Axial piston variable motor A6VM series 65 and 71



- Series 65, size 28 to 200
  - Nominal pressure 400 bar
  - Maximum pressure 450 bar (size 28)
  - Maximum pressure 530 bar (size 55 to 200)
- Series 71, size 60 to 280
  - Nominal pressure 450 bar
  - Maximum pressure 530 bar (size 60 to 215)
  - Maximum pressure 500 bar (size 280)
- Open and closed circuit

Features

- Robust motor with long service life
- Approved for very high rotational speeds
- High starting efficiency
- For series 71, especially good slow-running behavior
- High control range (can be swiveled to zero)
- High torque
- Large variety of controls
- Optionally with mounted flushing and boost-pressure valve
- Optionally with mounted counterbalance valve
- Bent-axis design

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Type code

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

Axial piston unit

01	Bent-axis design, variable displacement	**A6V**

Operating mode

02	Motor	**M**

Size (NG)

03	Geometric displacement, see technical data on page 10	**028**	**055**	**060**	**080**	**085**	**107**	**115**	**140**	**150**	**160**	**170**	**200**	**215**	**280**

Control device

				028	055	060	080	085	107	115	140	150	160	170	200	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 high-pressure related control, positive control	With minimum pressure increase	Δp ≤ approx. 10 bar	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**HA1**
		with pressure increase	Δp = 100 bar	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**HA2**
	Automatic speed-related control, 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

			028	055	060	080	085	107	115	140	150	160	170	200	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 controlled, proportional	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**T3**
		electric, two-point U = 12 V	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**U1**
		electric, two-point U = 24 V	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**U2**
		electric and travel direction valve, electric U = 12 V	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**R1**
		electric and travel direction valve, electric U = 24 V	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**R2**

Connector for solenoids[1)]

06	Without connectors (only for purely 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**			**/**			**W**	**V**	**0**						**–**	

Swivel angle sensor

		028	055	060	080	085	107	115	140	150	160	170	200	215	280	
07	Without swivel angle sensor	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	Neutral position switch	–	–	–	●	●	●	●	●	●	●	●	●	●	–	**N**

Additional function

08	Without additional function	**0**

Stroking time damping (for selection, see control)

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)]

			028	055	060	080	085	107	115	140	150	160	170	200	215	280	
10	$V_{g\,max}$ setting screw	$V_{g\,min}$ setting screw															
	Without setting screw[3)]	short (0-adjustable)	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**A**
		moderate	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**B**
		long	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**C**
		extra long	–	–	–	●	●	●	●	●	●	●	●	●	●	●	**D**
	Short	short (0-adjustable)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**E**
		moderate	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**F**
		long	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**G**
		extra long	–	–	–	●	●	●	●	●	●	●	●	●	●	●	**H**
	Medium[4)]	short (0-adjustable)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**J**
		moderate	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**K**
		long	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**L**
		extra long	–	–	–	●	●	●	●	●	●	●	●	●	●	●	**M**

Series

		028	055	060	080	085	107	115	140	150	160	170	200	215	280	
11	Series 6, index 5 (nominal pressure 400 bar)	●	●	–	●	–	●	–	●	–	●	–	●	–	–	**65**
	Series 7, index 1 (nominal pressure 450 bar)	–	–	●	–	●	–	●	–	●	–	●	–	●	●	**71**

Version of port and fastening threads

		028	055	060	080	085	107	115	140	150	160	170	200	215	280	
12	Metric ports based on ISO 6149 with O-ring seal, metric fastening thread according to DIN 13	–	●	●	●	●	●	●	●	●	●	●	●	●	●	**M**
	Metric ports threads with profile sealing ring based on DIN 3852, metric fastening thread according to DIN 13	●	–	–	–	–	–	–	–	–	–	–	–	–	–	**N**

Direction of rotation

13	Viewed on drive shaft, bi-directional	**W**

Sealing material

14	FKM (fluorocarbon rubber)	**V**

● = Available ○ = On request – = Not available

2) Please refer to the tables for the setting values associated with the setting screws (from page 96).
3) For size 28 with short threaded pin, not adjustable
4) $V_{g\,max}$ not adjustable for size 280, limitation due to 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**			**/**			**W**	**V**	**0**						**–**	

Drive shaft bearing

15	Standard bearing	**0**

Mounting flange

			028	055	060	080	085	107	115	140	150	160	170	200	215	280	
16	ISO 3019-2	100-4	●	–	–	–	–	–	–	–	–	–	–	–	–	–	**L4**
		125-4	–	●	●	–	–	–	–	–	–	–	–	–	–	–	**M4**
		140-4	–	–	–	●	●	–	–	–	–	–	–	–	–	–	**N4**
		160-4	–	–	–	–	–	●	●	–	–	–	–	–	–	–	**P4**
		180-4	–	–	–	–	–	–	–	●	●	●	●	–	–	–	**R4**
		200-4	–	–	–	–	–	–	–	–	–	–	–	●	●	●	**S4**

Drive shaft

			028	055	060	080	085	107	115	140	150	160	170	200	215	280	
17	Splined shaft ANSI B92.1a–1976	1 1/4 in 14T 12/24DP	–	●	●	●	○	–	–	–	–	–	–	–	–	–	**S7**
		1 1/2 in 17T 12/24DP	–	–	○	○	●	–	–	–	–	–	–	–	–	–	**S9**
		1 3/4 in 13T 8/16DP	–	–	–	–	–	●	●	●	●	●	○	–	–	–	**T1**
		2 in 15T 8/16DP	–	–	–	–	–	–	–	–	●	●	●	●	●	–	**T2**
		2 1/4 in 17T 8/16DP	–	–	–	–	–	–	–	–	–	–	–	–	–	●	**T3**
	Splined shaft DIN 5480	W25×1.25×18×9g	●	–	–	–	–	–	–	–	–	–	–	–	–	–	**Z5**
		W30×2×14×9g	●	●	○	–	–	–	–	–	–	–	–	–	–	–	**Z6**
		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

			028	055	060	080	085	107	115	140	150	160	170	200	215	280	
18	SAE working port **A** and **B** at rear		●	●	●	●	●	●	●	●	●	●	●	●	●	●	**1**
	SAE working ports **A** and **B** lateral, opposite		●	●	●	●	●	●	●	●	●	●	●	●	●	●	**2**
	SAE working port **A** and **B** at rear, with lateral measuring ports		–	–	–	●	●	●	●	●	●	●	●	●	●	–	**4**
	SAE working port **A** and **B** at bottom, with integrated counterbalance valve[5]		–	–	–	–	–	○	○	●	●	●	●	–	–	–	**6**
	Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (pilot operated)[6]	BVD20	–	●	●	●	●	●	●	–	–	–	–	–	–	–	**7**
		BVD25	–	–	–	–	–	●	●	●	●	●	●	–	–	–	**8**
		BVE25	–	–	–	–	–	●	●	–	–	–	–	–	–	–	**8**
	Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (direct operated)[6]	BVD25	–	–	–	–	–	–	–	–	–	–	–	●	●	○	**5**
		BVE25	–	–	–	–	–	–	–	–	–	●	●	●	●	○	**5**
		BVD/BVE32	–	–	–	–	–	–	–	–	–	–	–	●	●	●[7]	**9**

● = Available ○ = On request – = Not available

5) Only in combination with HZ5, EZ5, EZ6, HP or EP with respective negative control

6) Only possible in combination with HP, EP and HA control.

7) 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.

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

Valve

			028	055	060	080	085	107	115	140	150	160	170	200	215	280	
19	Without valve		●	●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	With integrated brake release valve (only with port plate 6)		–	–	–	–	–	○	○	●	●	●	●	–	–	–	**Y**
	With BVD/BVE counterbalance valves mounted[8)]		–	●	●	●	●	●	●	●	●	●	●	●	●	●	**W**
	With flushing and boost-pressure valve mounted, flushing on both sides Flushing flow at: $\Delta p = p_{ND} - p_G$ = 25 bar and v = 10 mm²/s (p_{ND} = low pressure, p_G = case pressure) Only possible with port plates 1, 2 and 4	**Flushing flow q_v [l/min]**															
		3.5	●	●	●	●	●	●	●	–	–	–	–	–	–	–	**A**
		5	●	●	●	●	●	●	●	–	–	–	–	–	–	–	**B**
		8	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**C**
		10	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**D**
		14	–	●	●	●	●	●	●	–	–	–	–	–	–	–	**F**
		15	–	–	–	–	–	–	–	●	●	●	●	●	●	–	**G**
		16	–	●	●	●	●	●[9)]	●[10)]	–	–	–	–	–	–	–	**H**
		18	–	–	–	–	–	●[9)]	●[10)]	●	●	●	●	●	●	–	**I**
		21	–	–	–	–	–	●[9)]	●[10)]	●	●	●	●	●	●	–	**J**
		27	–	–	–	–	–	●[9)]	●[10)]	●	●	●	●	●	●	–	**K**
		31	–	–	–	–	–	●[9)]	●[10)]	●	●	●	●	●	●	–	**L**
		37	–	–	–	–	–	–	–	●	●	●	●	●	●	–	**M**
	adjustable	0 ... 60	–	–	–	–	–	–	–	–	–	–	–	–	–	●	**V**

Speed sensor

		028	055	060	080	085	107	115	140	150	160	170	200	215	280	
20	Without speed sensor	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**0**
	Prepared for sensor DSA/20 and DST	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**W**
	Speed sensor DSA/20 mounted[11)]	●	●	●	●	●	●	●	●	●	●	●	●	●	●	**C**
	Speed sensor DST mounted[12)]	●	●	●	●	●	●	●	●	●	●	●	●	●	–	**E**

Standard/special version

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

● = Available ○ = On request – = Not available

Notice

- Please observe the project planning notes on 103!
- In addition to the type code, please specify the relevant technical data when placing your order.
- Please note that not all type code combinations are available although the individual functions are marked as being available.

8) Type code of counterbalance valve according to data sheet 95522 (BVD20, BVD25), 95526 (BVE25), 95528 (BVE/BVD32), specify separately.
9) Not for EZ3, 4, 7, 8 and HZ3, 7.
10) Not for EZ7, EZ8 and HZ7.
11) Specify type code of the sensor acc. to data sheet 95126 (DSA/20) separately and observe the requirements for the electronics.
12) Specify type code of the sensor acc. to data sheet 95131 (DST) separately and observe the requirements for the electronics.

Hydraulic fluid

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

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- 90223: Fire-resistant, water-containing hydraulic fluids (HFC/HFB/HFAE/HFAS)
- 90225: Limited technical data for operation with water-free and water-containing fire-resistant hydraulic fluids (HFDR, HFDU, HFAE, HFAS, HFB, HFC)

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

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

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

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

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[3]	Comment
Cold start	v_{max} ≤ 1600 mm²/s	NBR[2]	ϑ_{St} ≥ −40°C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
		FKM	ϑ_{St} ≥ −25°C	
Warm-up phase	v = 1600 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Permissible operating range	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	

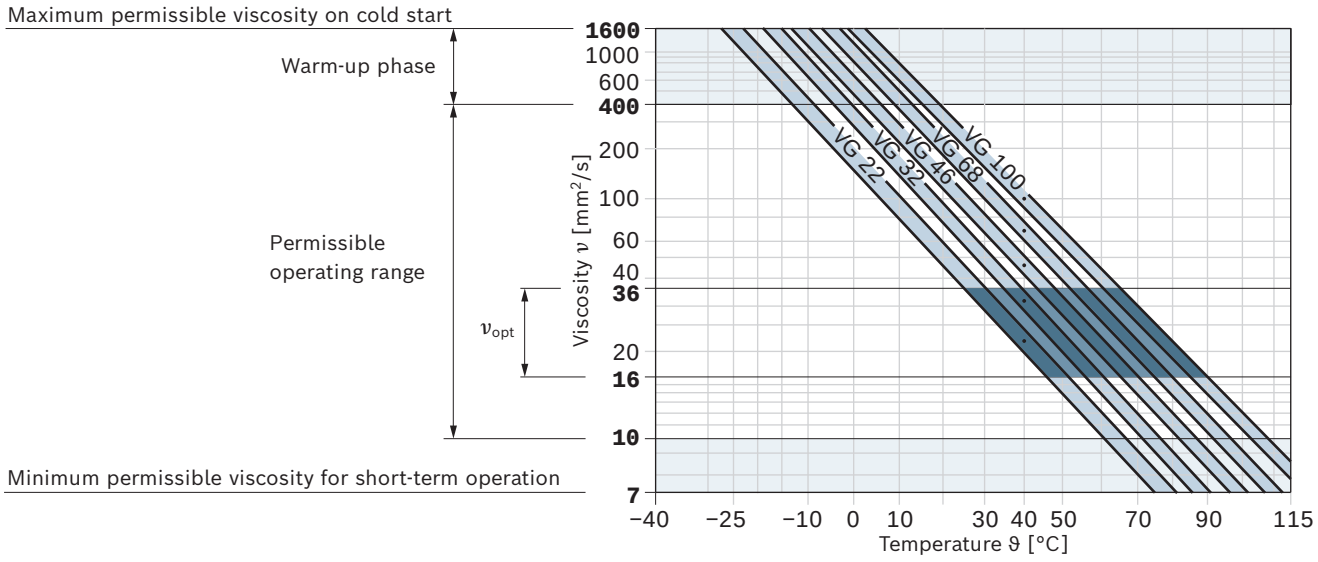
Notice:
The maximum circuit temperature of +115 °C must not be exceeded at the working ports **A** and **B** in compliance with the permissible viscosity.

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

2) Special version, please contact us

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

▼ **Selection diagram**



Filtration of the hydraulic fluid

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

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

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

For example, a viscosity of 10 mm²/s is achieved with the following hydraulic fluid and temperature:

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

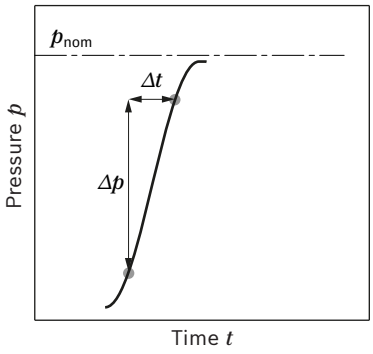
Flow direction

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

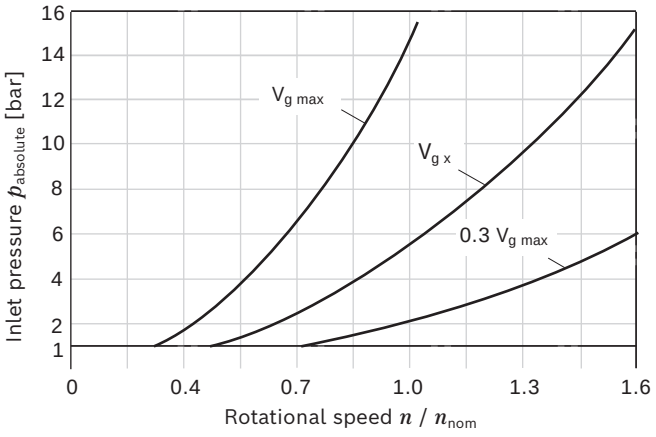
Working pressure range

Pressure at working port A or B				**Definition**
Nominal pressure p_{nom}	Series 65		400 bar	The nominal pressure corresponds to the maximum design pressure.
	Series 71		450 bar	
Maximum pressure p_{max}	Series 65	NG 28 to 200	450 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period. Within the total operating period of 300 h, a maximum pressure of 450 bar to 530 bar for series 65 (size 55 to 200) or 500 bar to 530 bar for series 71 (size 60 to 215) is permissible for a limited period of 50 h.
	Series 71	NG 60 to 280	500 bar	
Maximum single operating period			10 s	
Total operating period			300 h	
Swivel angle			100%	
Maximum pressure p_{max}	Series 65	NG 55 to 200	530 bar	
	Series 71	NG 60 to 215	530 bar	
Maximum single operating period			10 s	
Total operating period			50 h	
Minimum pressure (high-pressure side)			25 bar	Minimum pressure on the high-pressure side (**A** or **B**) required to prevent damage to the axial piston unit.
Minimum pressure – operation as a pump (inlet)			see diagram (next page)	To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{Su} (pressure **A** + pressure **B**)			700 bar	The summation pressure is the sum of the pressures at the ports for the working lines (**A** and **B**)
Rate of pressure change $R_{A\,max}$				Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
With integrated pressure relief valve			9000 bar/s	
Without pressure relief valve			16000 bar/s	
Case pressure at port T				
Continuous differential pressure $\Delta p_{T\,cont}$			2 bar	Maximum, averaged differential pressure at the shaft seal (housing to ambient pressure)
Maximum differential pressure $\Delta p_{T\,max}$			see diagram (next page)	Permissible differential pressure at the shaft seal (case pressure to ambient pressure)
Pressure peaks $p_{T\,peak}$			10 bar	t < 0.1 s

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

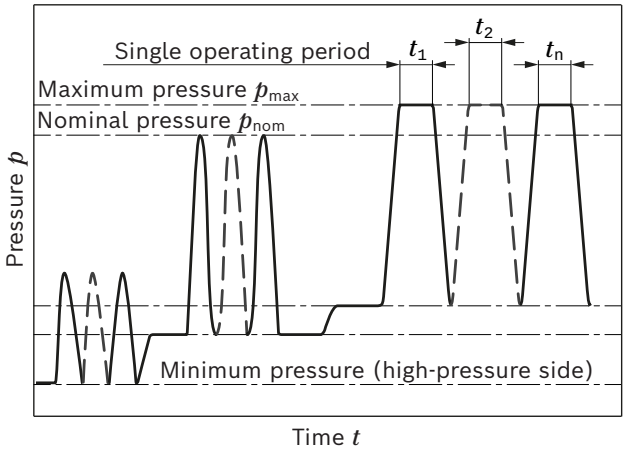


▼ **Minimum pressure – operation as a pump (inlet)**



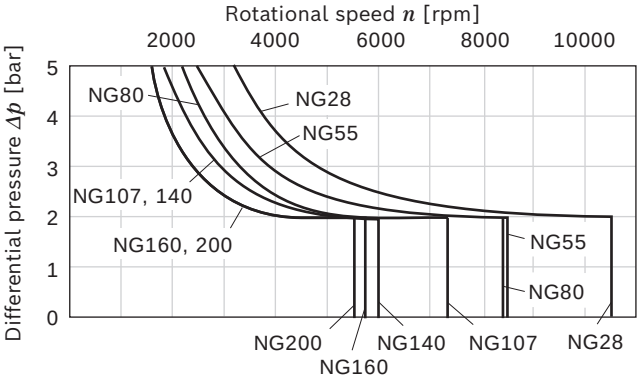
This diagram is valid only for the optimum viscosity range from v_{opt} = 36 to 16 mm²/s.
If the above-mentioned conditions cannot be ensured, please contact us.

▼ **Pressure definition**

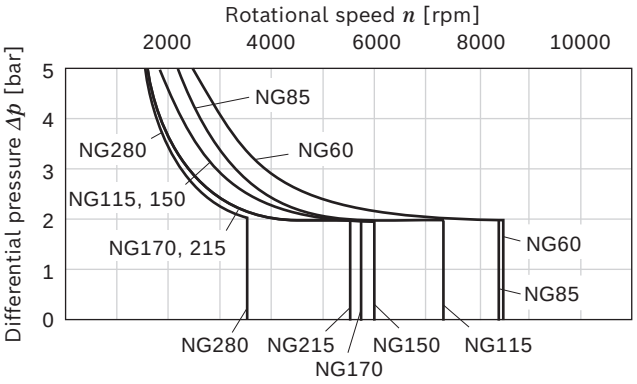


Total operating period = $t_1 + t_2 + ... + t_n$

▼ **Maximum differential pressure at the shaft seal ring, series 65**



▼ **Maximum differential pressure at the shaft seal ring, series 71**



Notice

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

Effect of case pressure on beginning of control

An increase in case pressure affects the beginning of control of the variable motor when using the following control options:
HP, HA.T3: increase
DA: reduction
With the following settings, an increase in case pressure will have no effect on the beginning of control:
HA.R and HA.U, EP, HA
The factory settings for the beginning of control are made at
$p_{absolute}$ = 2 bar case pressure (size 28 to 215) or
$p_{absolute}$ = 1 bar case pressure (size 280).

Technical data

Series 65

Size		NG		28	55	80	107	140	160	200
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	28.1	54.8	80.3	106.7	140.2	160.2	200
		$V_{g\,min}$	cm^3	0	0	0	0	0	0	0
		$V_{g\,x}$	cm^3	18	35	51	68	88	61	76
Maximum rotational speed[1] (complying with the maximum permissible inlet flow)	at $V_{g\,max}$	n_{nom}	rpm	5550	4450	3900	3550	3250	3100	2900
	at $V_g < V_{g\,x}$ (see diagram)	n_{max}	rpm	8750	7000	6150	5600	5150	4900	4600
	at $V_{g\,0}$	n_{max}	rpm	10450	8350	7350	6300	5750	5500	5100
Inlet flow[2]	at n_{nom} and $V_{g\,max}$	$q_{v\,max}$	l/min	156	244	312	380	455	496	580
Torque[3]	at $V_{g\,max}$ and Δp = 400 bar	M	Nm	179	349	509	681	891	1019	1273
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	kNm/rad	6	10	16	21	34	35	44
	$V_g/2$ to 0 (interpolated)	c_{min}	kNm/rad	18	32	48	65	93	105	130
Moment of inertia of the rotary group		J_{TW}	kgm^2	0.0014	0.0042	0.008	0.0127	0.0207	0.0253	0.0353
Case volume		V	l	0.5	0.75	1.2	1.5	1.8	2.4	2.7
Weight approx.		m	kg	16	28	36	46	61	62	78

Series 71

Size		NG		60	85	115	150	170	215	280
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	62.0	85.2	115.6	152.1	171.8	216.5	280.1
		$V_{g\,min}$	cm^3	0	0	0	0	0	0	0
		$V_{g\,x}$	cm^3	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	M	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 the rotary group		J_{TW}	kgm^2	0.0043	0.0072	0.0110	0.0181	0.0213	0.0303	0.0479
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

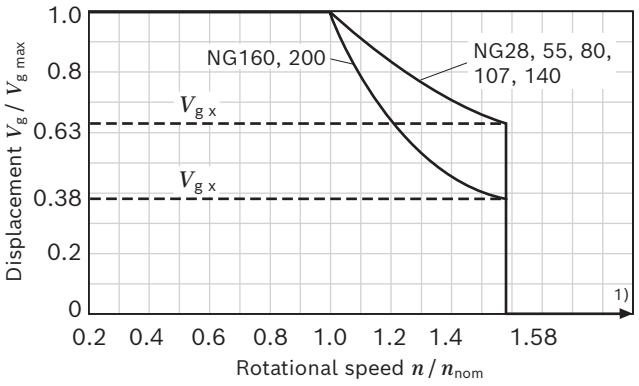
The minimum rotational speed n_{min} is not limited.
For applications with requirements on the evenness of the rotation at low rotational speeds, please contact us.

Notice

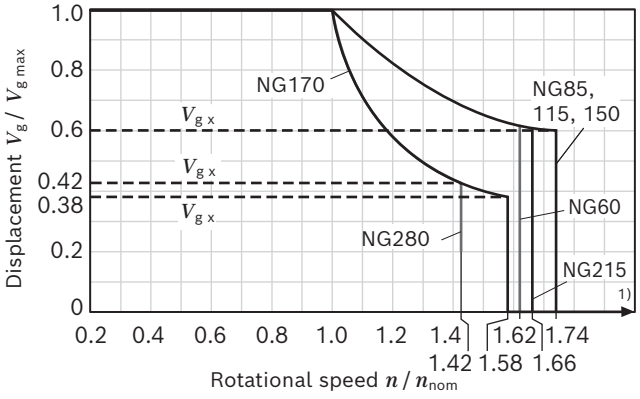
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, such as speed variation, reduced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

1) The values are applicable:
   – for the optimum viscosity range from v_{opt} = 36 to 16 mm^2/s
   – with hydraulic fluid based on mineral oils
2) Note inlet flow limitation due to counterbalance valve (page 86).
3) Torque without radial force, with radial force see page 12.

