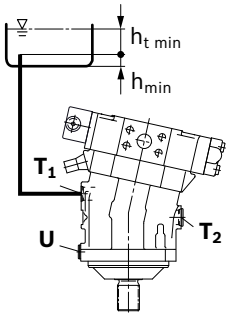
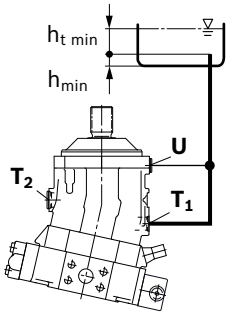
Effects on the control system are to be expected in certain installation positions. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

Installation position

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

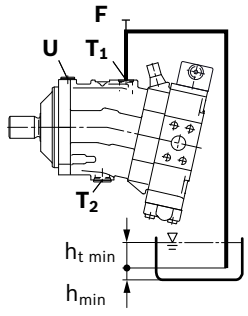
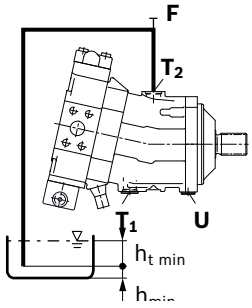
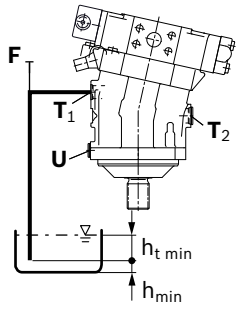
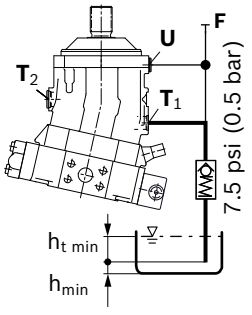
Below-reservoir installation (standard)

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

Installation position	Air bleed	Filling
1 		**T**$_1$
2 		**T**$_2$
3 		**T**$_1$
4 	**U**	**T**$_1$

Above-reservoir installation

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

Installation position	Air bleed	Filling
5 	**U** (**F**)	T_1 (**F**)
6 	**F**	T_2 (**F**)
7 	**F**	T_1 (**F**)
8 	**U**	T_1 (**F**)

Key	
F	Filling/air bleeding
U	Bearing flushing port/air bleeding
T_1, T_2	Drain port
$h_{t\,min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

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 A6VM is designed to be used in open and closed circuits.
- The project planning, installation and commissioning of the axial piston unit require the involvement of qualified skilled persons.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- 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 preservative protection for a maximum of 12 months. If longer preservation is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, which can be found in data sheet 90312 or in the instruction manual.
- Not all versions of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.

- 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 working 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 manufacturers 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 permissile 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.