Permissible displacement in relation to rotational speed Series 65



Permissible displacement in relation to rotational speed Series 71



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

Key

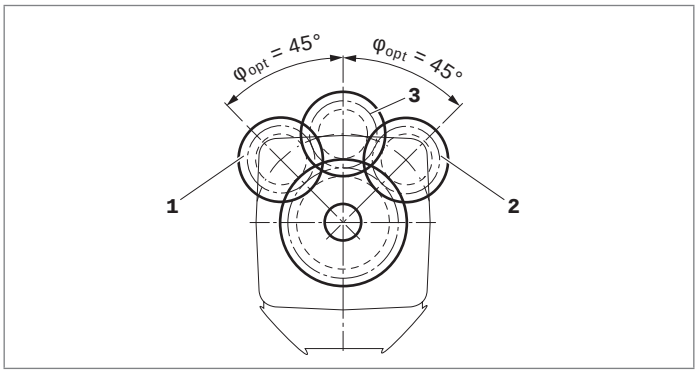
V_g	Displacement per revolution [cm³]
Δp	Differential pressure [bar]
n	Rotational speed [rpm]
η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

1) Values in this range on request

Effect of the radial force F_q on the bearing service life

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

▼ **Gear output drive**



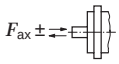
1 "Counter-clockwise" rotation, pressure at port **B**
2 "Clockwise" rotation, pressure at port **A**
3 "Bi-directional" direction of rotation

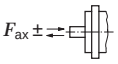
Notice

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

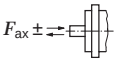
Permissible radial and axial loading on the drive shafts

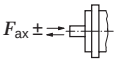
Series 65

Size	NG		55	80	107	140	160	200
Drive shaft	⌀	in	1 1/4	1 1/4	1 3/4	1 3/4	1 3/4	2
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	7811	7559	12256	16036	14488	20047
	a	mm	24.0	24.0	33.5	33.5	33.5	33.5
Maximum torque at $F_{q\,max}$	$M_{q\,max}$	Nm	310	300	681	891	920	1273
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	315	236	400	400	361	400
Maximum axial force at standstill or depressurized operation 	+ $F_{ax\,max}$	N	0	0	0	0	0	0
	− $F_{ax\,max}$	N	500	710	900	1030	1120	1250
Permissible axial force per bar working pressure	+ $F_{ax\,perm/bar}$	N/bar	7.5	9.6	11.3	13.3	15.1	17.0

Size	NG		28	28	55	55	80	80	107	107	140	160	160	200
Drive shaft	⌀	mm	W25	W30	W30	W35	W35	W40	W40	W45	W45	W45	W50	W50
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	6436	4838	7581	8069	10867	10283	13758	12215	15982	18278	16435	20532
	a	mm	14.0	17.5	17.5	20.0	20.0	22.5	22.5	25.0	25.0	25.0	27.5	27.5
Maximum torque at $F_{q\,max}$	$M_{q\,max}$	Nm	179	179	281	349	470	509	681	681	891	1019	1019	1273
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	400	400	322	400	369	400	400	400	400	400	400	400
Maximum axial force at standstill or depressurized operation 	+ $F_{ax\,max}$	N	8	0	0	0	0	0	0	0	0	0	0	0
	− $F_{ax\,max}$	N	315	315	500	500	710	710	900	900	1030	1120	1120	1250
Permissible axial force per bar working pressure	+ $F_{ax\,perm/bar}$	N/bar	4.6	4.6	7.5	7.5	9.6	9.6	11.3	11.3	13.3	15.1	15.1	17.0

Series 71

Size	NG		60	85	115	150	150	170	215	280
Drive shaft	⌀	in	1 1/4 in	1 1/2 in	1 3/4 in	1 3/4 in	2 in	2 in	2 in	2 1/4 in
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	7620	12463	14902	15948	17424	19370	22602	26821
	a	mm	24.0	27.0	33.5	33.5	33.5	33.5	33.5	40.0
Maximum torque at $F_{q\,max}$	$M_{q\,max}$	Nm	310	595	828	890	1089	1230	1445	1916
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	315	440	450	370	450	450	420	430
Maximum axial force at standstill or depressurized operation 	+ $F_{ax\,max}$	N	0	0	0	0	0	0	0	0
	− $F_{ax\,max}$	N	500	710	900	1300	1300	1120	1250	1575
Permissible axial force per bar working pressure	+ $F_{ax\,perm/bar}$	N/bar	7.5	9.6	11.3	13.3	13.3	15.1	17.0	19.4

Size	NG		60	85	115	150	170	215	280
Drive shaft	⌀	mm	W35	W40	W40	W45	W45	W50	W60
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	N	10266	12323	16727	19534	21220	25016	26913
	a	mm	20.0	22.5	22.5	25.0	25.0	27.5	35.0
Maximum torque at $F_{q\,max}$	$M_{q\,max}$	Nm	444	610	828	1089	1200	1550	2005
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	bar	450	450	450	450	440	450	450
Maximum axial force at standstill or depressurized operation 	+ $F_{ax\,max}$	N	0	0	0	0	0	0	0
	− $F_{ax\,max}$	N	500	710	900	1300	1120	1250	1575
Permissible axial force per bar working pressure	+ $F_{ax\,perm/bar}$	N/bar	7.5	9.6	11.3	13.3	15.1	17.0	19.4

HP – Proportional control, hydraulic

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

HP1, HP2 positive control

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

HP5, HP6 negative control

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

Notice

- Maximum permissible pilot pressure: p_{St} = 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
- Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.
- Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 10 bar.
- The beginning of control and the HP characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 9) and thus a parallel shift 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 external 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 nozzle Ø1.2

Option

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

▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215
Groove size [mm]	0.30	0.45	0.45	0.55	0.55	0.55	0.65

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

HP1 positive control

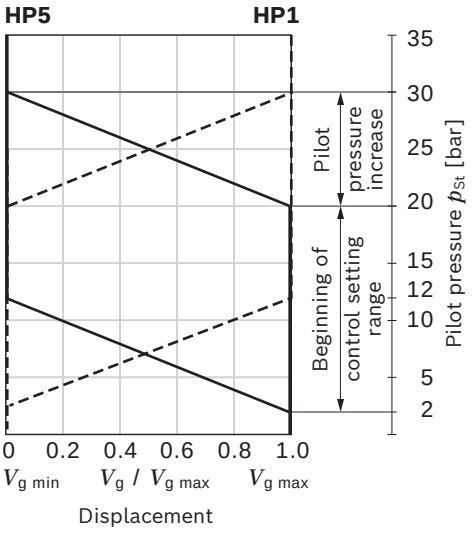
A pilot pressure increase of 10 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

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

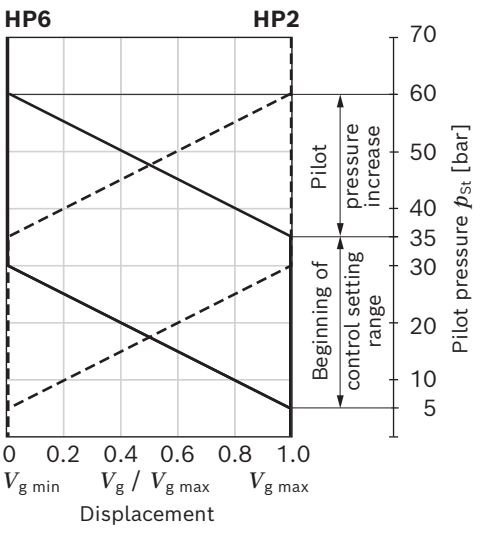
A pilot pressure increase of 25 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP6 negative control

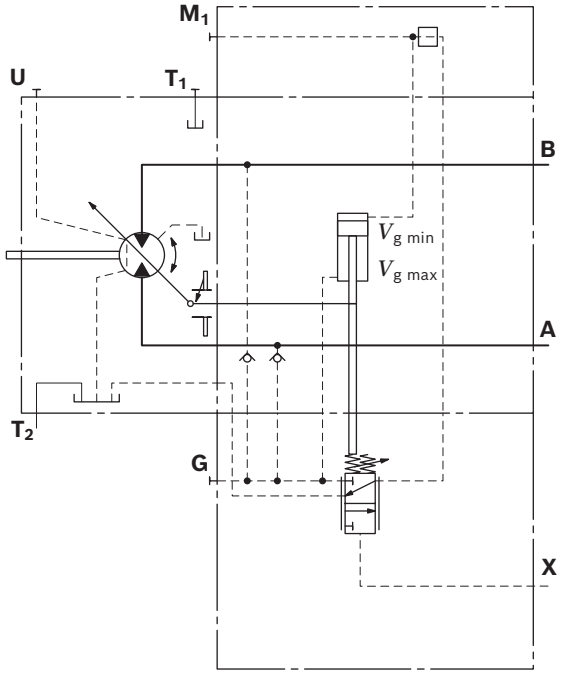
A pilot pressure increase of 25 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

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

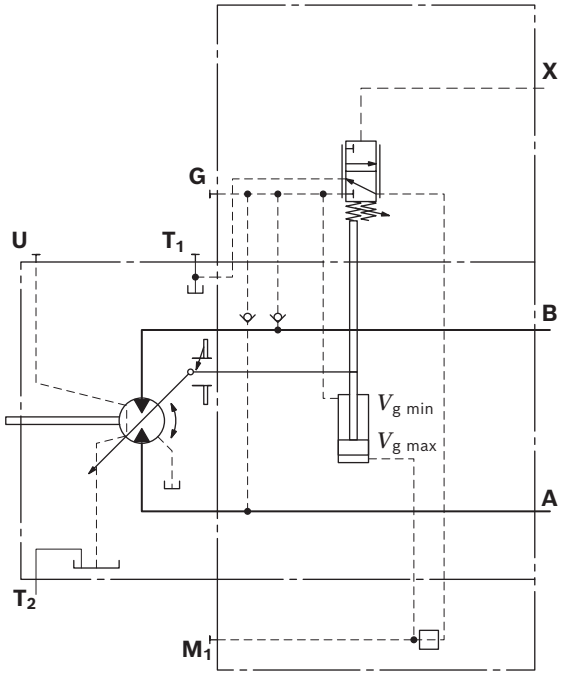
▼ **Characteristic curve**



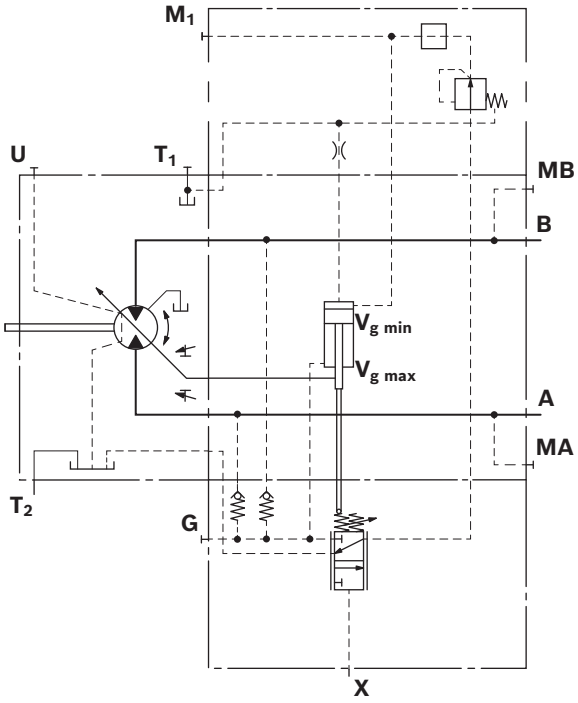
▼ **Circuit diagram HP1, HP2 (positive control)**
Size 28 to 215



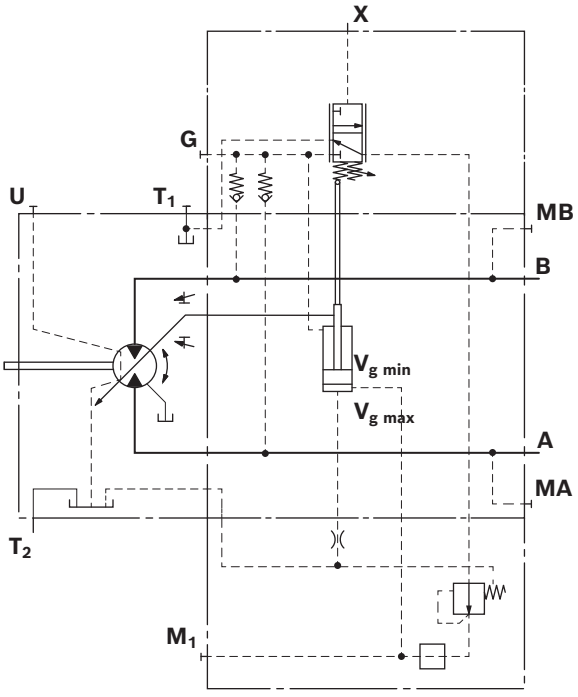
▼ **Circuit diagram HP5, HP6 (negative control)**
Size 28 to 215



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



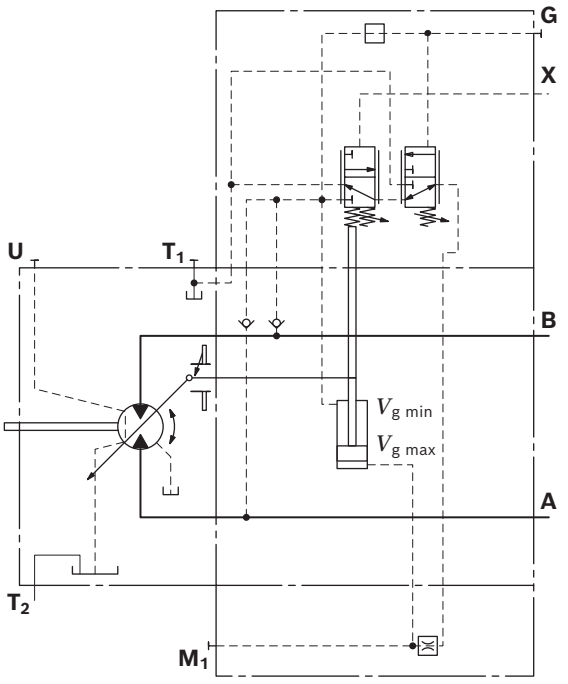
▼ **Circuit diagram HP5, HP6 (negative control)**
Size 280



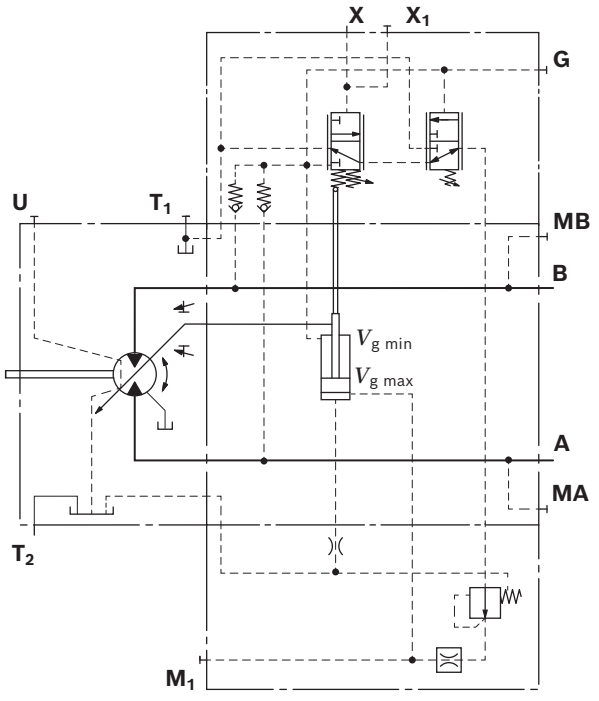
HP5D1, HP6D1 Pressure control, fixed setting

The pressure control overrides the HP 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 provides more torque, while the pressure remains constant.
Setting range at pressure control valve: 80 to 400 bar with series 65 and 80 to 450 bar with series 71.

▼ **Circuit diagram HP5D1, HP6D1 (negative control) Size 28 to 215**



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



EP – Proportional control, electric

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

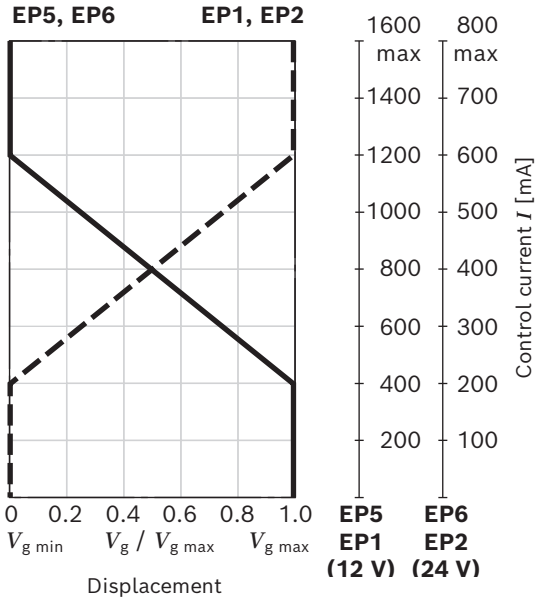
EP1, EP2 positive control

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

EP5, EP6 negative control

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

▼ **Characteristic curve**



Notice

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
- Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.

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

Option

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

▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215
Groove size [mm]	0.30	0.45	0.45	0.55	0.55	0.55	0.65

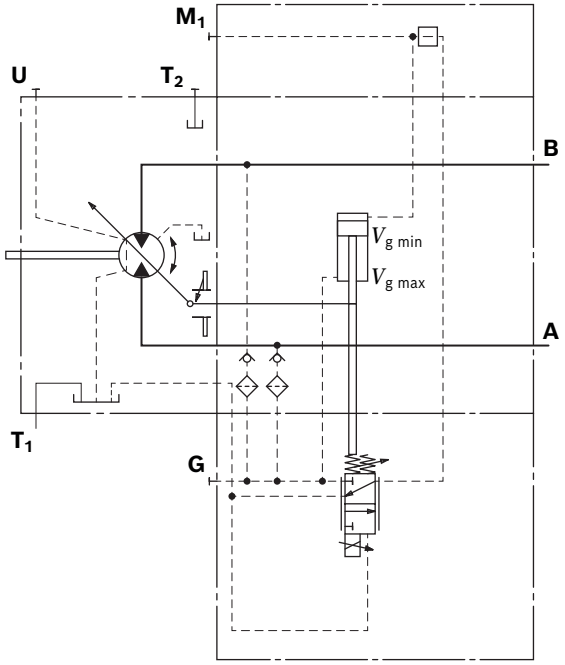
Technical data, solenoid	EP1, EP5	EP2, EP6
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither		
Frequency	100 Hz	100 Hz
Minimum oscillation range[1)]	240 mA	120 mA
Duty cycle	100%	100%
Type of protection: see connector version page 80		

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

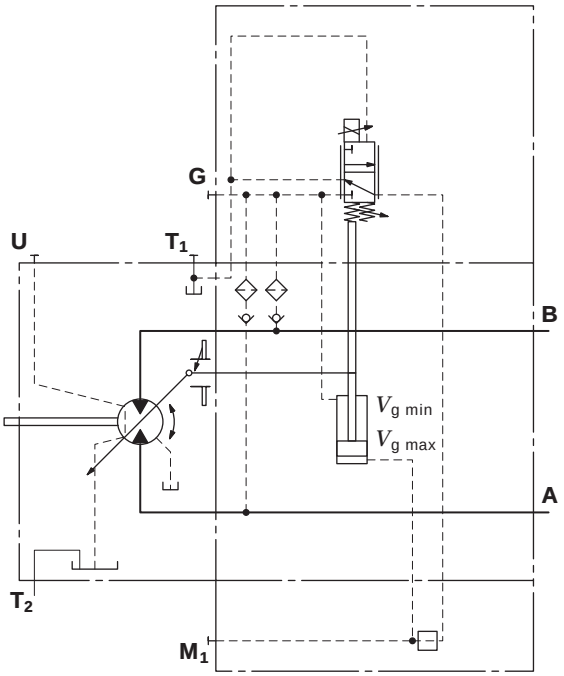
Further information can also be found online under www.boschrexroth.com/mobile-electronics.

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)

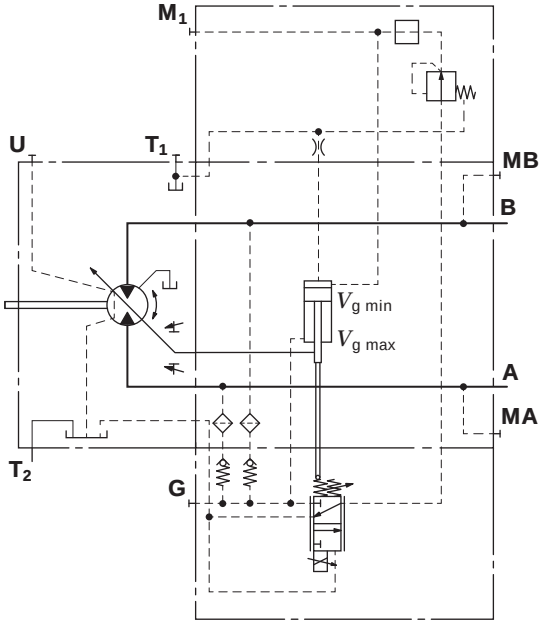
▼ **Circuit diagram EP1, EP2 (positive control)**
Size 28 to 215



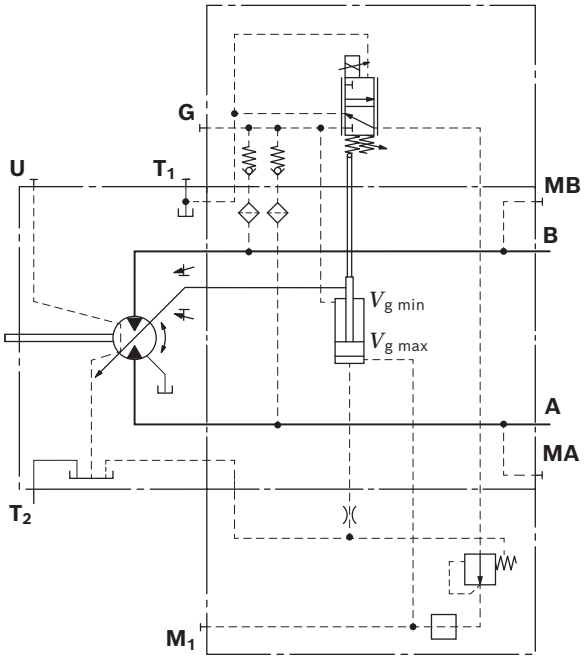
▼ **Circuit diagram EP5, EP6 (negative control)**
Size 28 to 215



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



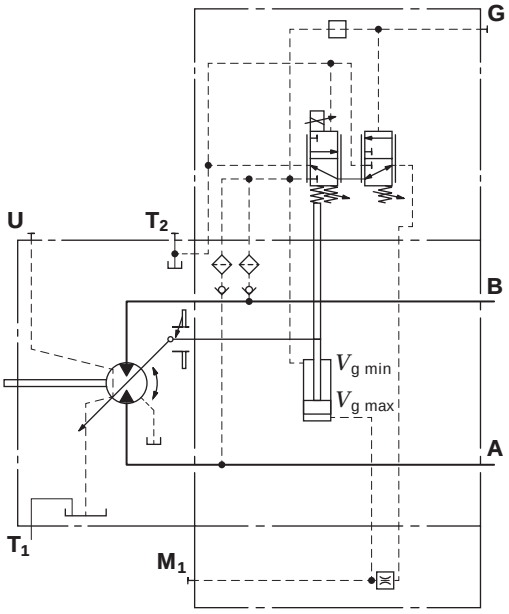
▼ **Circuit diagram EP5, EP6 (negative control)**
Size 280



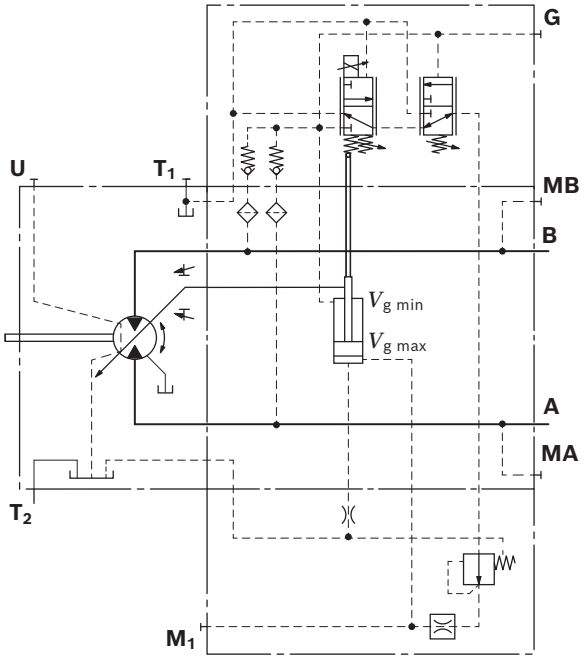
EP5D1, EP6D1 Pressure control, fixed setting

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 provides more torque, while the pressure remains constant.
Setting range at pressure control valve:
80 to 400 bar with series 65 and
80 to 450 bar with series 71.

▼ **Circuit diagram EP5D1, EP6D1 (negative control)**
Size 28 to 215



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



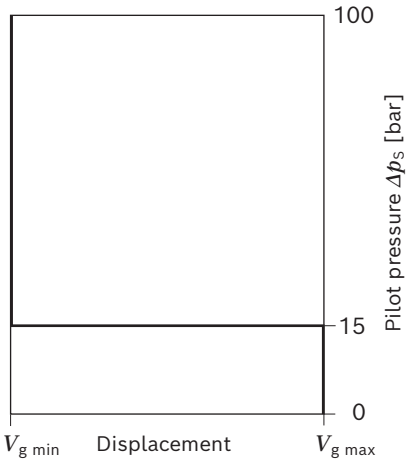
HZ – Two-point control, hydraulic

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

HZ5, HZ7 negative control

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

▼ **Characteristic curve HZ5, HZ7**



Notice

- Maximum permissible pilot pressure: 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.
- A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir.

Stroking time damping

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

Standard for size 28 and 140 to 280

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

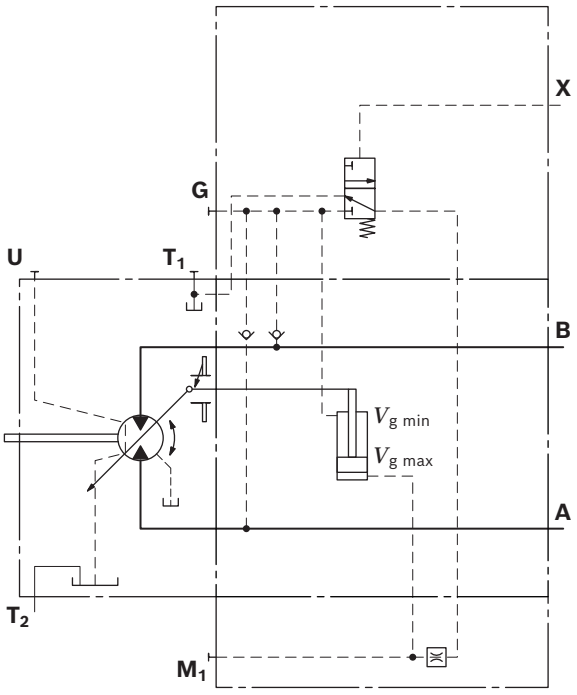
Standard for size 55 to 115

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

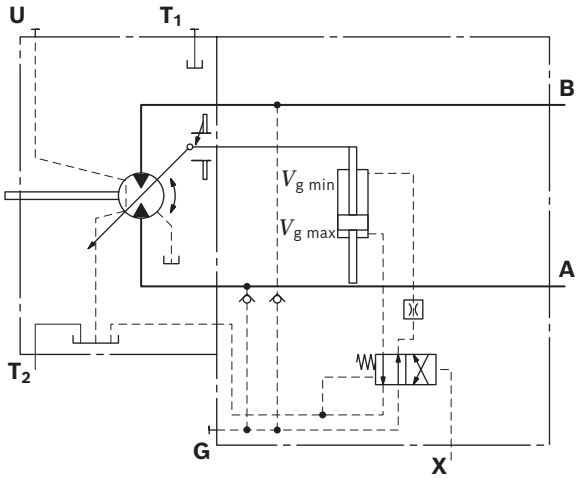
▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215
Groove size [mm]	0.30	0.30	0.30	0.30	0.55	0.55	0.65

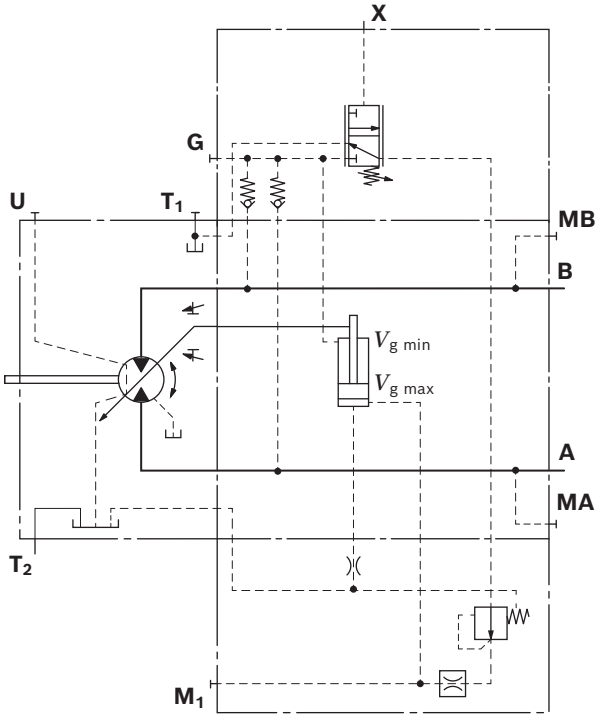
▼ **Circuit diagram HZ5, (negative control)**
Size 28 and 140 to 215



▼ **Circuit diagram HZ7 (negative control)**
Size 55 to 115



▼ **Circuit diagram HZ5, (negative control)**
Size 280



EZ – Two-point control, electric

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

Notice

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.

Stroking time damping

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

Standard for size 28 and 140 to 280

EZ5, **EZ6** with throttle pin acting on both sides, symmetrical (see table), size 280 with nozzle Ø1.2

Standard for size 55 to 115

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

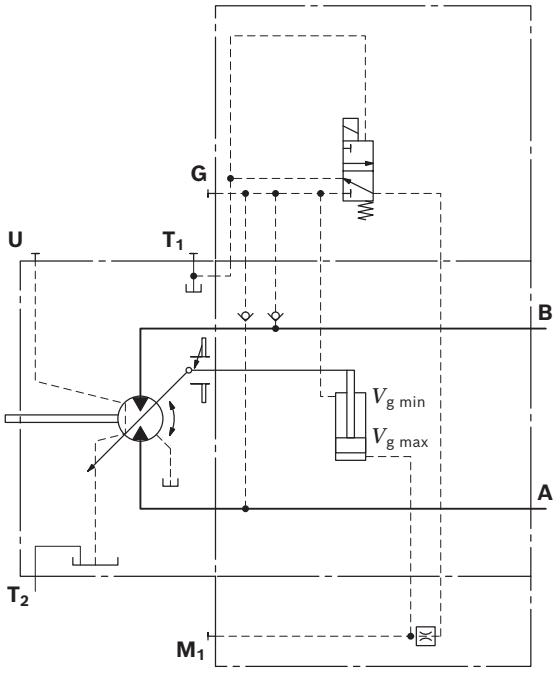
▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215
Groove size [mm]	0.30	0.30	0.30	0.30	0.55	0.55	0.65

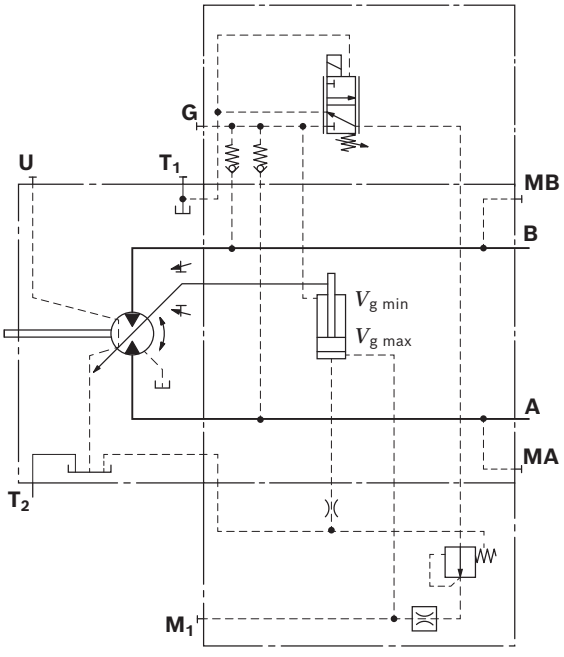
Size 28 and 140 to 280

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 80		

▼ **Circuit diagram EZ5, EZ6 (negative control)**
Size 28 and 140 to 215



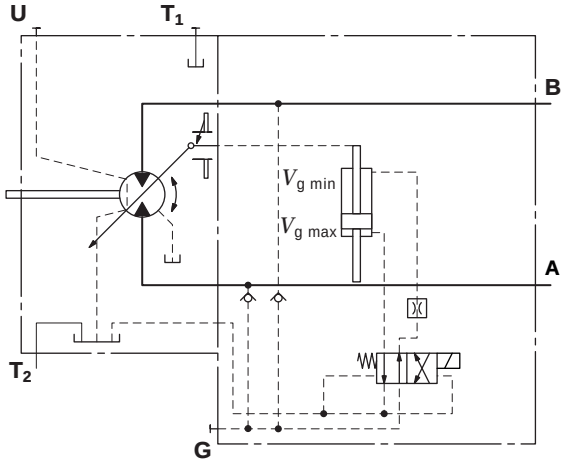
▼ **Circuit diagram EZ5, EZ6 (negative control)**
Size 280



Size 55 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 80		

▼ **Circuit diagram EZ7, EZ8 (negative control)**
Size 55 to 115



HA – Automatic control, high-pressure related

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 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 required in A (B). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.
- The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in case pressure causes an increase in the beginning of control (see page 9) and thus a parallel shift 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 size 28 to 280

HA1, HA2 with throttle pin on one side, throttle from $V_{g\,min}$ to $V_{g\,max}$ (see table)

▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215	280
Groove size [mm]	0.30	0.45	0.45	0.55	0.55	0.55	0.65	2×1.0

Standard for size 55 to 215

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

▼ **Throttle screw**

NG		55 60	80 85	107 115	140 150	160 170	200 215
Diameter	[mm]	0.80	0.80	0.80	0.80	0.80	0.80

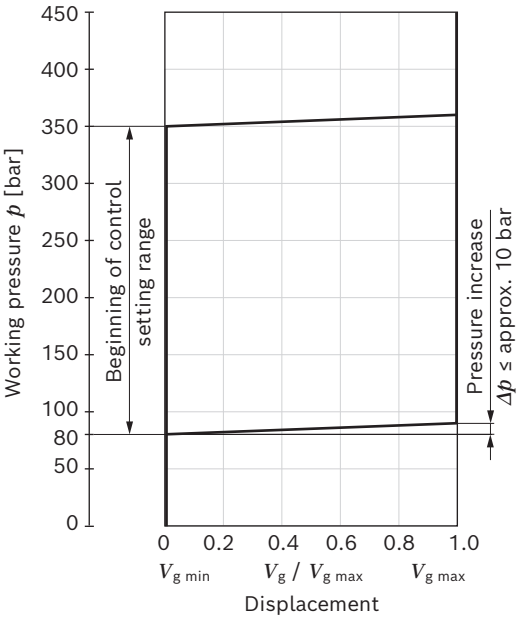
HA1 with minimum pressure increase, positive control

A working pressure increase of Δp ≤ approx. 10 bar results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

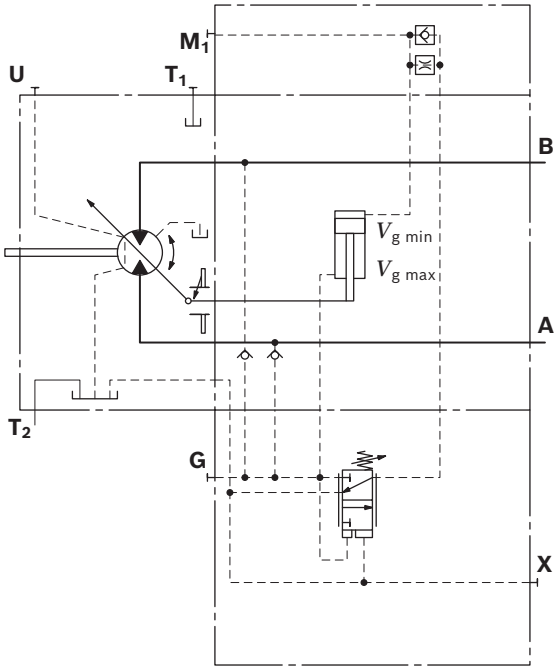
Beginning of control, setting range 80 to 350 bar

Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 300 bar.

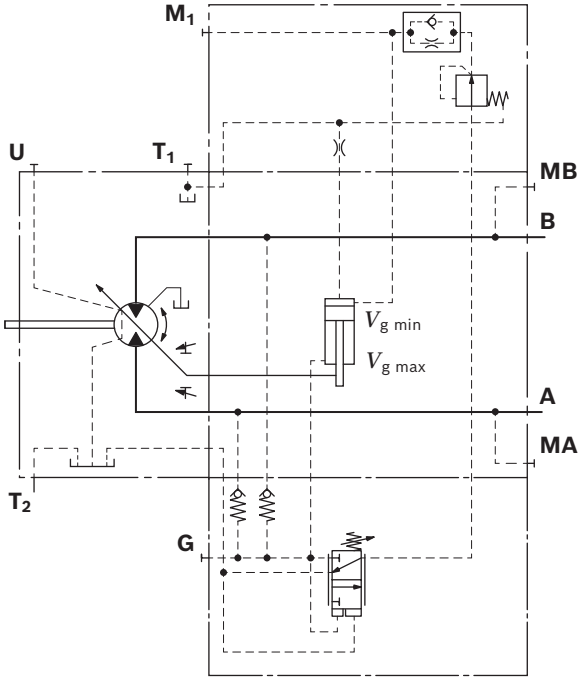
▼ **Characteristic curve HA1**



▼ **Circuit diagram HA1**
Size 28 to 215



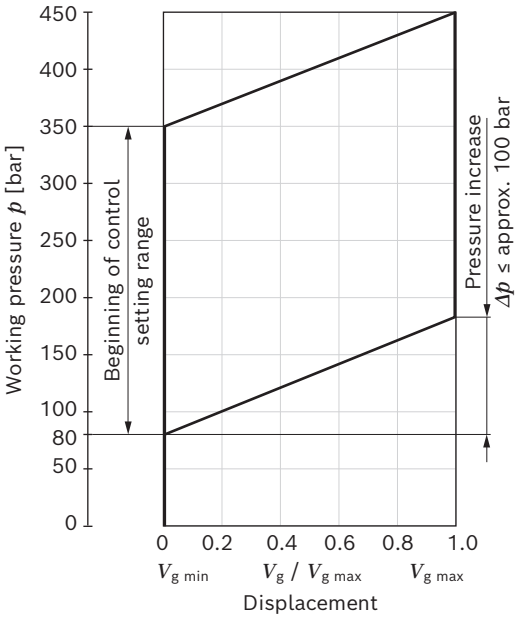
▼ **Circuit diagram HA1**
Size 280



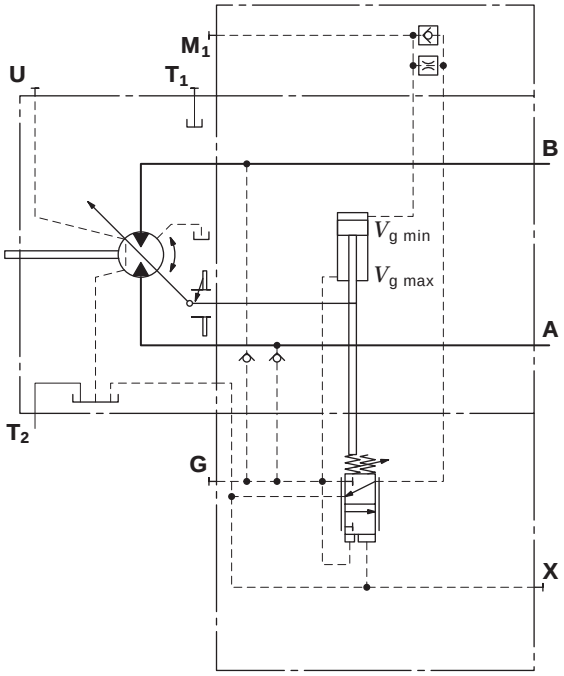
HA2 with pressure increase, positive control

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[1)]
Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 200 bar.

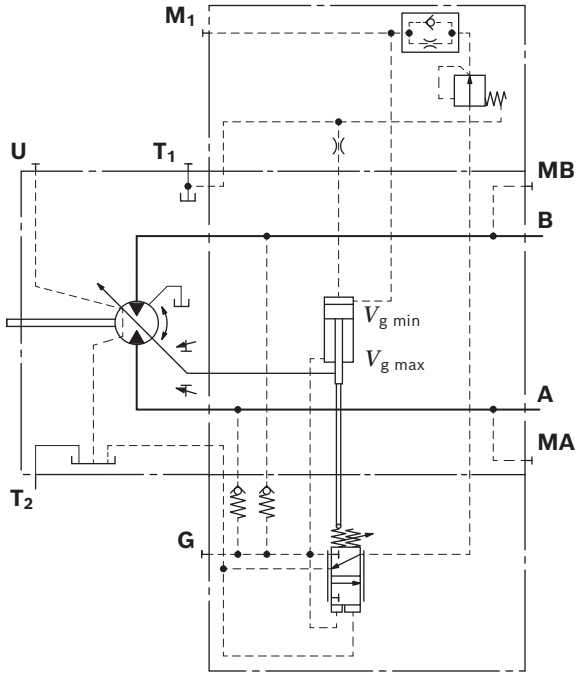
▼ **Characteristic curve HA2**



▼ **Circuit diagram HA2**
Size 28 to 215



▼ **Circuit diagram HA2**
Size 280



1) With series 65 and beginning of control above 300 bar, the permissible nominal pressure of 400 bar can be exceeded. Please note the maximum single operating period and total operating period of the maximum pressure, see page 8

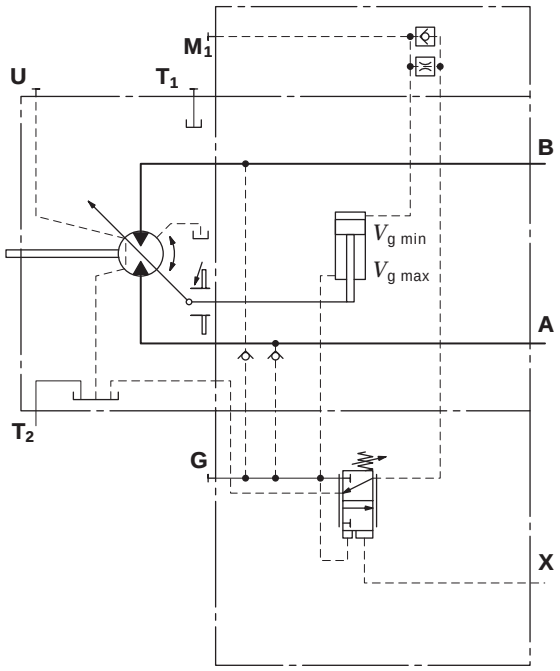
HA.T3 override, hydraulic, remote controlled, proportional

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.

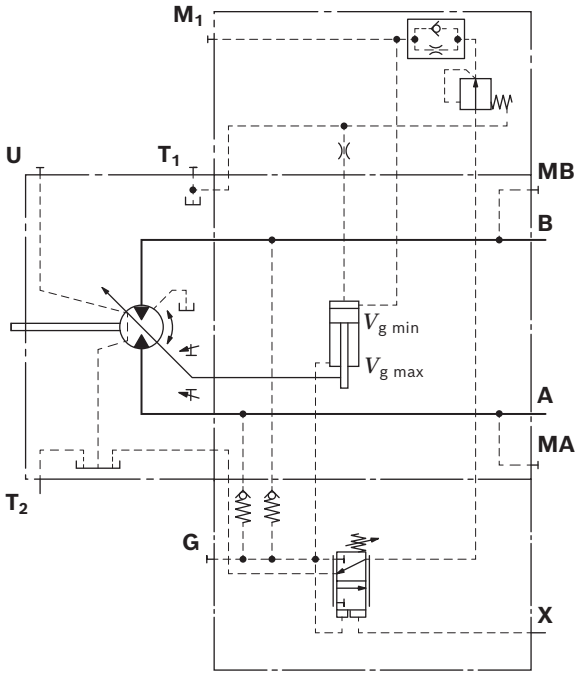
Beginning of control setting	300 bar	NG28 to 215 300 bar	NG280 300 bar
Pilot pressure at port **X**	0 bar	10 bar	10 bar
Beginning of control at	300 bar	130 bar	70 bar

Notice
Maximum permissible pilot pressure 100 bar.

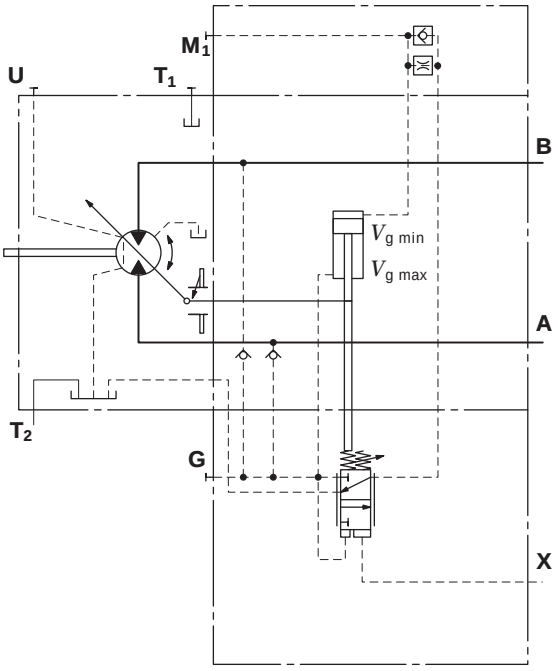
▼ **Circuit diagram HA1T3**
Size 28 to 215



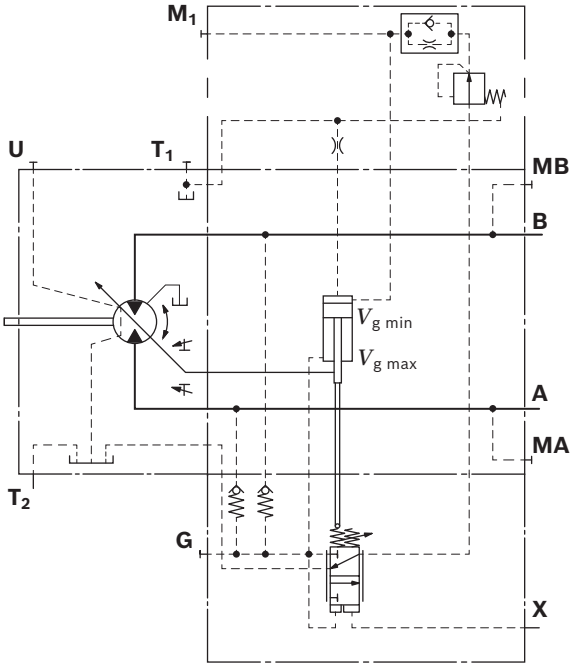
▼ **Circuit diagram HA1T3**
Size 280



▼ **Circuit diagram HA2T3**
Size 28 to 215



▼ **Circuit diagram HA2T3**
Size 280

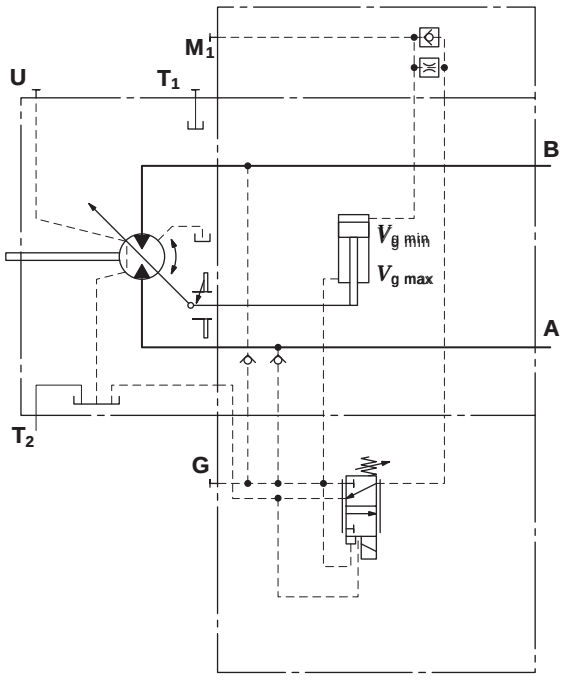


HA.U1, HA.U2 electric override, two-point

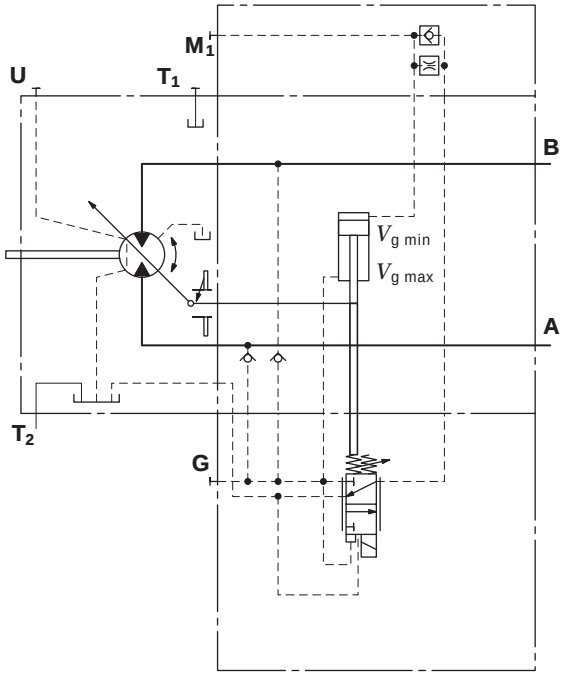
With the HA.U1 or HA.U2 control, the beginning of control can be overridden by an electric signal to a switching solenoid. When the override solenoid is energized, the variable motor swivels to maximum swivel angle, without intermediate position.
The beginning of control can be set between 80 and 300 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 80		

▼ **Circuit diagram HA1U1, HA1U2**



▼ **Circuit diagram HA2U1, HA2U2**



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 33).

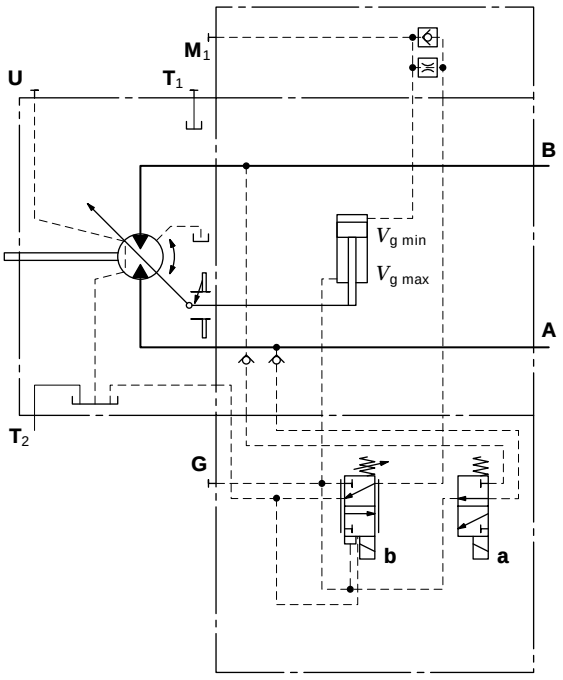
Electric override

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 80		

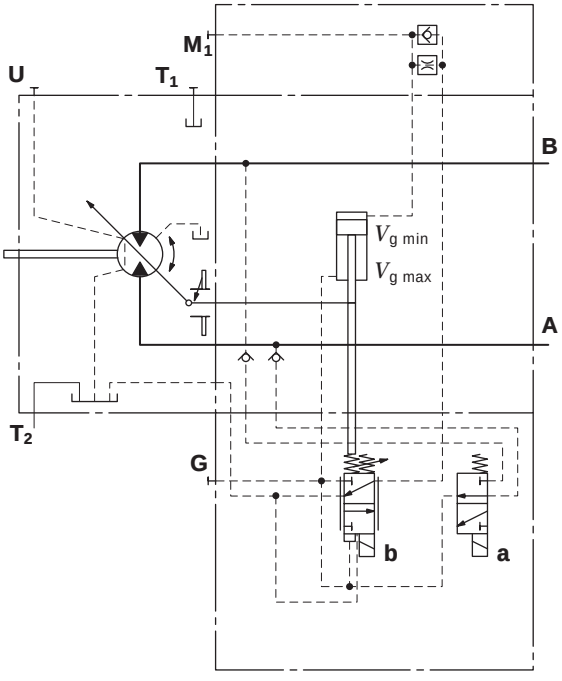
Travel direction valve, electric

Technical data, solenoid a with Ø37		R1	R2
Voltage		12 V (±20%)	24 V (±20%)
Direction of rotation	Working pressure in		
Counter-clockwise	**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 80			

▼ **Circuit diagram HA1R1, HA1R2**



▼ **Circuit diagram HA2R1, HA2R2**



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 (NG28 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 properly 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 case pressure causes a reduction in the beginning of control (see page 9) and thus a parallel shift 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 size 28 to 280
DA with throttle pin on one side, throttle from $V_{g\,min}$ to $V_{g\,max}$ (see table)

▼ **Throttle pin overview**

NG	28	55 60	80 85	107 115	140 150	160 170	200 215	280
Groove size [mm]	0.30	0.45	0.45	0.55	0.55	0.55	0.65	2×1.0

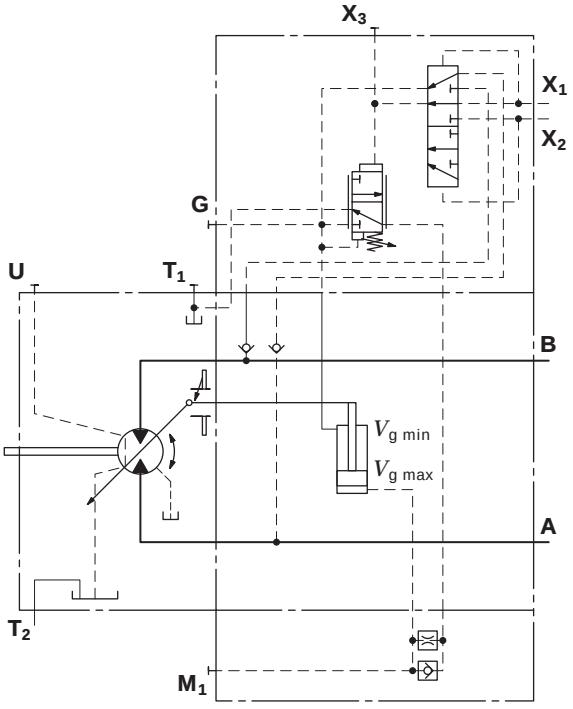
DA0, DA7

Hydraulic travel direction valve, negative control

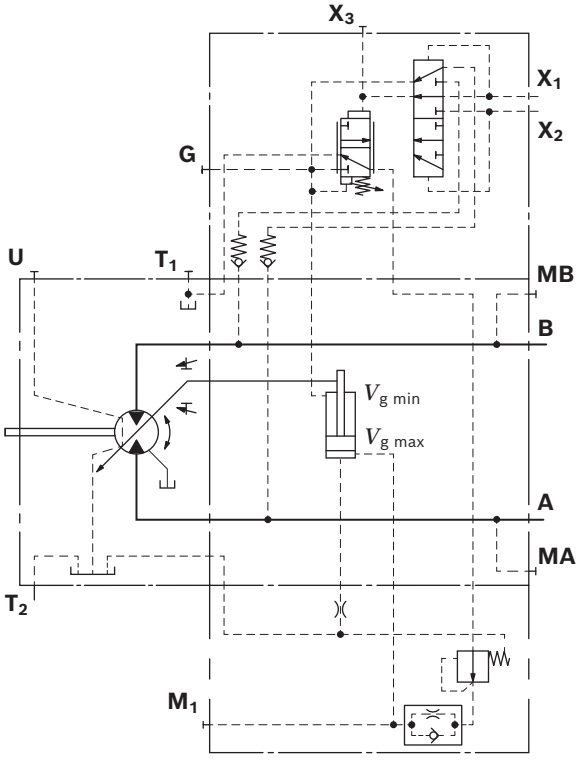
Depending on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressure ports X_1 or X_2.

Direction of rotation	Working pressure in	Pilot pressure in
Clockwise	**A**	X_1
Counter-clockwise	**B**	X_2

▼ **Circuit diagram DA0**
Size 28 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).

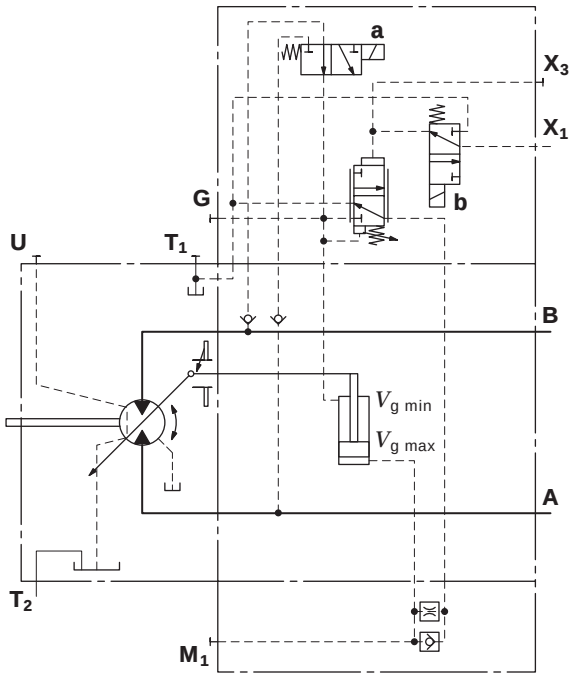
Travel direction valve, electric

Technical data, solenoid a with Ø37		DA1	DA2
Voltage		12 V (±20%)	24 V (±20%)
Direction of rotation	Working pressure in		
Counter-clockwise	**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 80			

Electric override

Technical data, solenoid b with Ø37	DA1	DA2
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 80		

▼ **Circuit diagram DA1, DA2**
Size 28 to 215



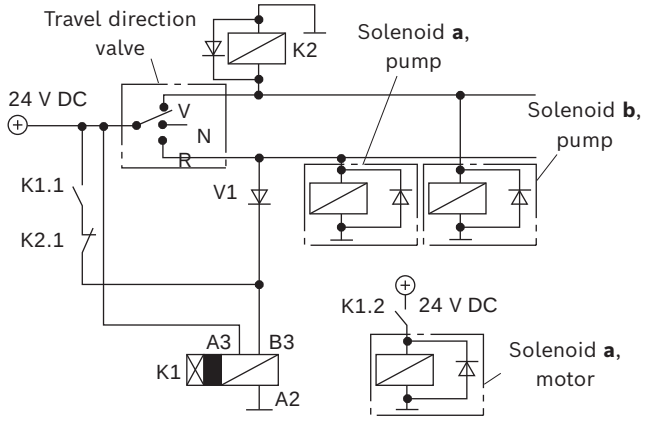
Electric travel direction valve (for DA, HA.R)

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

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

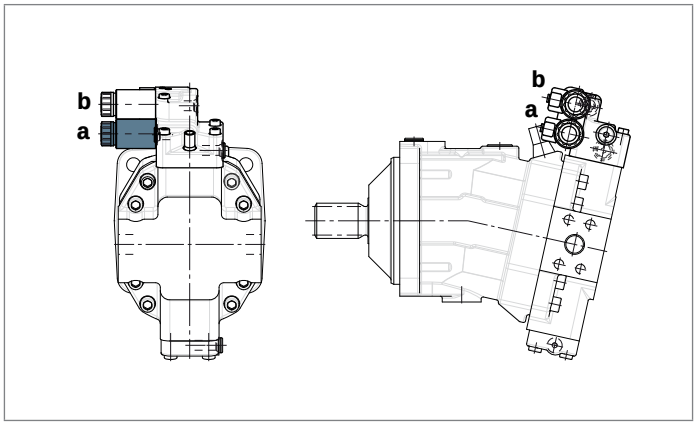
As a result, jerky deceleration or braking is prevented in both cases.

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

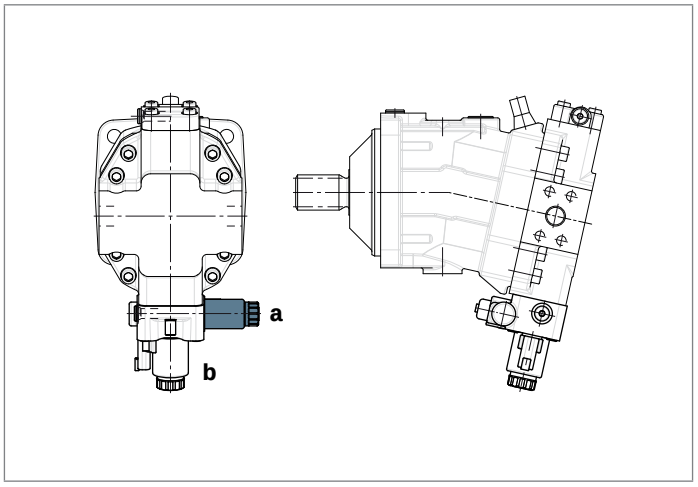


Notice
The shown diodes and relays are not included in the scope of delivery of the motor.

▼ **Control DA1, DA**



▼ **Control, HA1R., HA2R.**

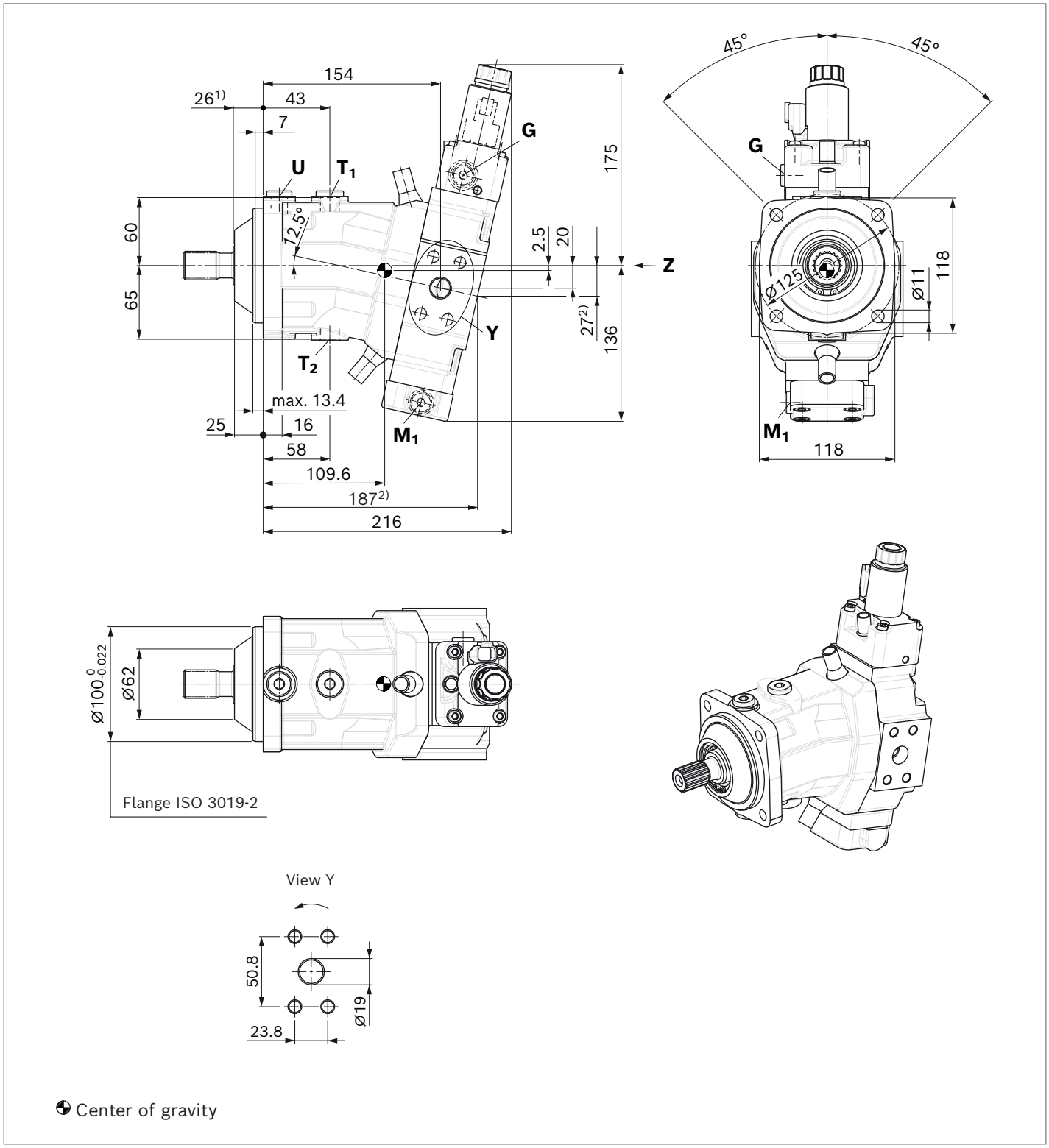


Dimensions

Series 65: Size 28

EP5, EP6 – Proportional electric control, negative control

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

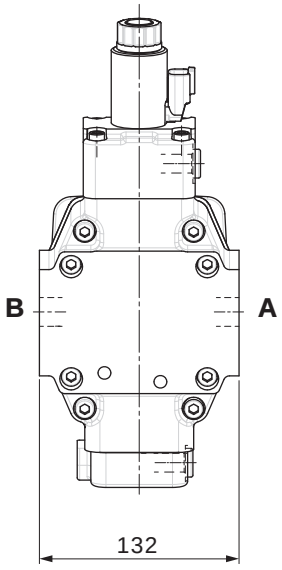


1) To shaft collar

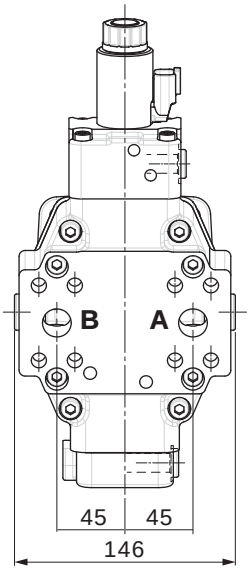
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

2 SAE working ports **A** and **B** lateral, opposite

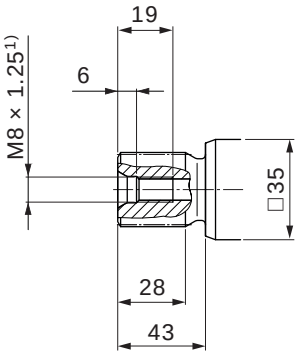


1 SAE working ports **A** and **B** at rear



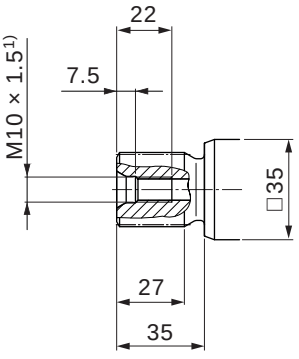
▼ **Splined shaft DIN 5480**

Z5 – W25×1.25×18×9g



▼ **Splined shaft DIN 5480**

Z6 –W30×2×14×9g

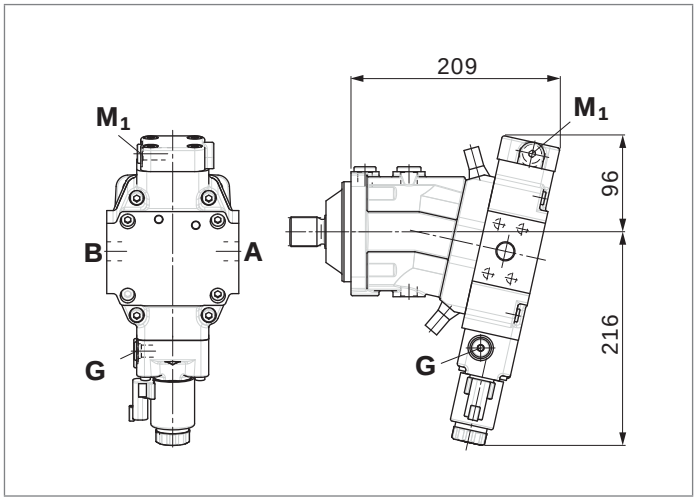


1) Center bore according to DIN 332 (thread according to DIN 13)

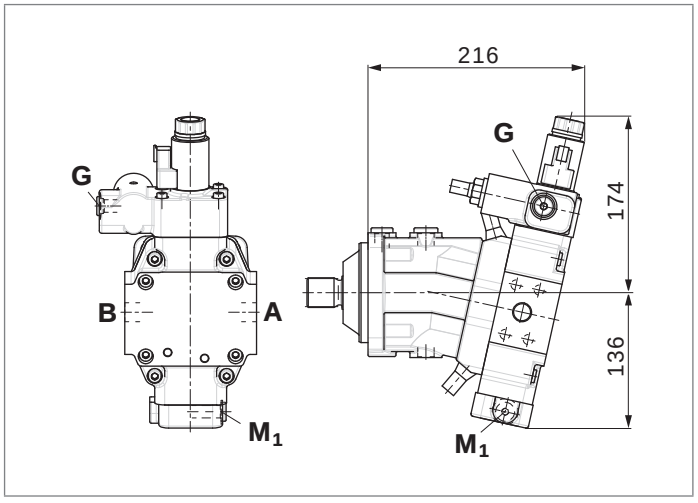
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	3/4 in M10 × 1.5; 17 deep	450	O
T_1	Drain port	DIN 3852[4]	M18 × 1.5; 12 deep	3	X[3]
T_2	Drain port	DIN 3852[4]	M18 × 1.5; 12 deep	3	O[3]
G	Synchronous control	DIN 3852[4]	M14 × 1.5; 11.5 deep	450	X
U	Bearing flushing port	DIN 3852[4]	M16 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	DIN 3852[4]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	DIN 3852[4]	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Pilot pressure port (DA0)	DIN 2353-CL	8B-ST	40	O
X_1	Pilot pressure port (DA1, DA2)	DIN 3852[4]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA0, DA1, DA2)	DIN 3852[4]	M14 × 1.5; 11.5 deep	40	X
M_1	Measuring port, control pressure	DIN 3852[4]	M14 × 1.5; 11.5 deep	450	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

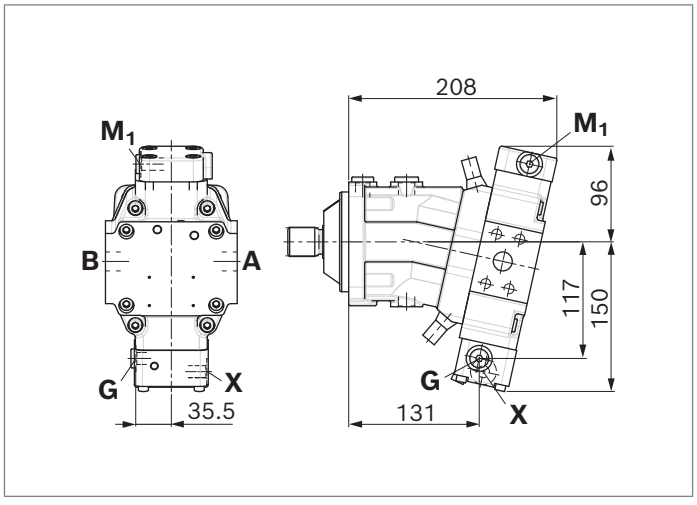
▼ **EP1, EP2** – Proportional electric control, positive control



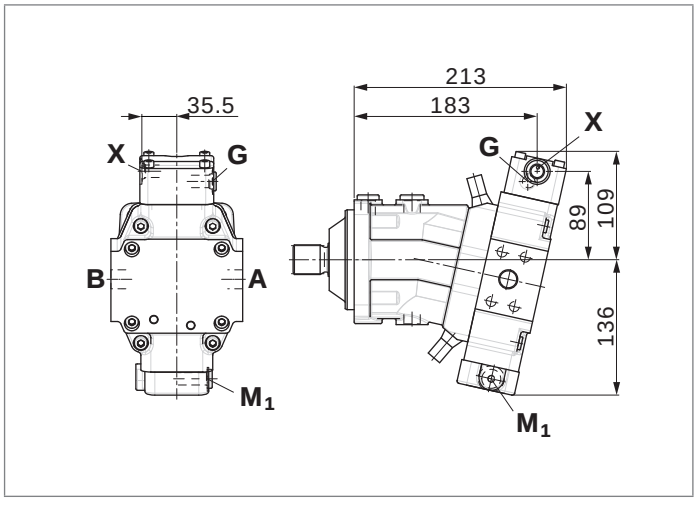
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



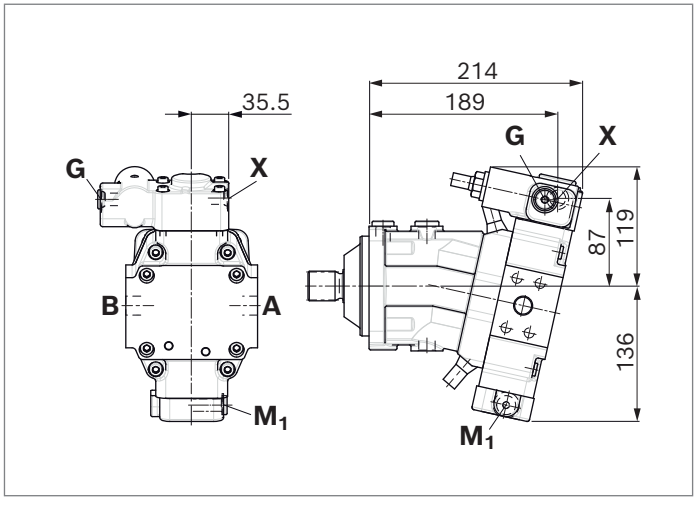
▼ **HP1, HP2** – Proportional hydraulic control, positive control



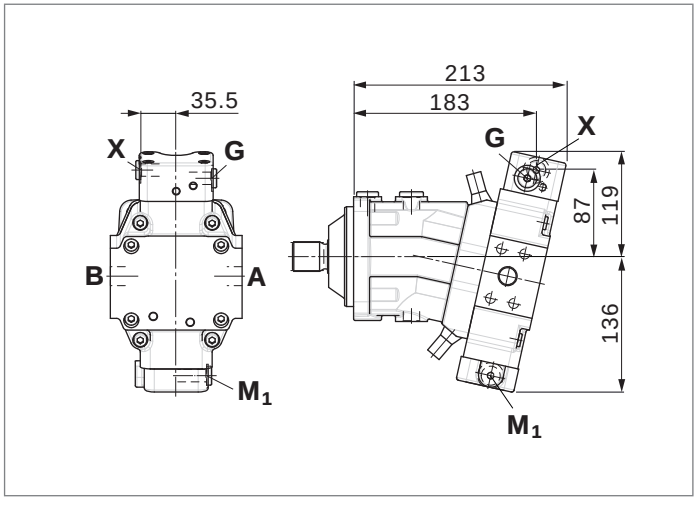
▼ **HP5, HP6** – Proportional hydraulic control, negative control



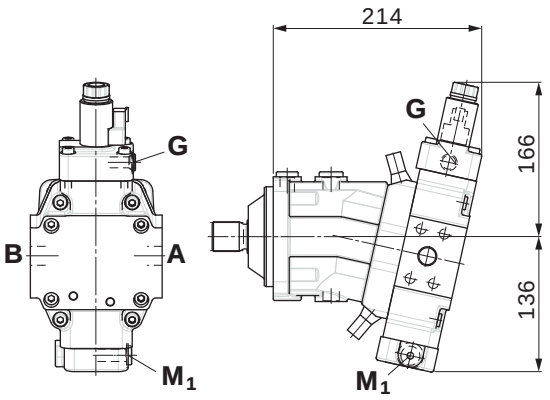
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



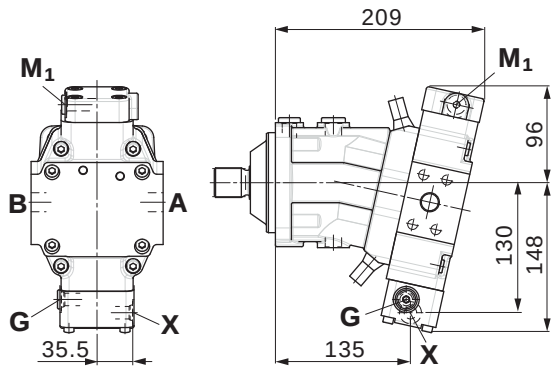
▼ **HZ5** – Two-point control, hydraulic, negative control



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

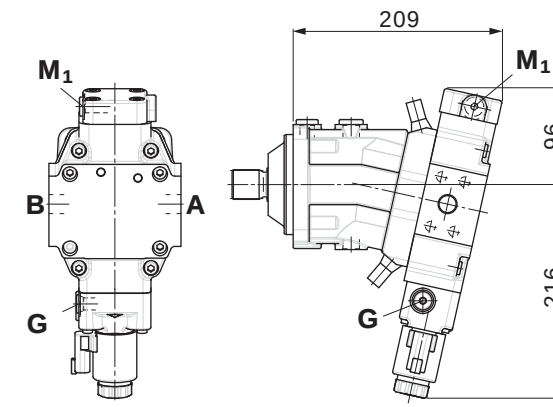


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

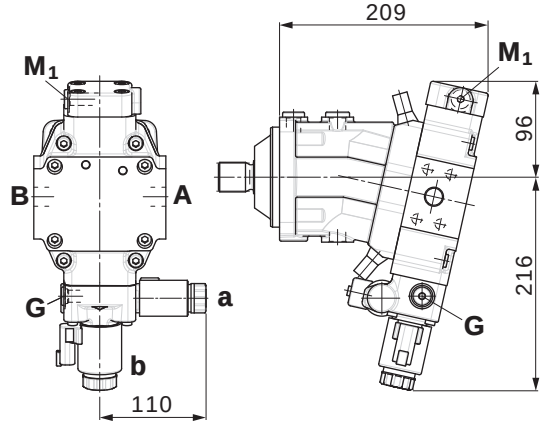


HA1 and HA2, **X** plugged
HA1T3 and HA2T3, **X** open

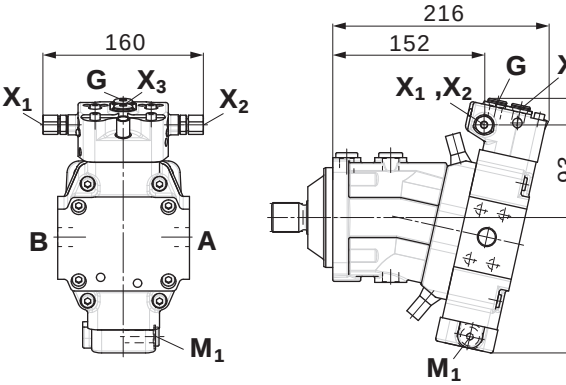
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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

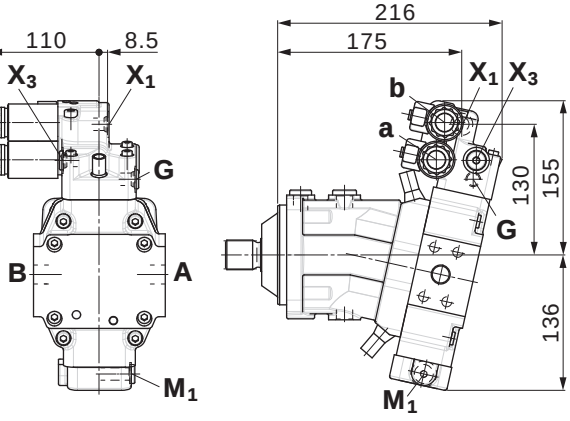


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

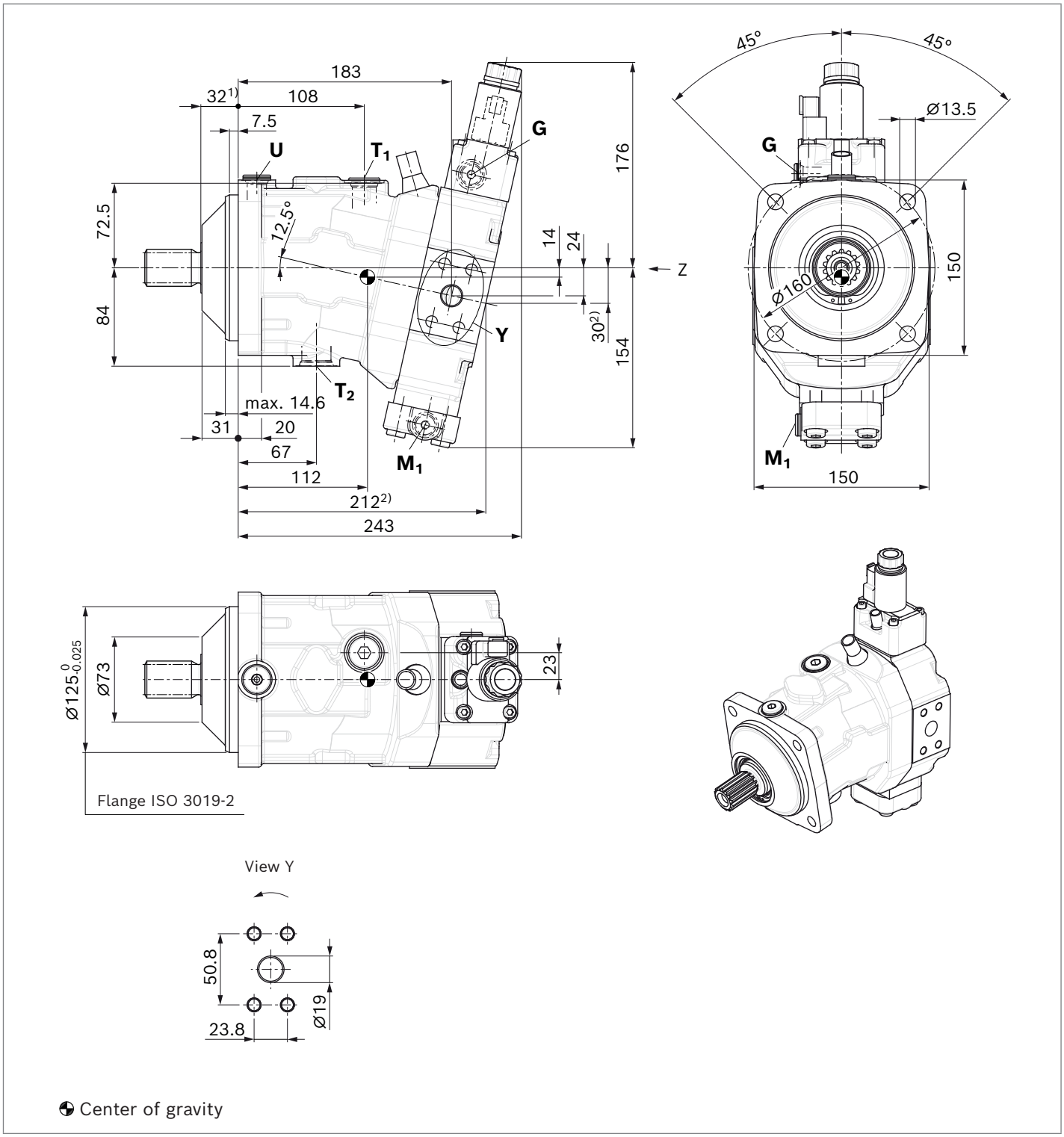


Dimensions

Series 65: Size 55,
Series 71: Size 60

EP5, EP6 – Proportional electric control, negative control

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

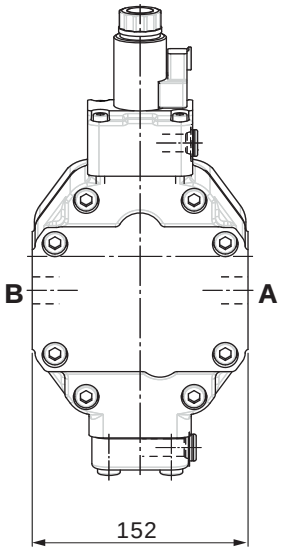


1) To shaft collar

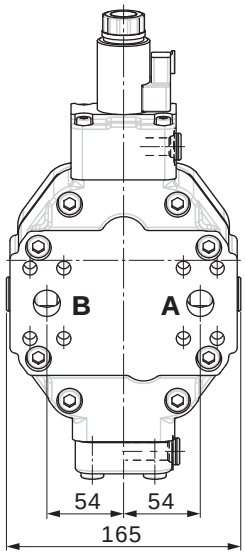
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

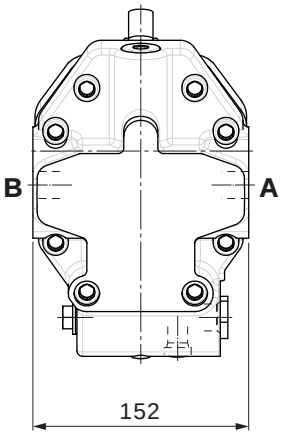
2 SAE working ports **A** and **B** lateral, opposite



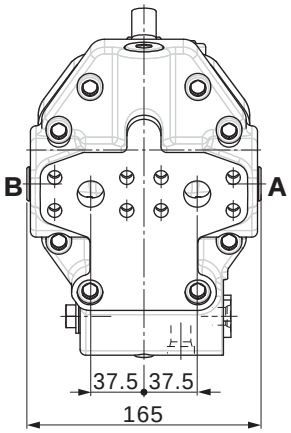
1 SAE working ports **A** and **B** at rear



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

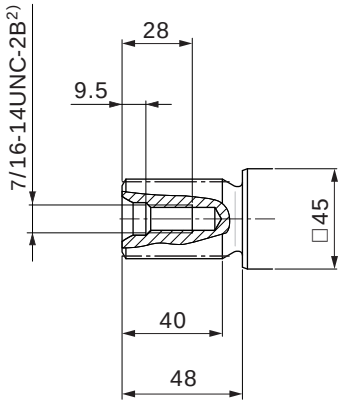


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



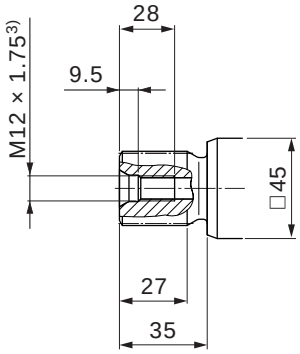
▼ **Splined shaft SAE J744**

S7 – 1 1/4 in 14T 12/24DP[1)]



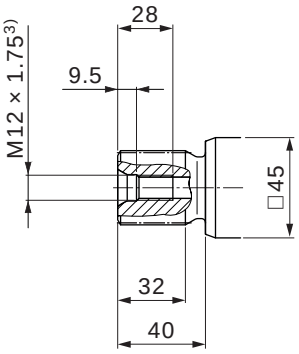
▼ **Splined shaft DIN 5480 (series 65 only)**

Z6 – W30×2×14×9g



▼ **Splined shaft DIN 5480**

Z8 – W35×2×16×9g

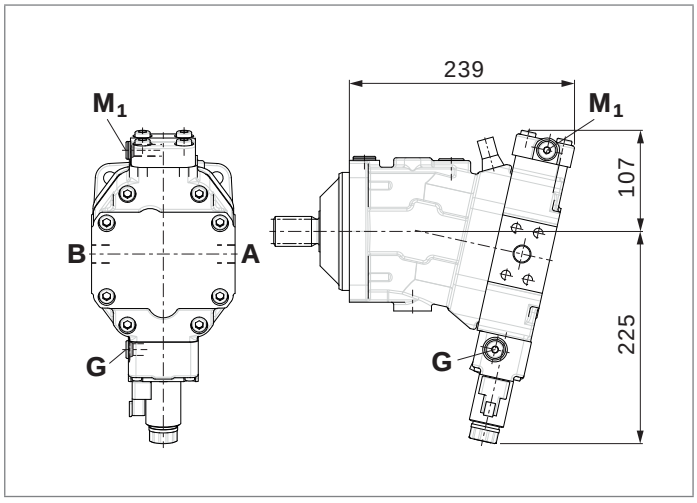


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

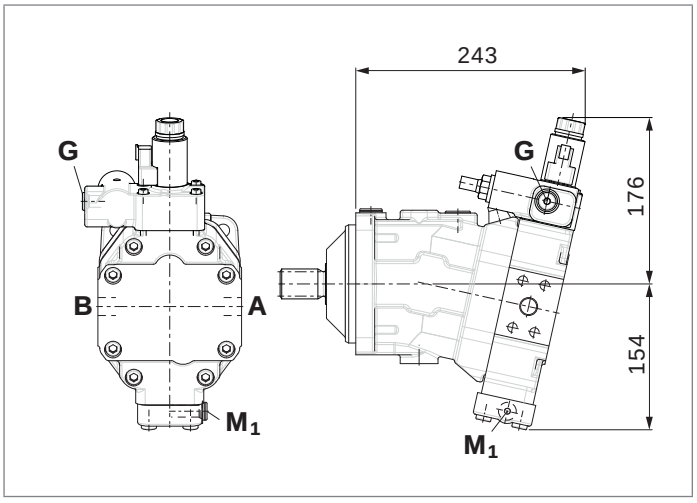
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	3/4 in M10 × 1.5; 17 deep	530	O
T_1	Drain port	ISO 6149[4]	M22 × 1.5; 15.5 deep	3	X[3]
T_2	Drain port	ISO 6149[4]	M27 × 2; 19 deep	3	O[3]
G	Synchronous control	ISO 6149[4]	M14 × 1.5; 11.5 deep	530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

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

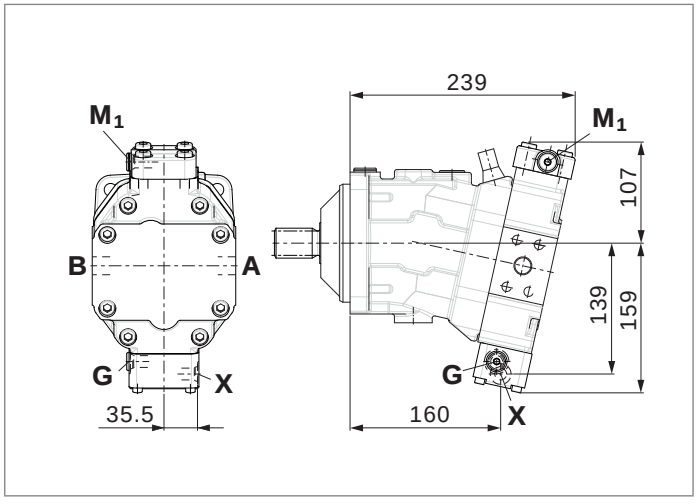
▼ **EP1, EP2** – Proportional electric control, positive control



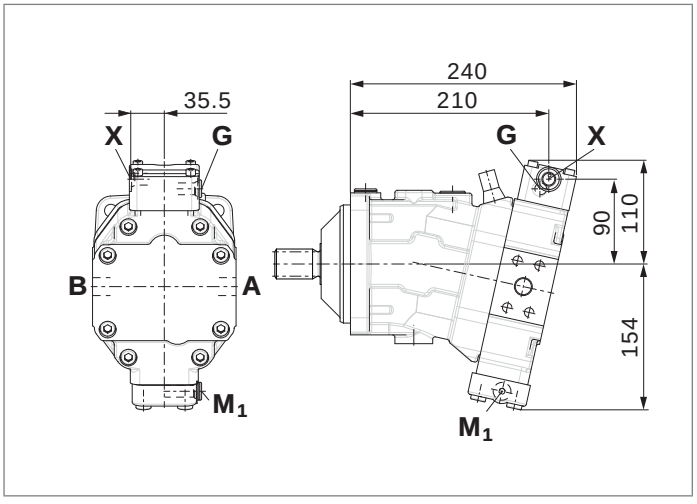
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



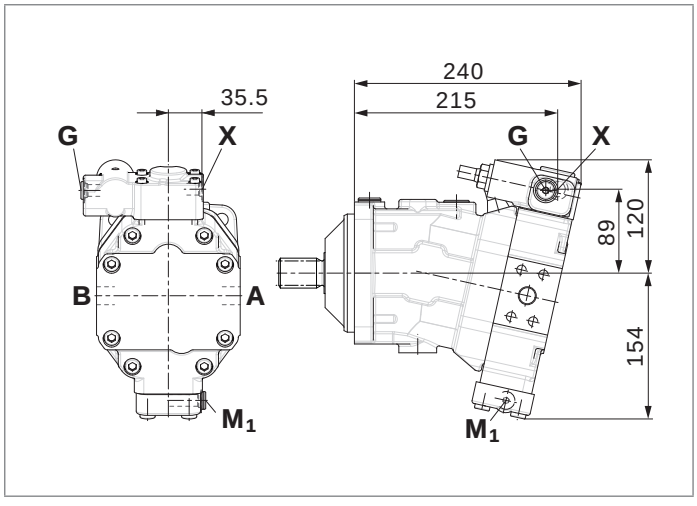
▼ **HP1, HP2** – Proportional hydraulic control, positive control



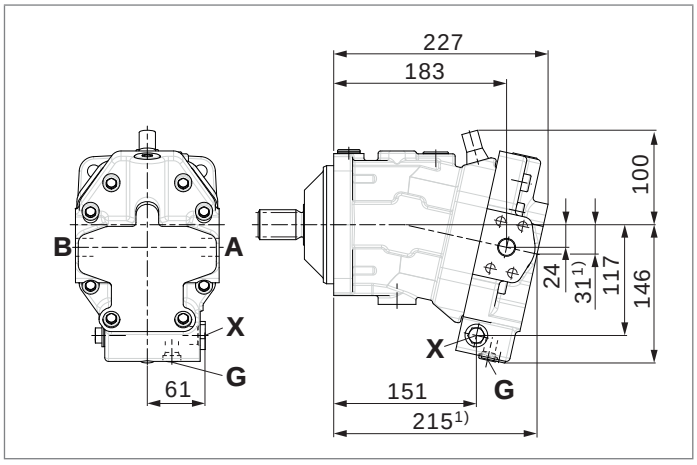
▼ **HP5, HP6** – Proportional hydraulic control, negative control



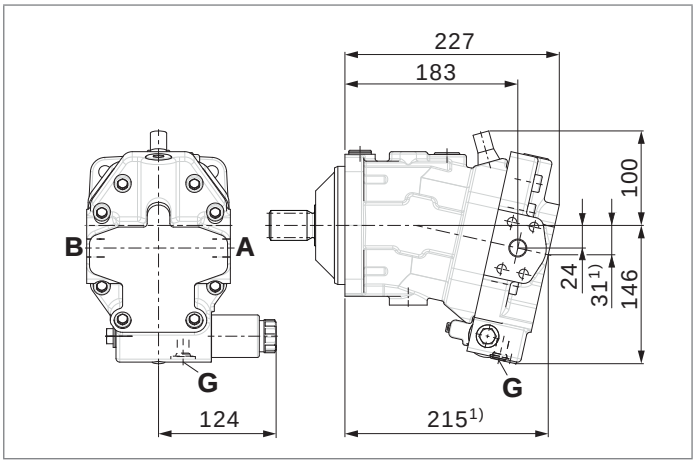
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



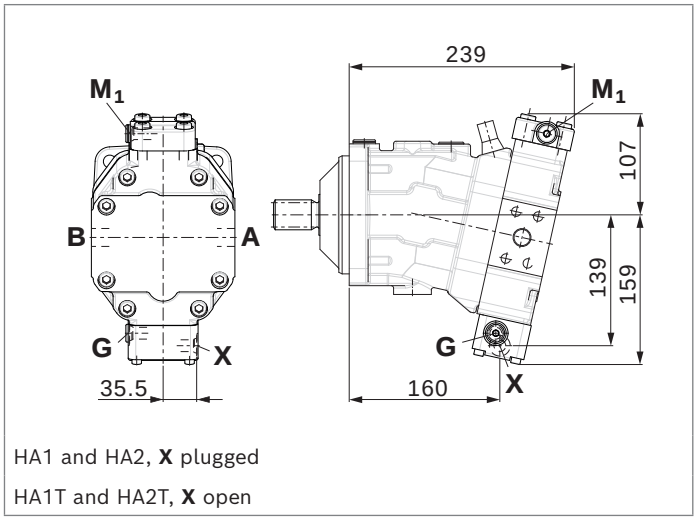
▼ **HZ7** – Two-point control, hydraulic, negative control



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



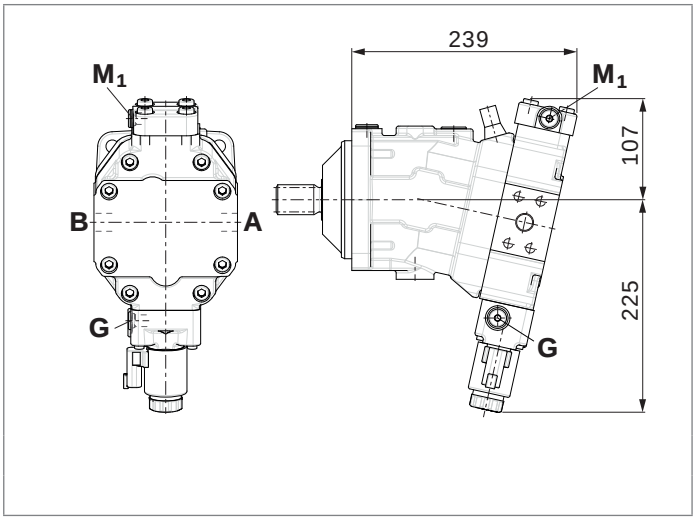
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



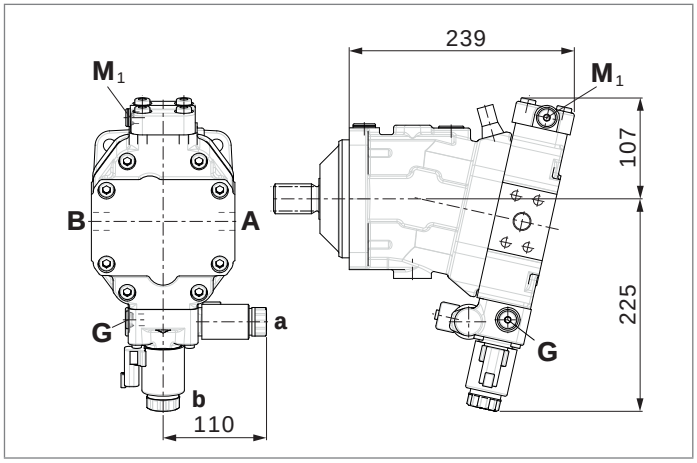
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

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

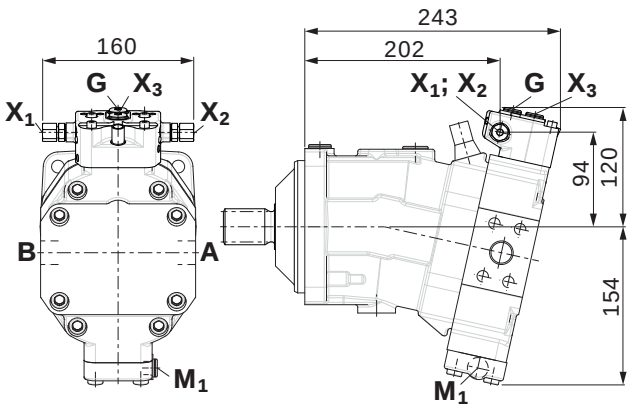


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



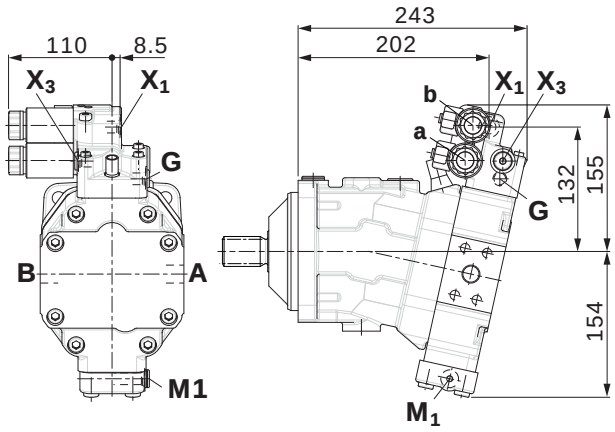
1) Port plate 1 — SAE working ports **A** and **B** at rear

▼ **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!

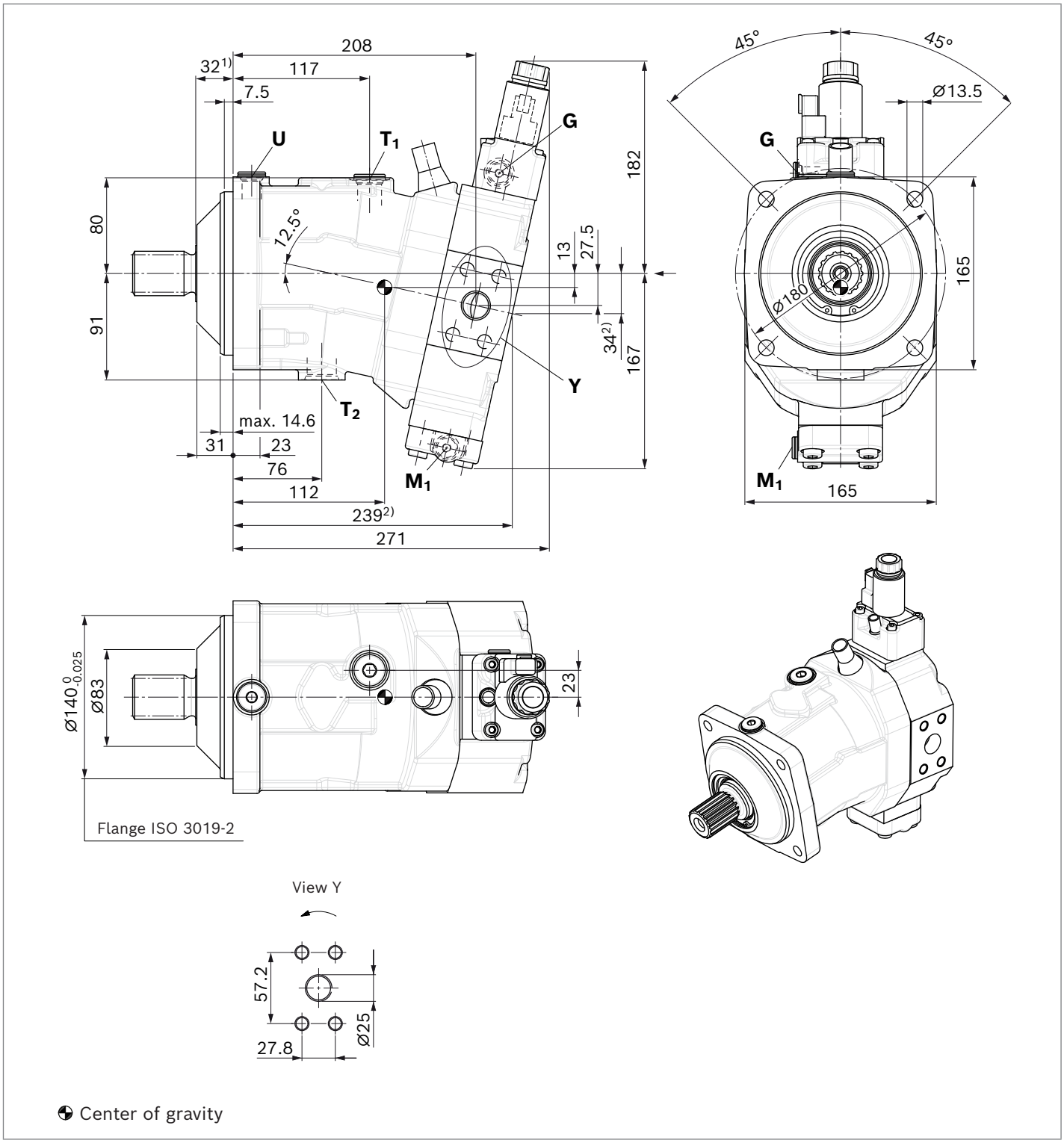
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions

Series 65: Size 80, Series 71: Size 85

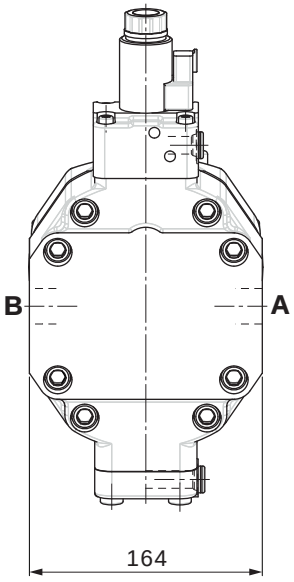
▼ **EP5, EP6 – Proportional electric control, negative control**
Port plate 2 – SAE working ports **A** and **B** lateral, opposite



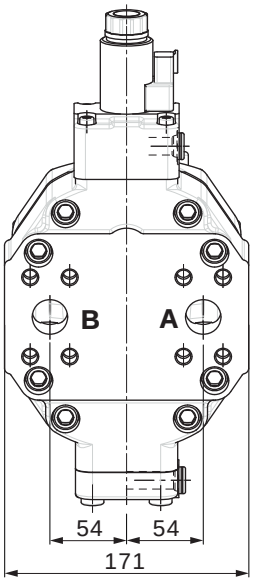
1) To shaft collar
2) Port plate 1 – SAE working ports **A** and **B** at rear

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

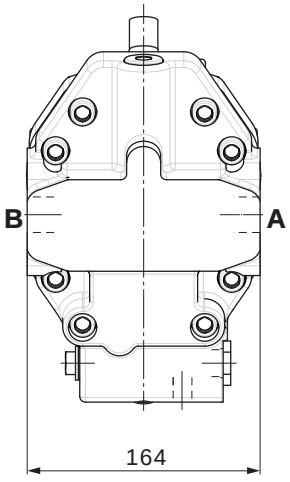
2 SAE working ports **A** and **B** lateral, opposite



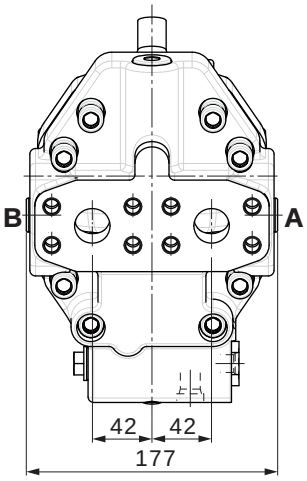
1 SAE working ports **A** and **B** at rear



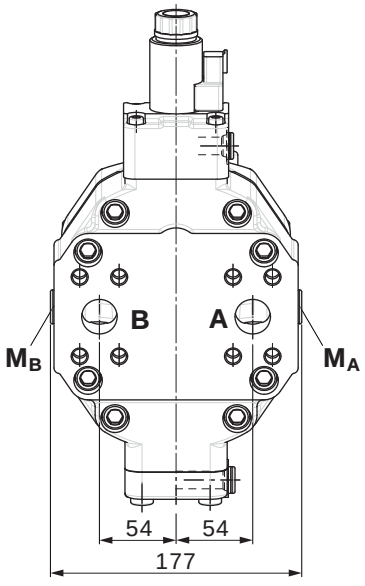
2 SAE working ports **A** and **B** lateral, opposite, only HZ7, EZ7/8



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



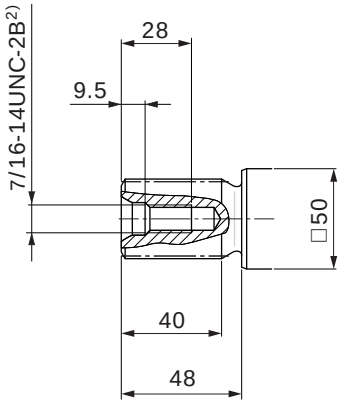
4 SAE working ports **A** and **B** at rear, with lateral measuring ports



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

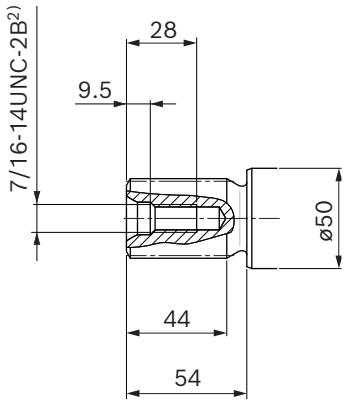
▼ **Splined shaft SAE J744 (series 65 only)**

S7 – 1 1/4 in 14T 12/24DP[1)]



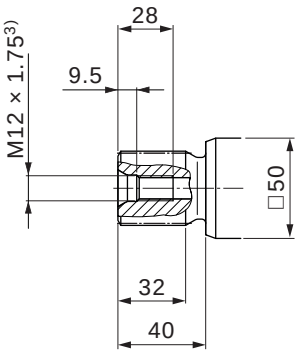
▼ **Splined shaft DIN 5480 (series 71 only)**

S9 – 1 1/2 in 17T 12/24DP



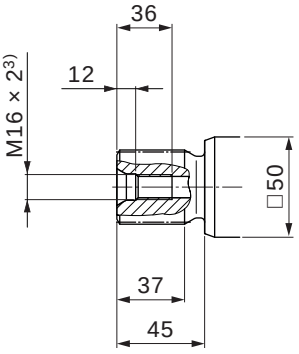
▼ **Splined shaft DIN 5480 (series 65 only)**

Z8 – W35×2×16×9g



▼ **Splined shaft DIN 5480**

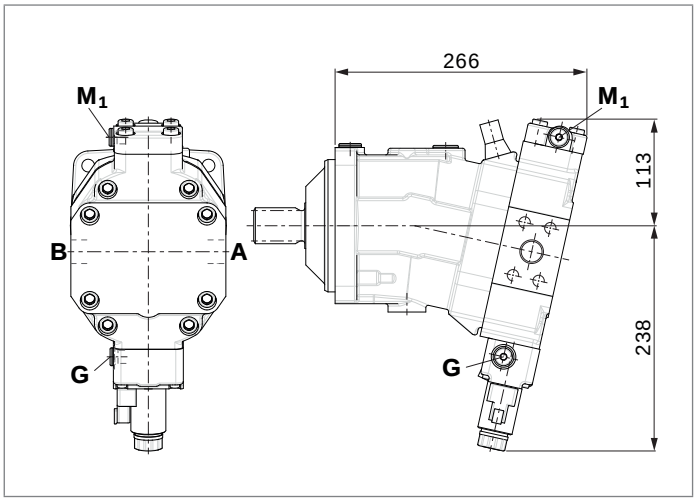
Z9 – W40×2×18×9g



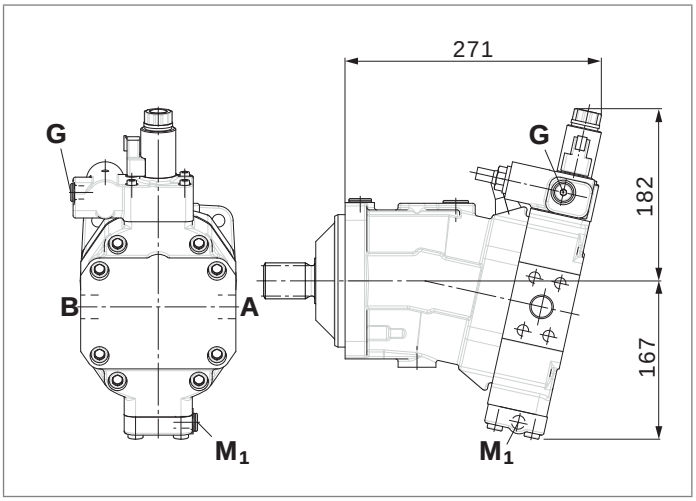
Ports		Standard	Size	p_{max} [bar][4)]	State[8)]
A, B	Working port Fastening thread A/B	SAE J518[5)] DIN 13	1 in M12 × 1.75; 17 deep	530	O
T_1	Drain port	ISO 6149[7)]	M22 × 1.5; 15.5 deep	3	X[6)]
T_2	Drain port	ISO 6149[7)]	M27 × 2; 19 deep	3	O[6)]
G	Synchronous control	ISO 6149[7)]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[7)]	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[7)]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[7)]	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[7)]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA0, DA1, DA2)	ISO 6149[7)]	M14 × 1.5; 11.5 deep	40	X
M_1	Measuring port, control pressure	ISO 6149[7)]	M14 × 1.5; 11.5 deep	530	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149[7)]	M18 × 1.5; 14.5 deep	530	X

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) Center bore according to DIN 332 (thread according to DIN 13)
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
6) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on page 100).
7) The countersink may be deeper than specified in the standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

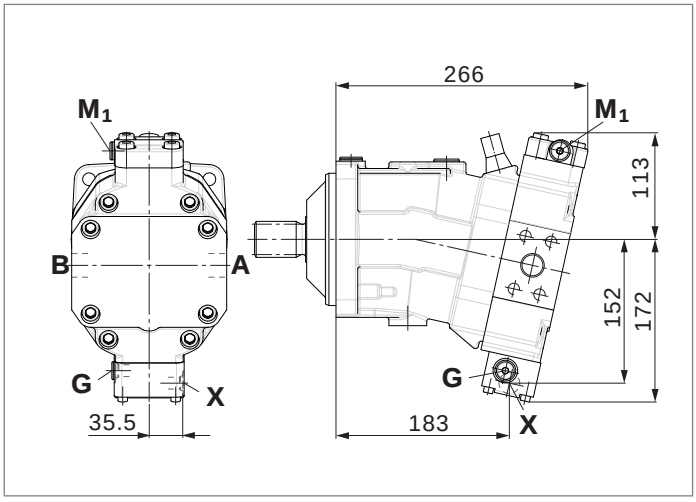
▼ **EP1, EP2** – Proportional electric control, positive control



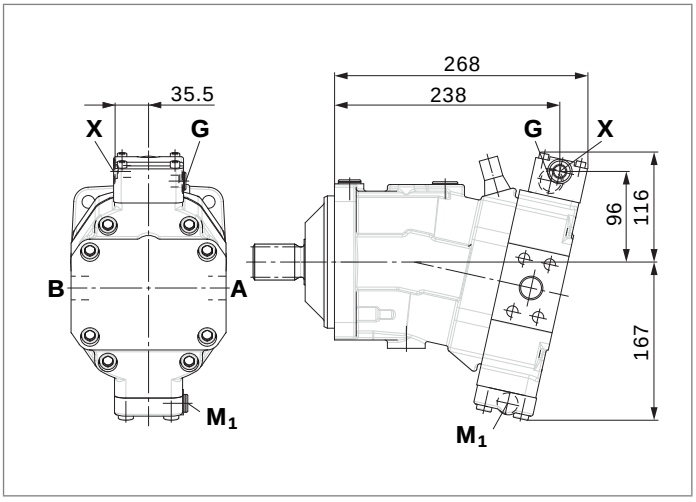
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



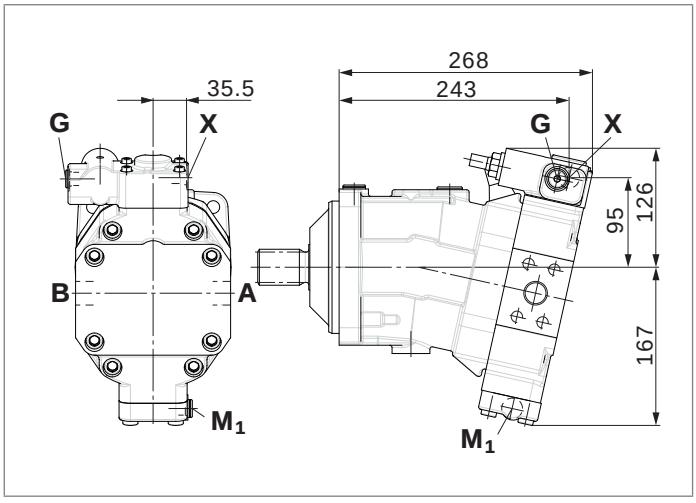
▼ **HP1, HP2** – Proportional hydraulic control, positive control



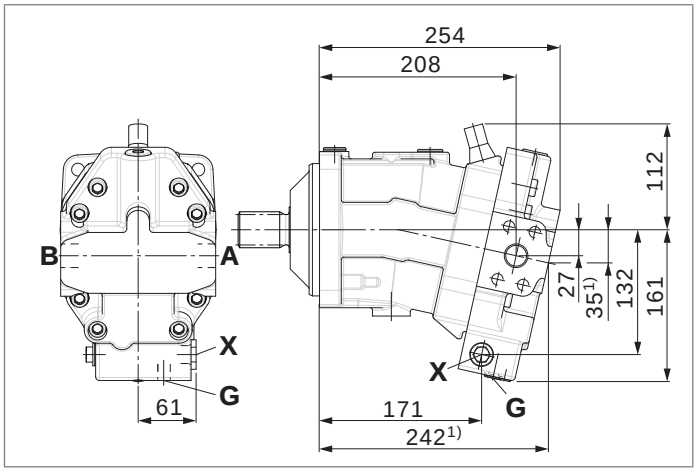
▼ **HP5, HP6** – Proportional hydraulic control, negative control



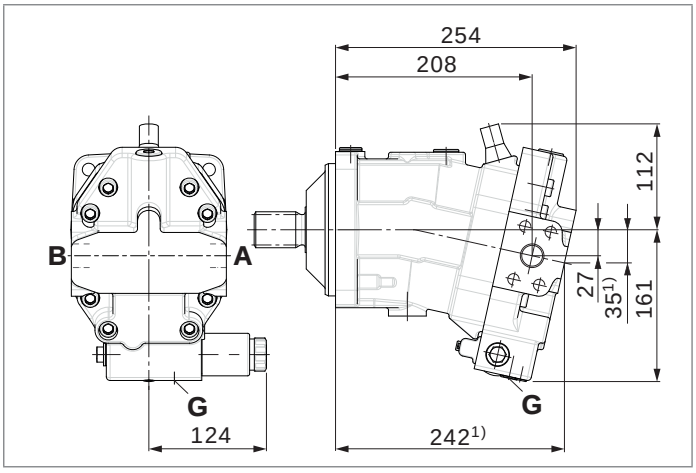
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



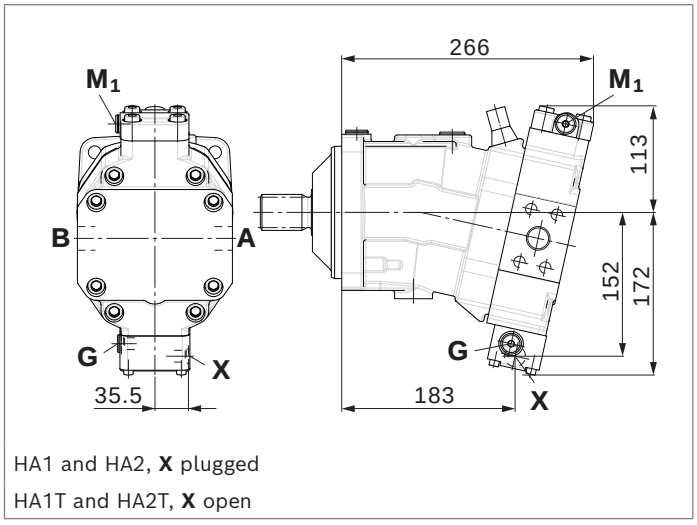
▼ **HZ7** – Two-point control, hydraulic, negative control



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

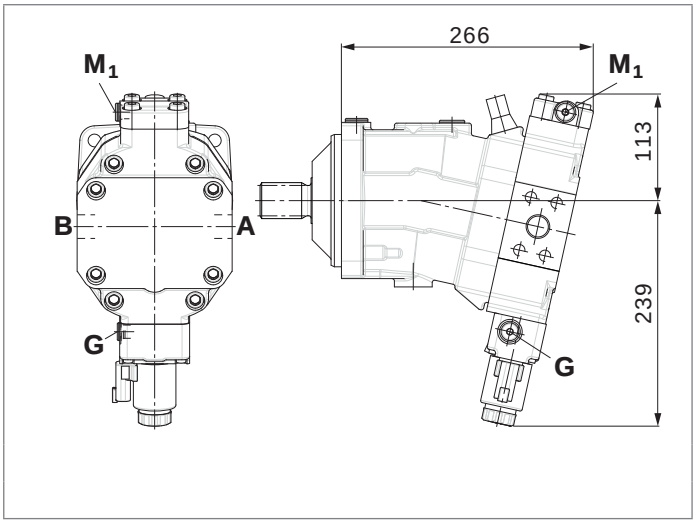


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

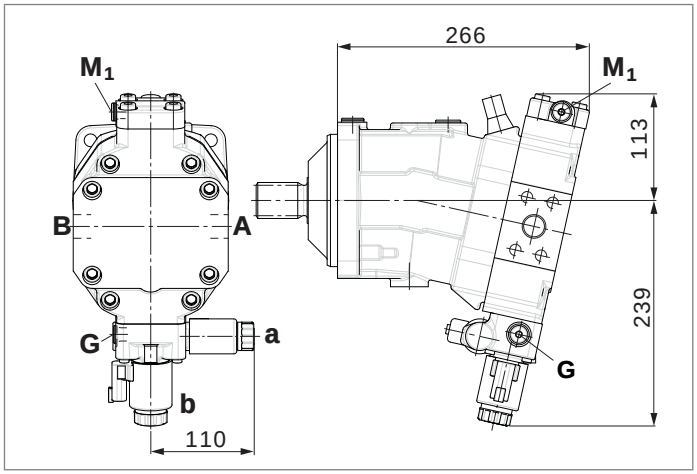


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

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

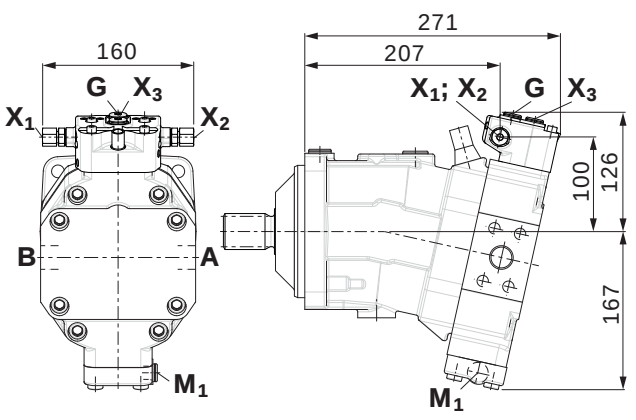


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



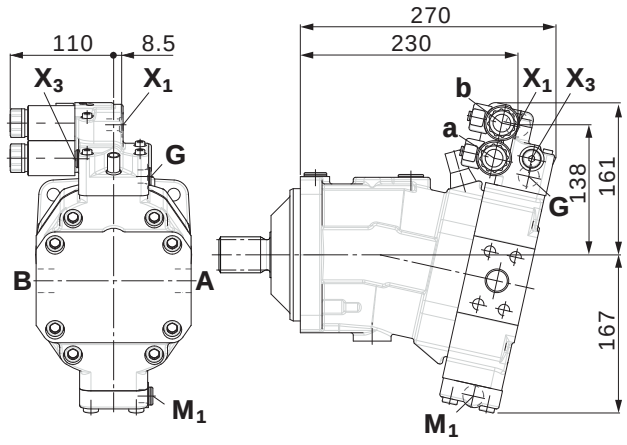
1) Port plate 1 – SAE working ports **A** and **B** at rear

▼ **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

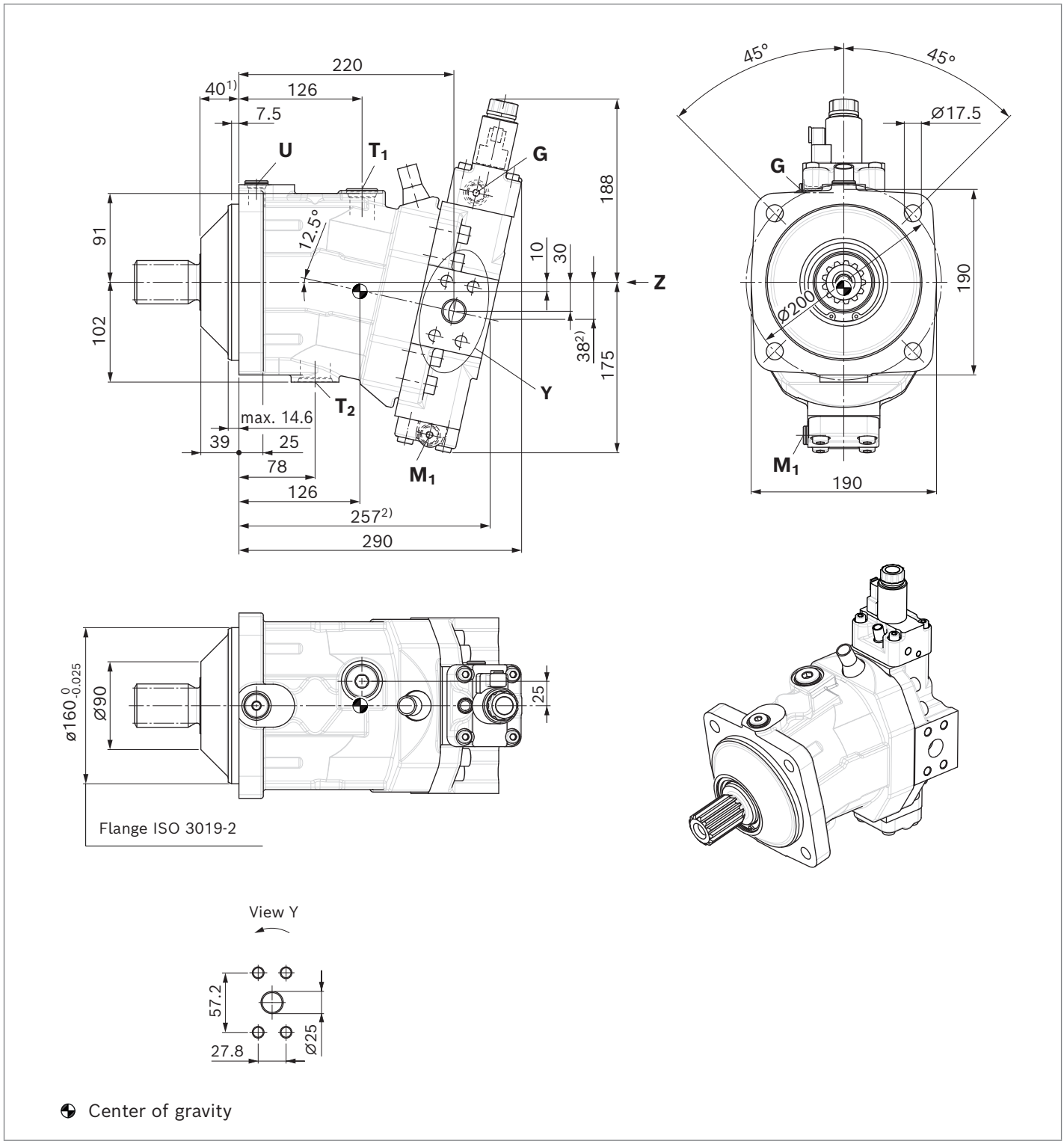


Dimensions

Series 65: Size 107,
Series 71: Size 115

EP5, EP6 – Proportional electric control, negative control

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

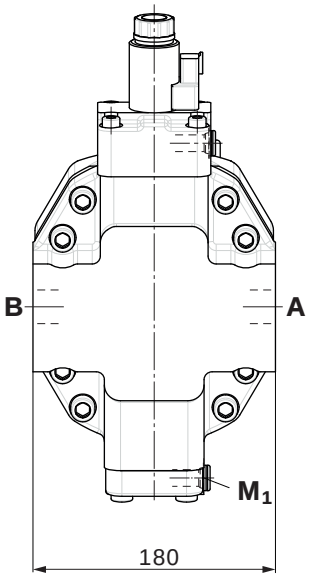


1) To shaft collar

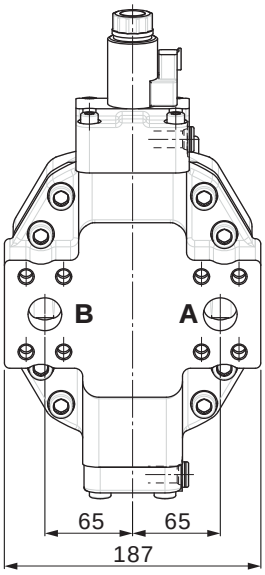
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

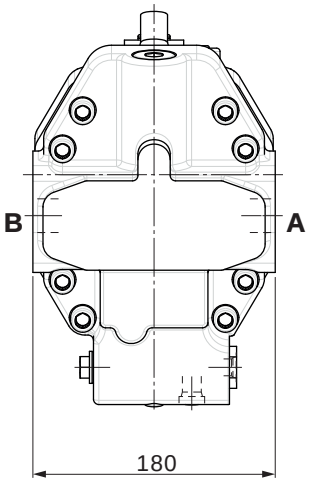
2 SAE working ports **A** and **B** lateral, opposite



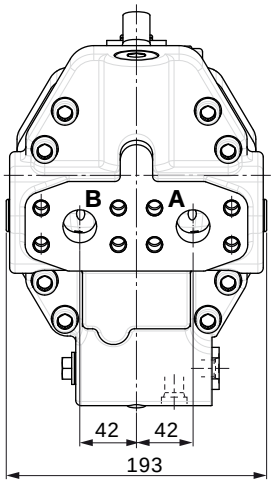
1 SAE working ports **A** and **B** at rear



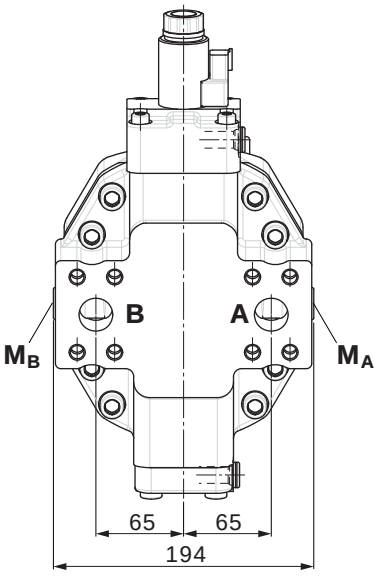
2 SAE working ports **A** and **B** lateral, opposite only HZ7, EZ7/8



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

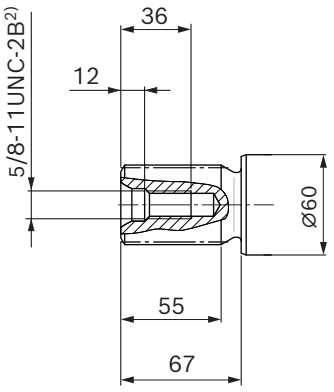


4 SAE working ports **A** and **B** at rear, with lateral measuring ports



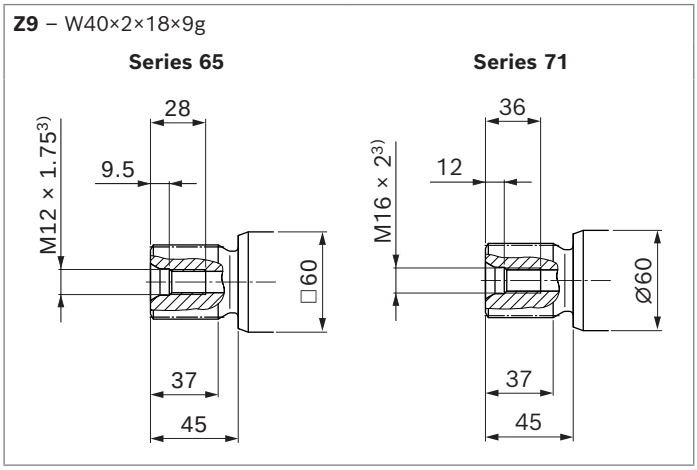
▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP[1)]



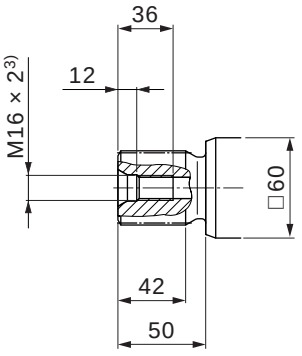
▼ **Splined shaft DIN 5480**

Z9 – W40×2×18×9g



▼ **Splined shaft DIN 5480**

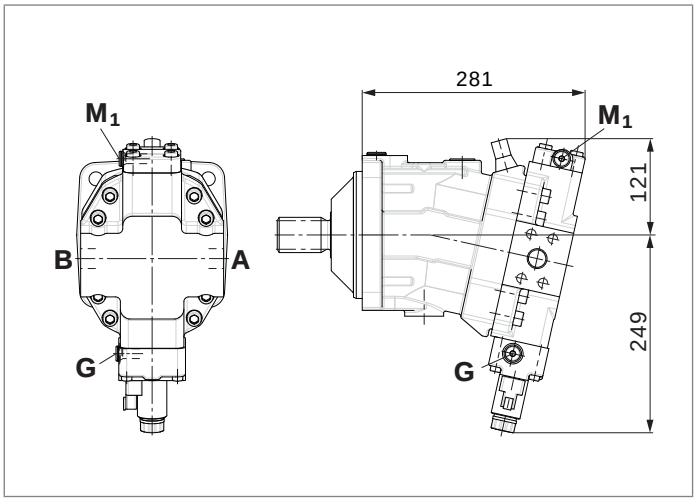
A1 – W45×2×21×9g



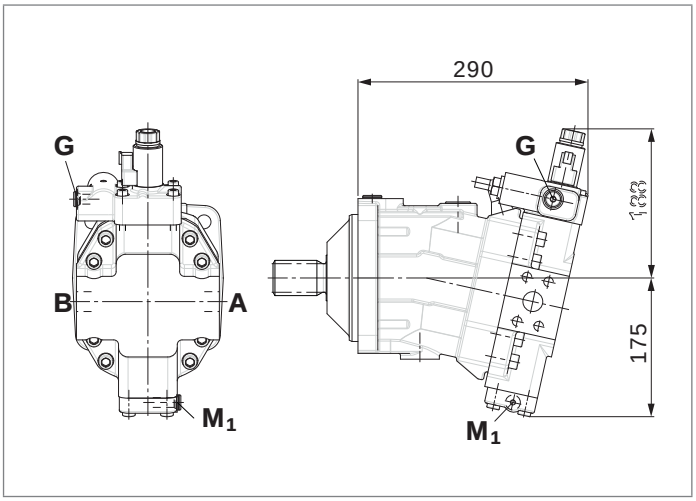
Ports		Standard	Size	p_{max} [bar][4)]	State[8)]
A, B	Working port Fastening thread A/B	SAE J518[5)] DIN 13	1 in M12 × 1.75; 17 deep	530	O
T_1	Drain port	ISO 6149[7)]	M27 × 2; 19 deep	3	X[6)]
T_2	Drain port	ISO 6149[7)]	M33 × 2; 19 deep	3	O[6)]
G	Synchronous control	ISO 6149[7)]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[7)]	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[7)]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[7)]	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[7)]	M14 × 1.5; 11.5 deep	40	O
X_3	Pilot pressure port (DA0, DA1, DA2)	ISO 6149[7)]	M14 × 1.5; 11.5 deep	40	X
M_1	Measuring port, control pressure	ISO 6149[7)]	M14 × 1.5; 11.5 deep	530	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149[7)]	M18 × 1.5; 14.5 deep	530	X

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) Center bore according to DIN 332 (thread according to DIN 13)
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 100).
7) The countersink may be deeper than specified in the standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

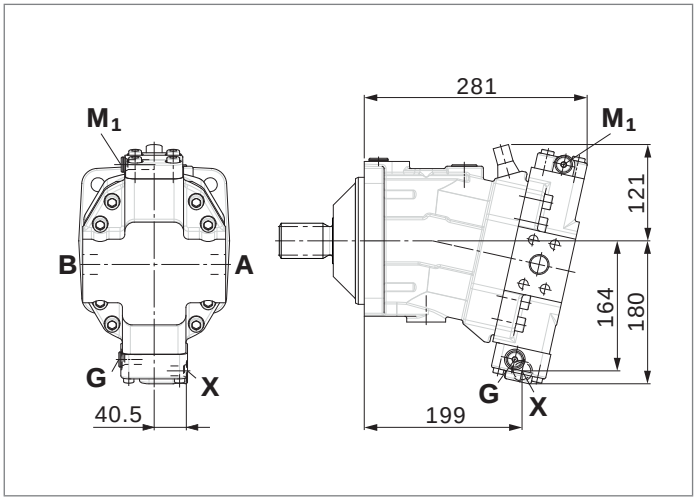
▼ **EP1, EP2** – Proportional electric control, positive control



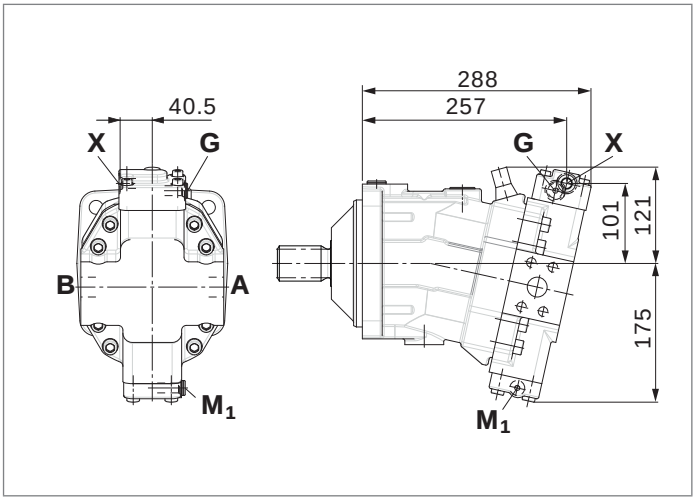
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



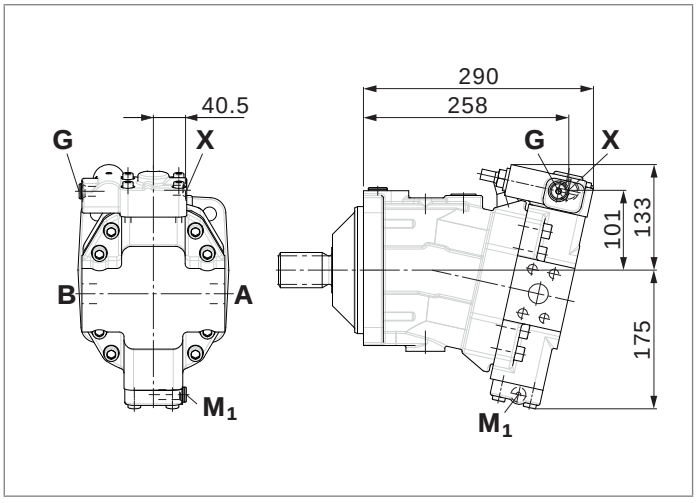
▼ **HP1, HP2** – Proportional hydraulic control, positive control



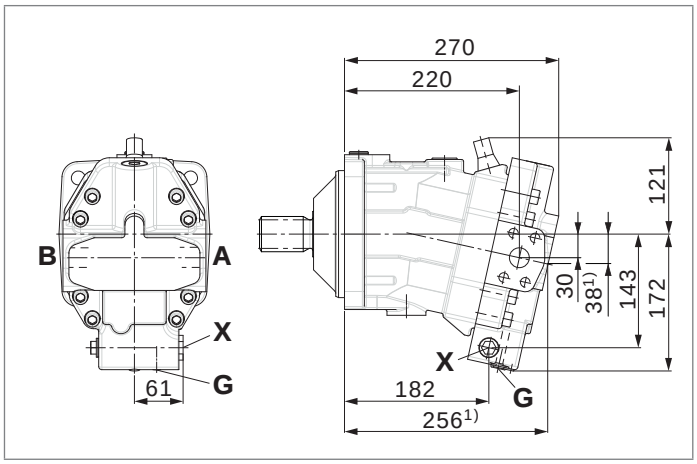
▼ **HP5, HP6** – Proportional hydraulic control, negative control



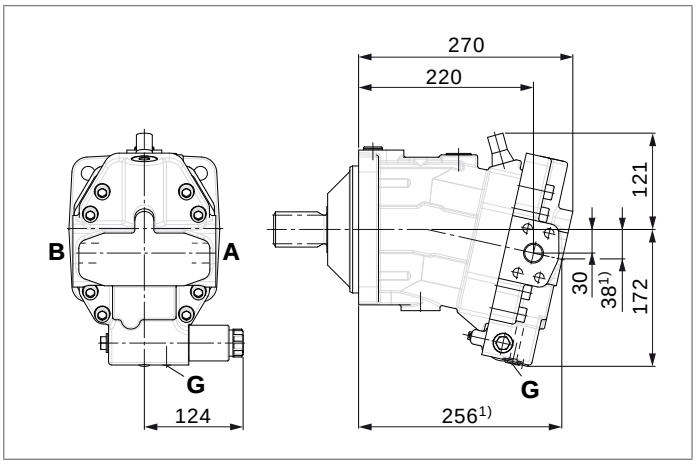
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



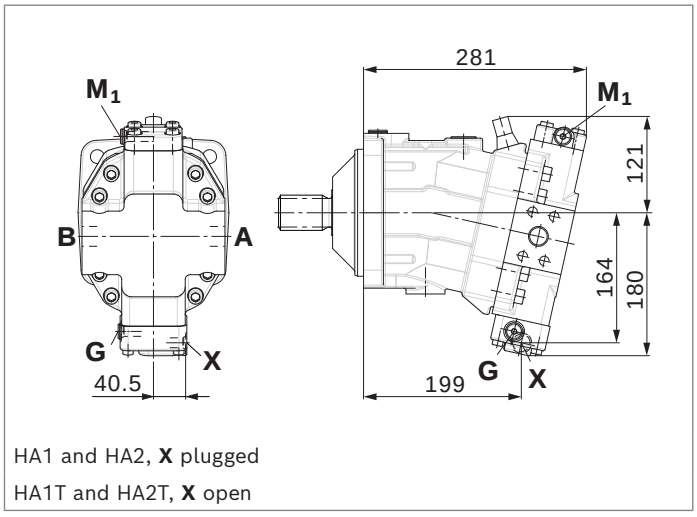
▼ **HZ7** – Two-point control, hydraulic, negative control



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

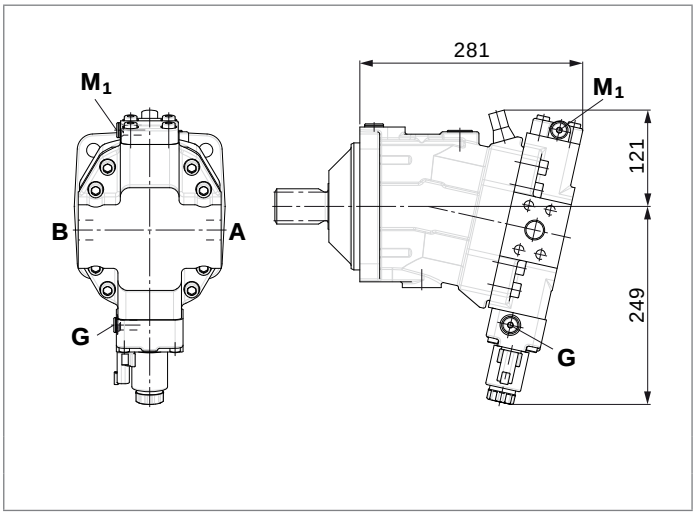


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

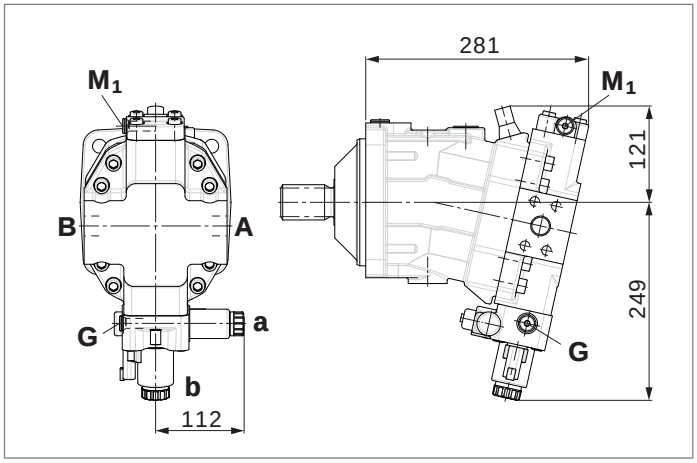


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

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

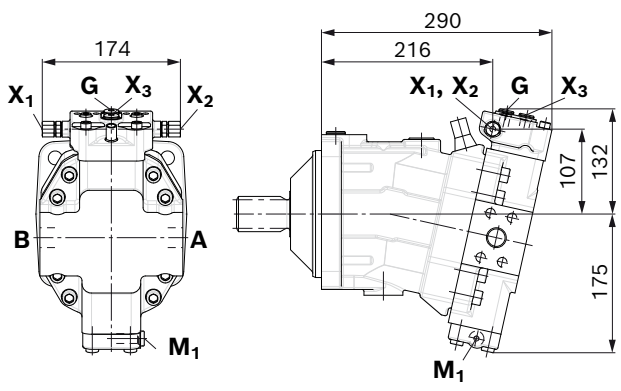


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



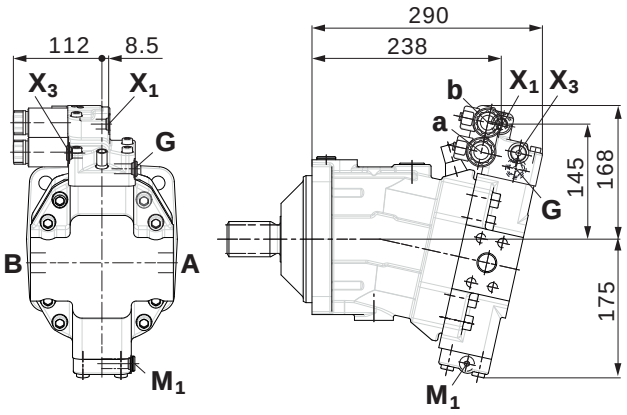
1) Port plate 1 – SAE working ports **A** and **B** at rear

▼ **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

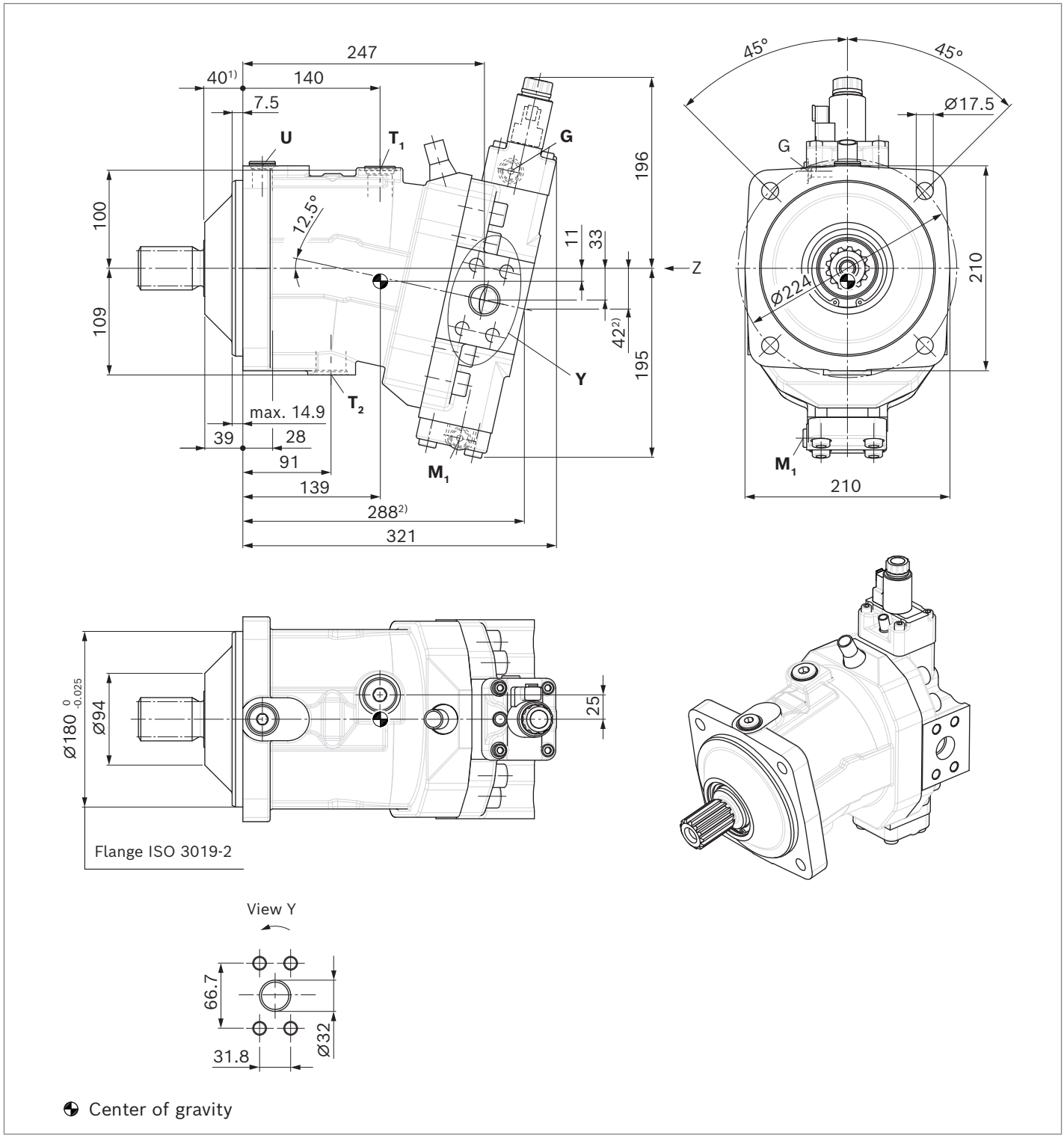


Dimensions

Series 65: Size 140,
Series 71: Size 150

EP5, EP6 – Proportional electric control, negative control

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

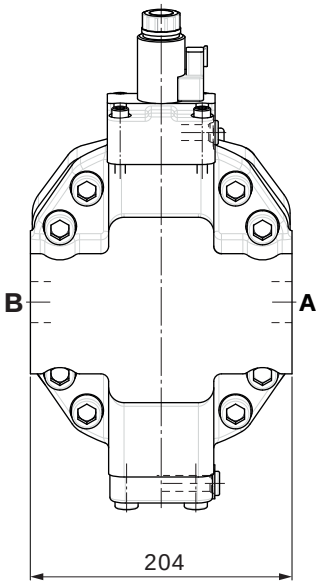


1) To shaft collar

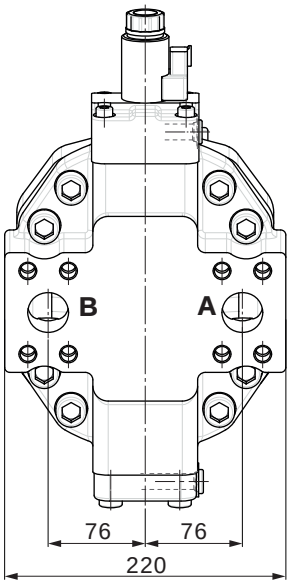
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

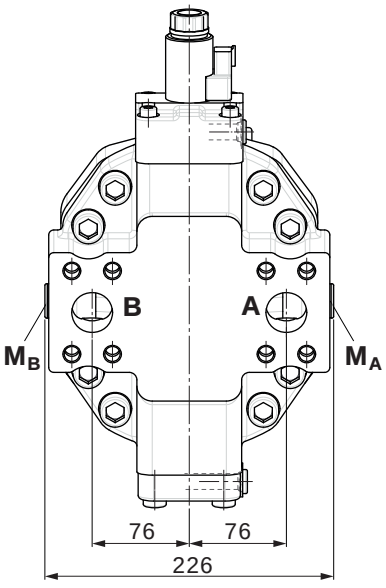
2 SAE working ports **A** and **B** lateral, opposite



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

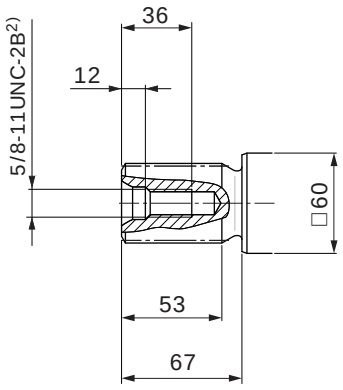


4 SAE working ports **A** and **B** at rear, with lateral measuring ports



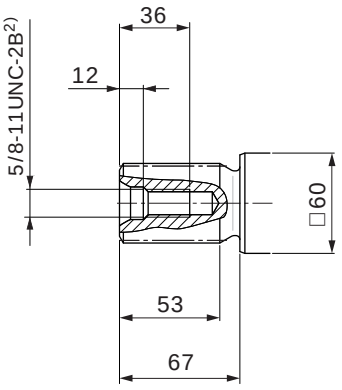
▼ **Splined shaft SAE J744**

T1 – 1 3/4 in 13T 8/16DP[1)]



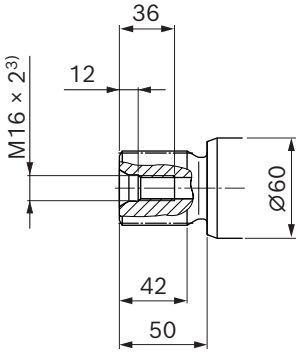
▼ **Splined shaft SAE J744 (only for size 150)**

T2 – 2 in 15T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

A1 – W45×2×21×9g

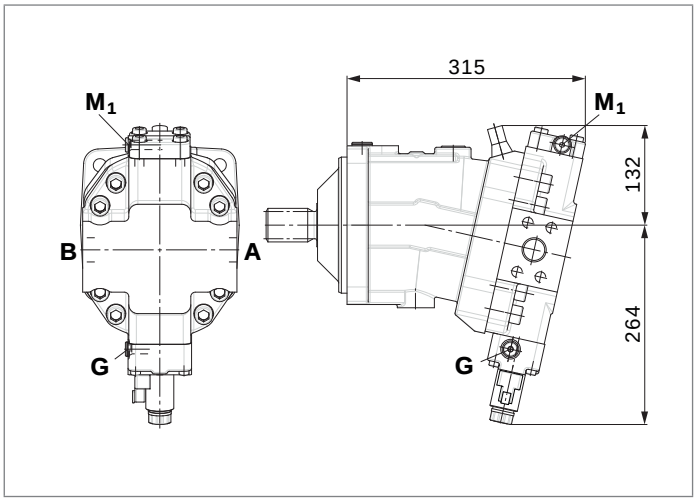


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

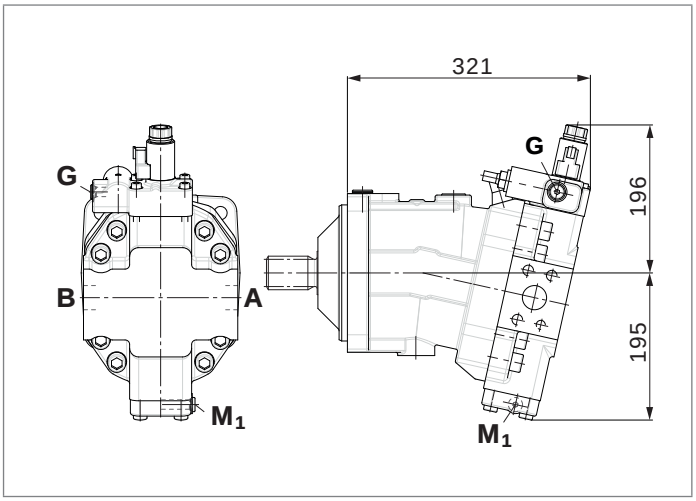
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
$\mathbf{T}_1$	Drain port	ISO 6149[4]	M27 × 2; 19 deep	3	X[3]
$\mathbf{T}_2$	Drain port	ISO 6149[4]	M33 × 2; 19 deep	3	O[3]
G	Synchronous control	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[4]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[4]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	3	X
$\mathbf{X}_1$, $\mathbf{X}_2$	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
$\mathbf{X}_1$	Pilot pressure port (DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	O
$\mathbf{X}_3$	Pilot pressure port (DA0, DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	X
$\mathbf{M}_1$	Measuring port, control pressure	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port, pressure A, B	ISO 6149[4]	M22 × 1.5; 15.5 deep	530	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, $\mathbf{T}_1$ or $\mathbf{T}_2$ must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

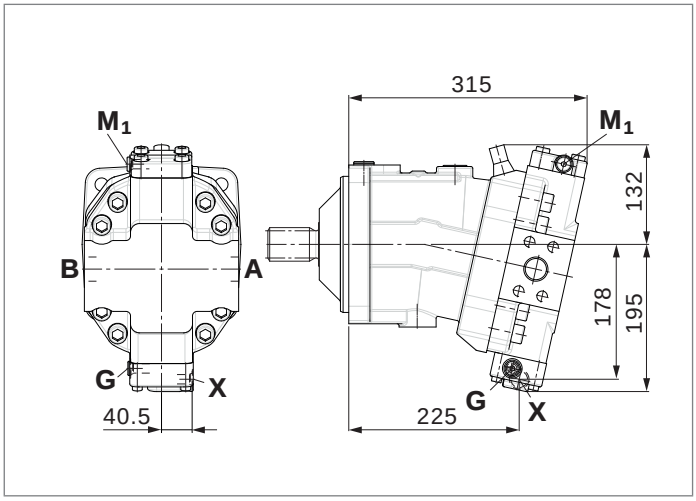
▼ **EP1, EP2** – Proportional electric control, positive control



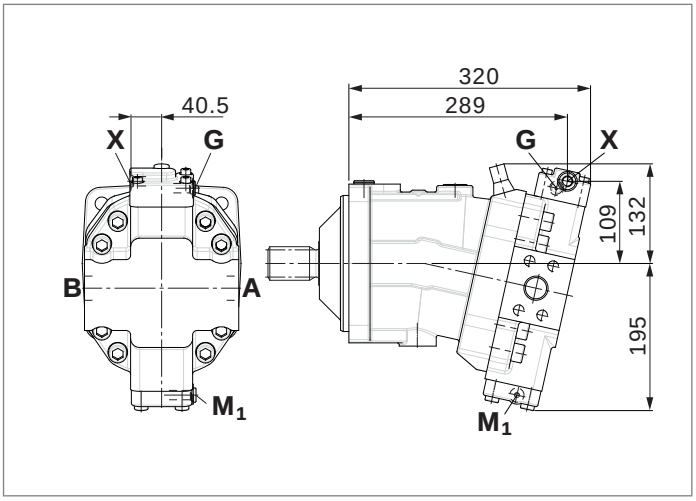
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



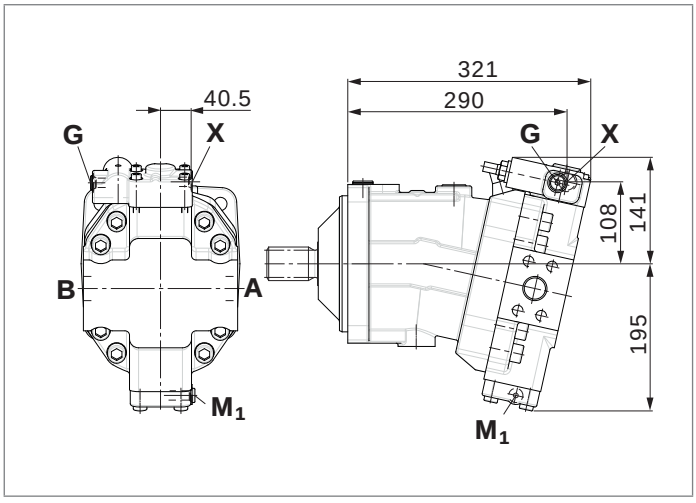
▼ **HP1, HP2** – Proportional hydraulic control, positive control



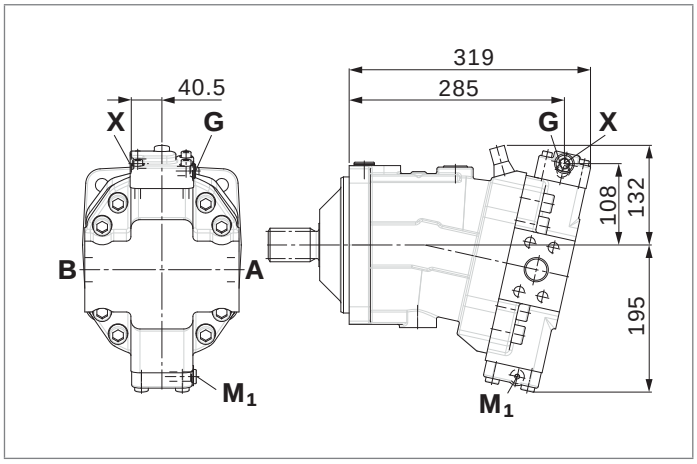
▼ **HP5, HP6** – Proportional hydraulic control, negative control



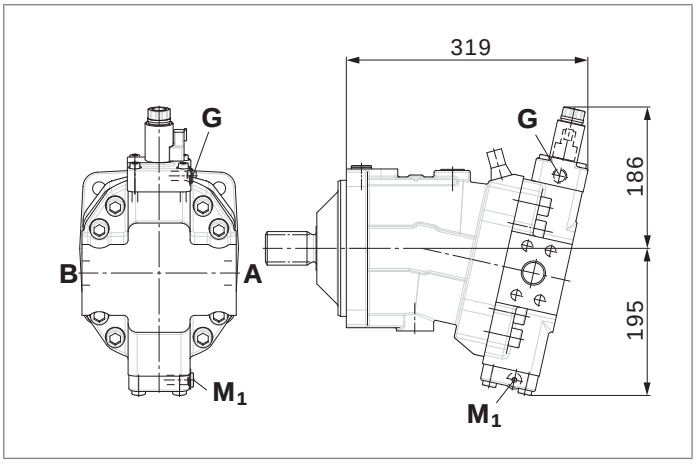
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



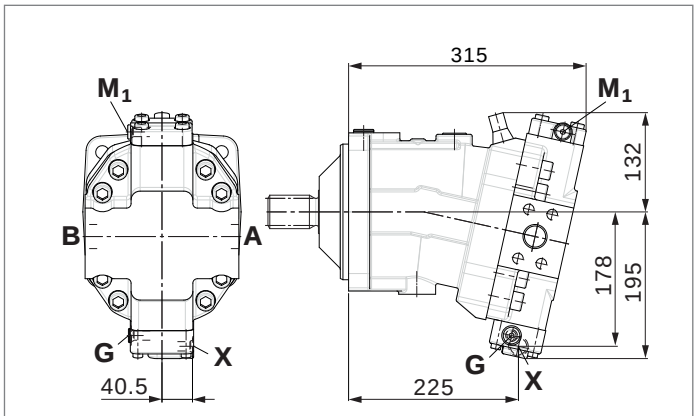
▼ **HZ5** – Two-point control, hydraulic, negative control



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

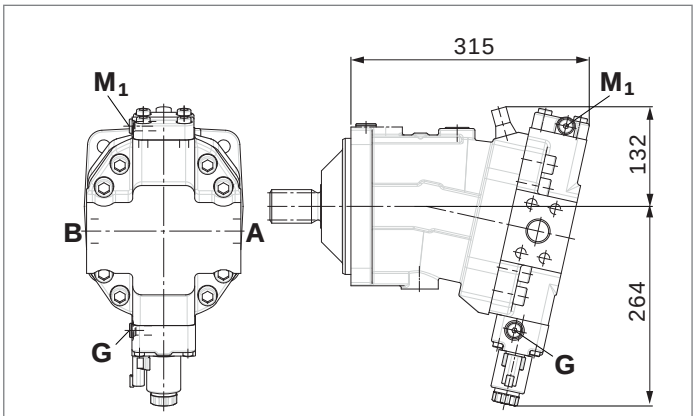


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

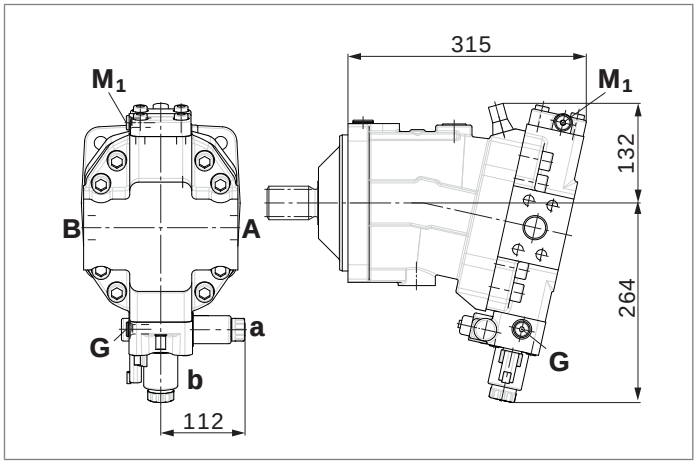


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

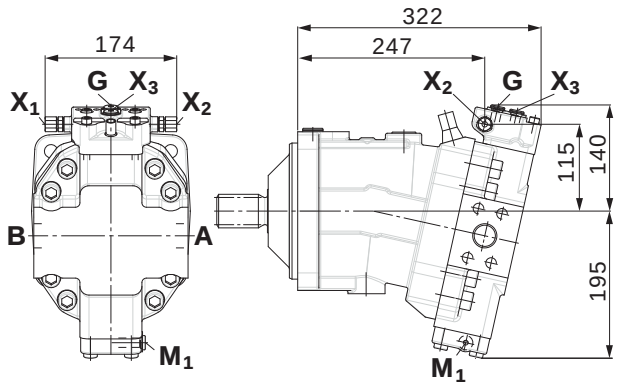
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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



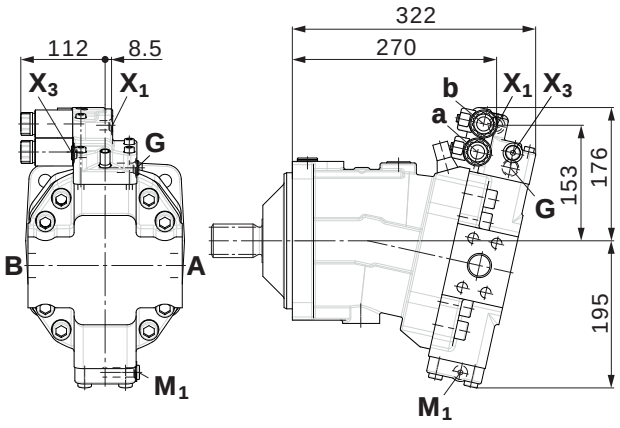
▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

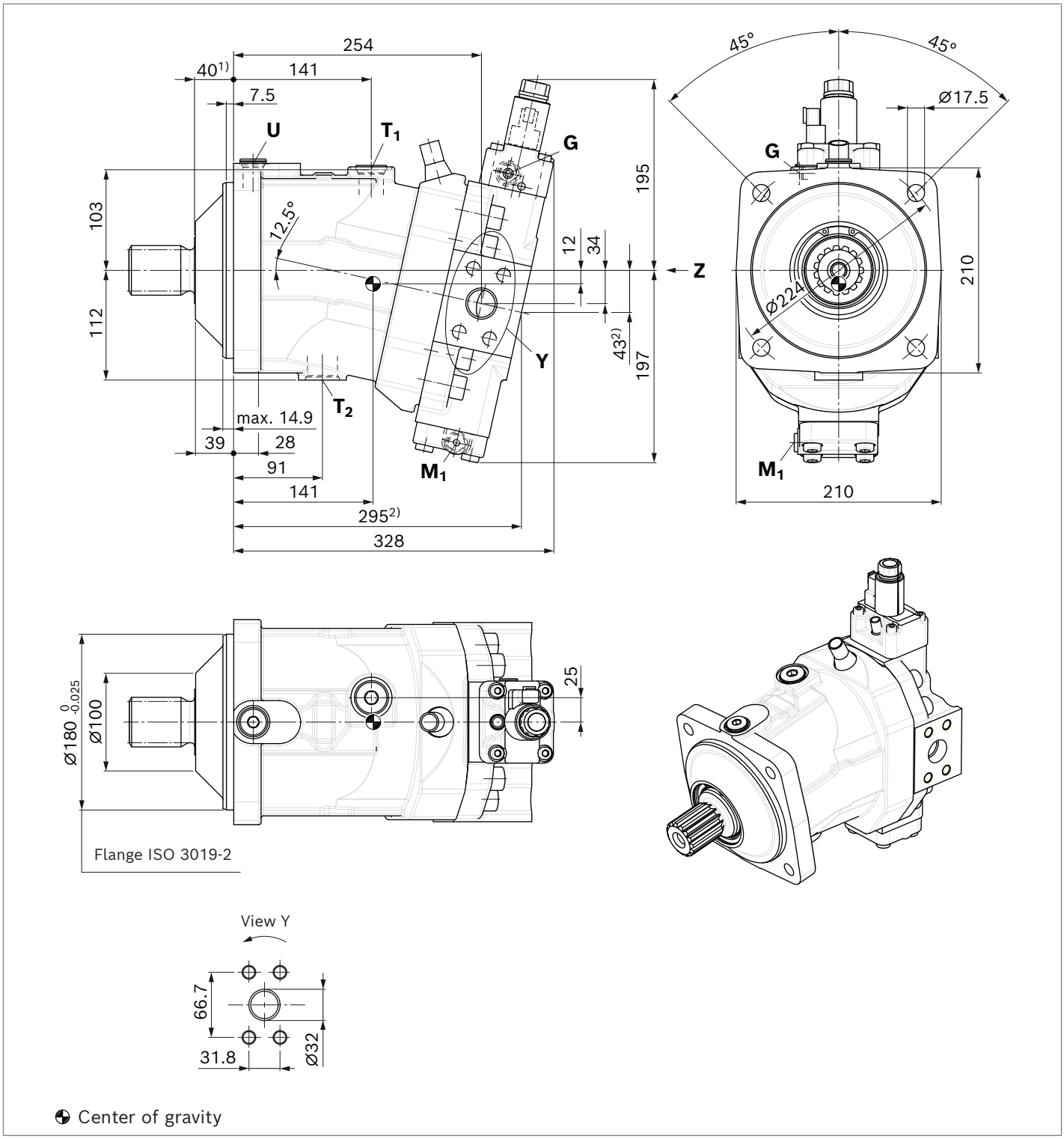


Dimensions

Series 65: Size 160, Series 71: Size 170

EP5, EP6 – Proportional electric control, negative control

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

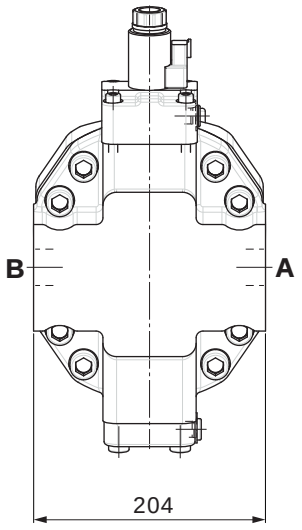


1) To shaft collar

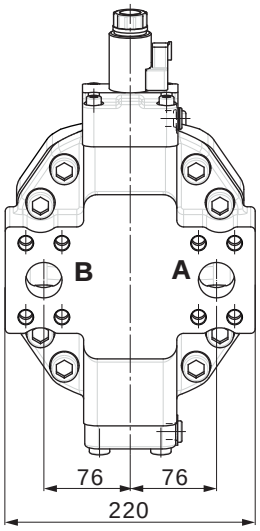
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

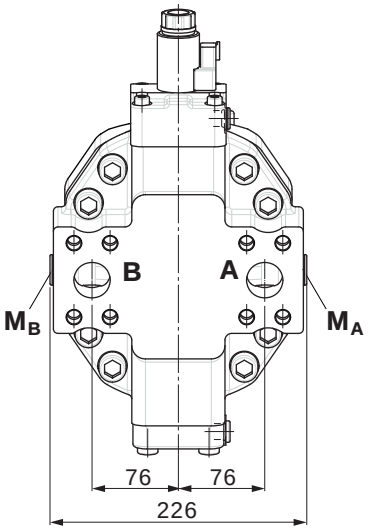
2 SAE working ports **A** and **B** lateral, opposite



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

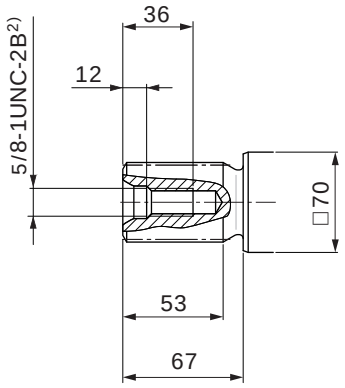


4 SAE working ports **A** and **B** at rear, with lateral measuring ports



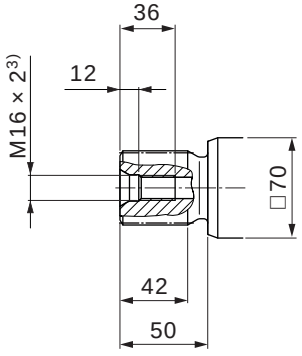
▼ **Splined shaft SAE J744**

T2 – 2 in 15T 8/16DP[1)]



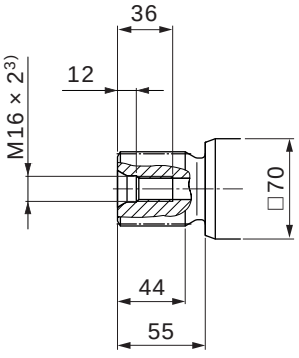
▼ **Splined shaft DIN 5480**

A1 – W45×2×21×9g



▼ **Splined shaft DIN 5480**

A2 – W50×2×24×9g

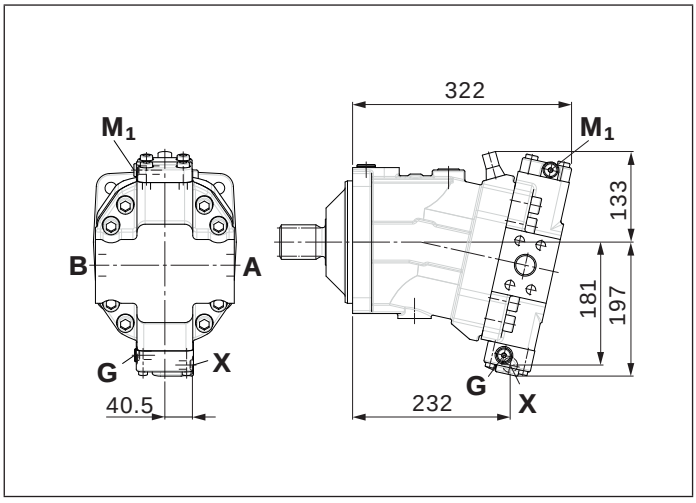


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

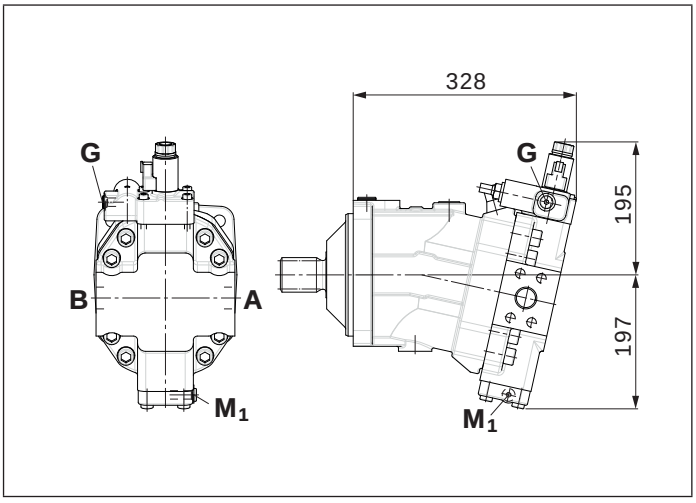
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
$\mathbf{T}_1$	Drain port	ISO 6149[4]	M27 × 2; 19 deep	3	X[3]
$\mathbf{T}_2$	Drain port	ISO 6149[4]	M33 × 2; 19 deep	3	O[3]
G	Synchronous control	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[4]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[4]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	3	X
$\mathbf{X}_1$, $\mathbf{X}_2$	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
$\mathbf{X}_1$	Pilot pressure port (DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	O
$\mathbf{X}_3$	Pilot pressure port (DA0, DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	X
$\mathbf{M}_1$	Measuring port, control pressure	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port, pressure A, B	ISO 6149[4]	M22 × 1.5; 15.5 deep	530	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, $\mathbf{T}_1$ or $\mathbf{T}_2$ must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

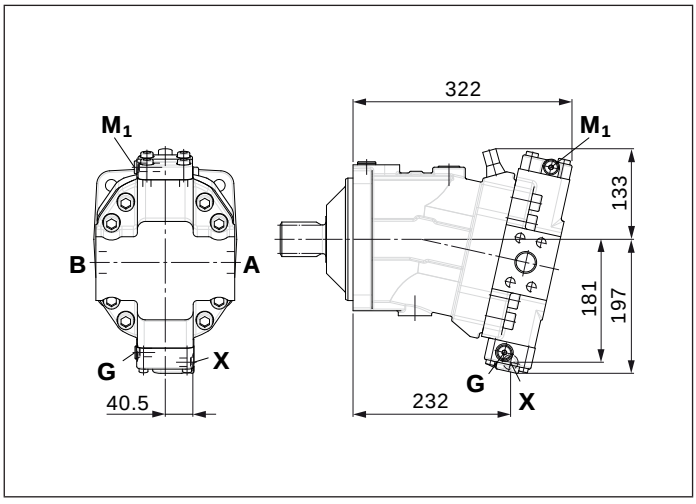
▼ **EP1, EP2** – Proportional electric control, positive control



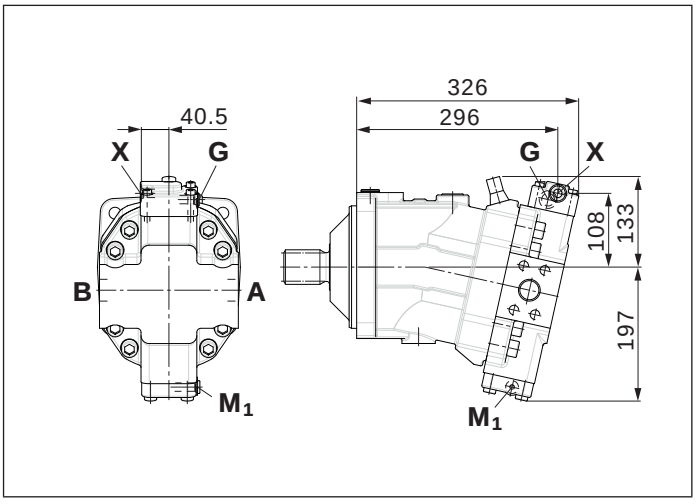
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



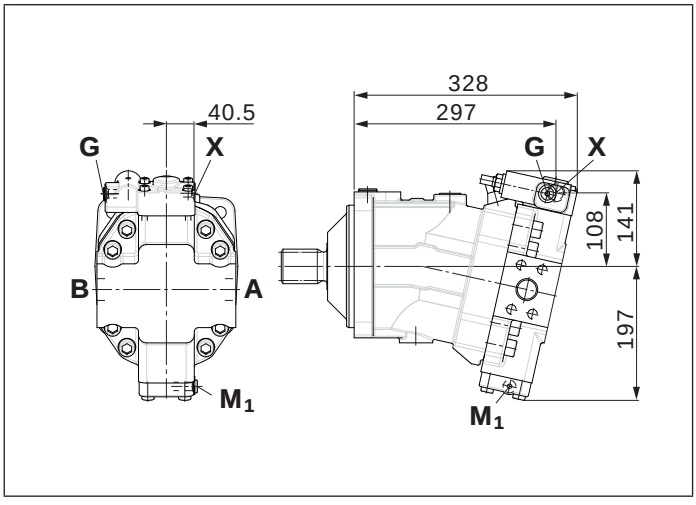
▼ **HP1, HP2** – Proportional hydraulic control, positive control



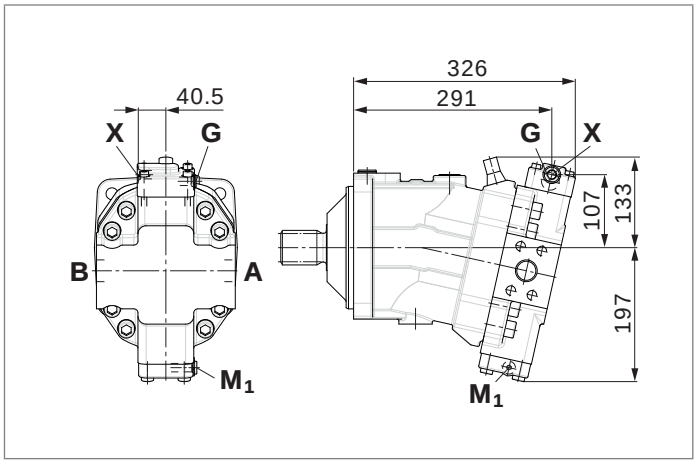
▼ **HP5, HP6** – Proportional hydraulic control, negative control



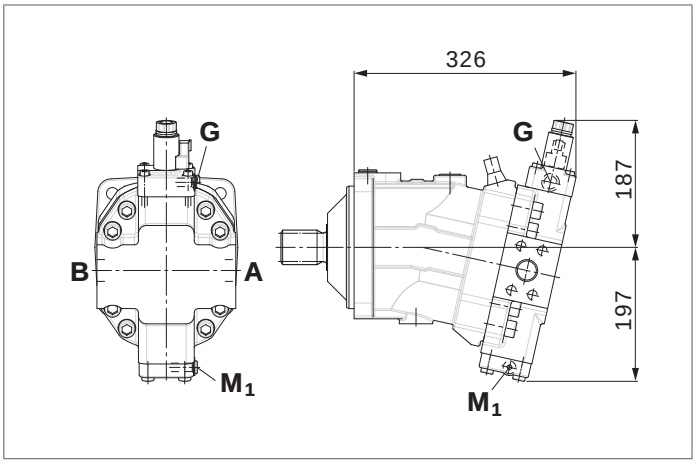
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



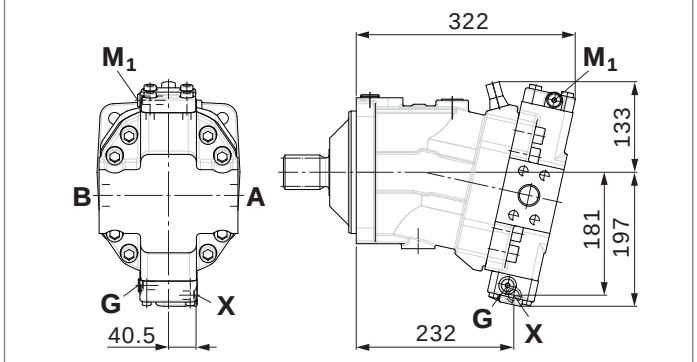
▼ **HZ5** – Two-point control, hydraulic, negative control



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



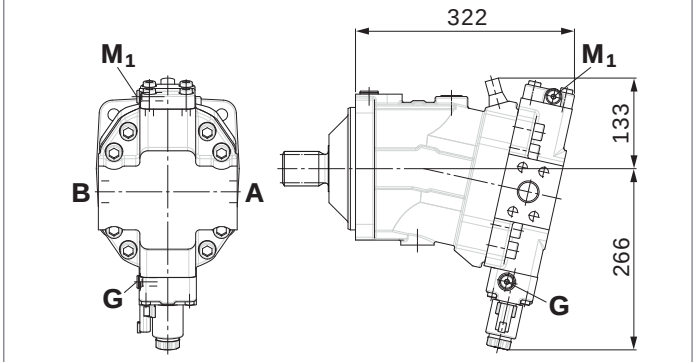
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



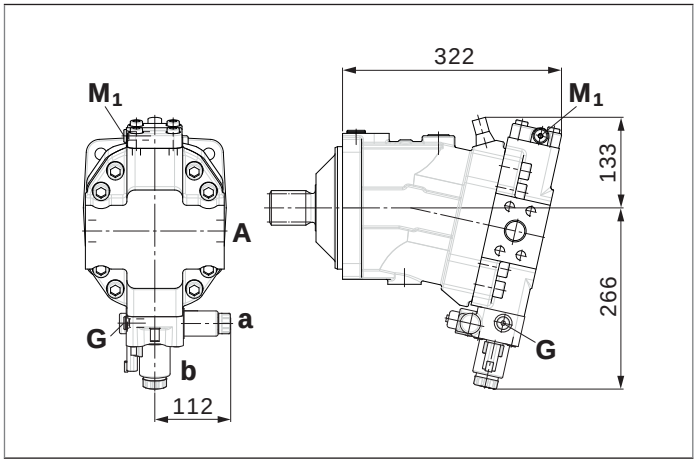
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

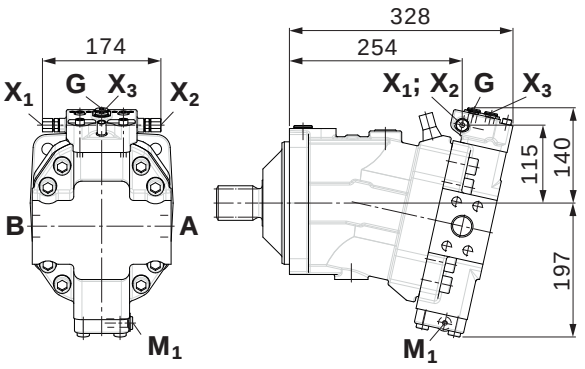
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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



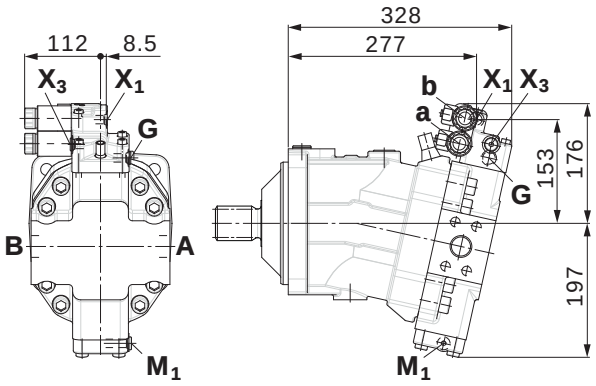
▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

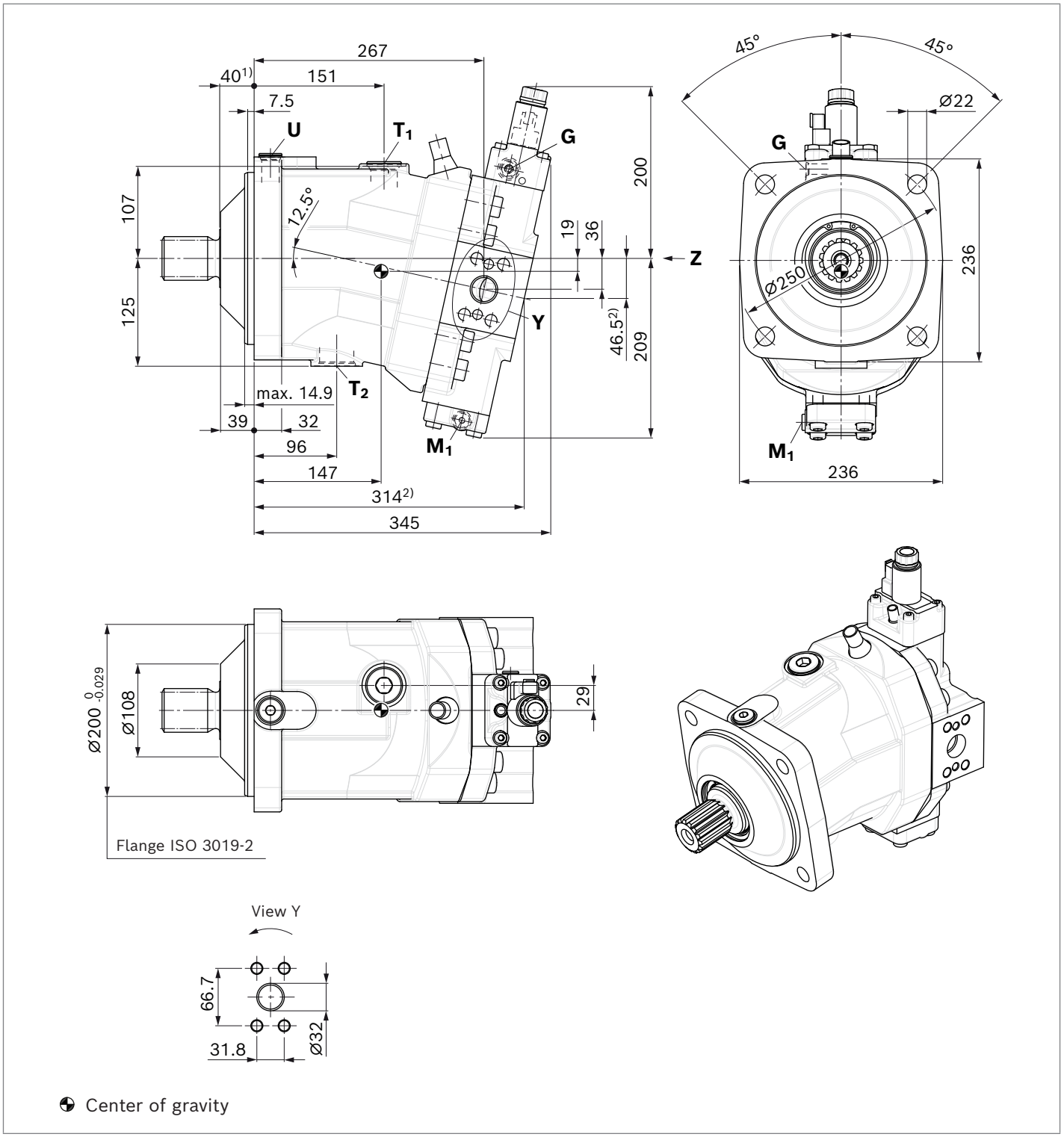


Dimensions

Series 65: Size 200,
Series 71: Size 215

EP5, EP6 – Proportional electric control, negative control

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

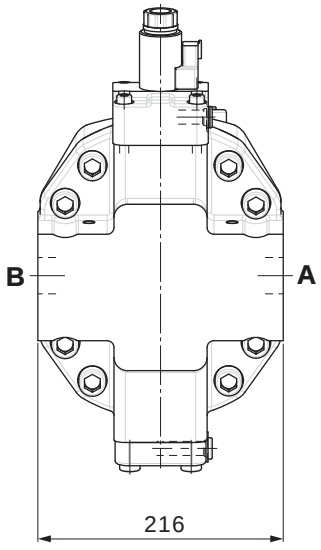


1) To shaft collar

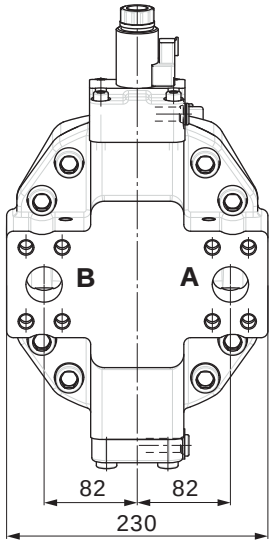
2) Port plate 1 — SAE working ports **A** and **B** at rear

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

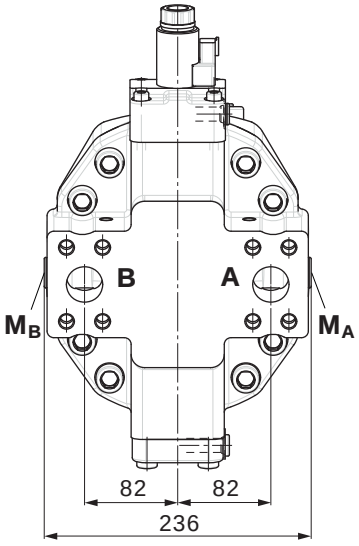
2 SAE working ports **A** and **B** lateral, opposite



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

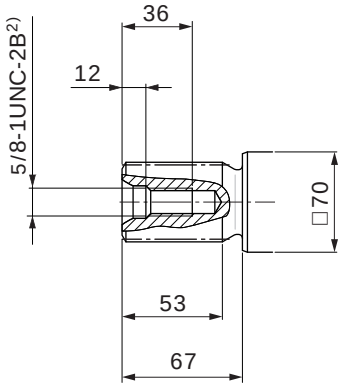


4 SAE working ports **A** and **B** at rear, with lateral measuring ports



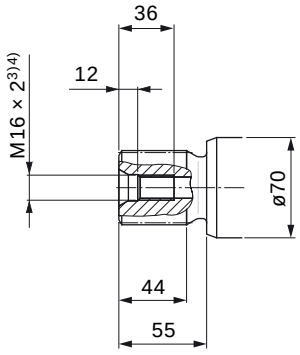
▼ **Splined shaft SAE J744**

T2 – 2 in 15T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

A2 – W50×2×24×9g

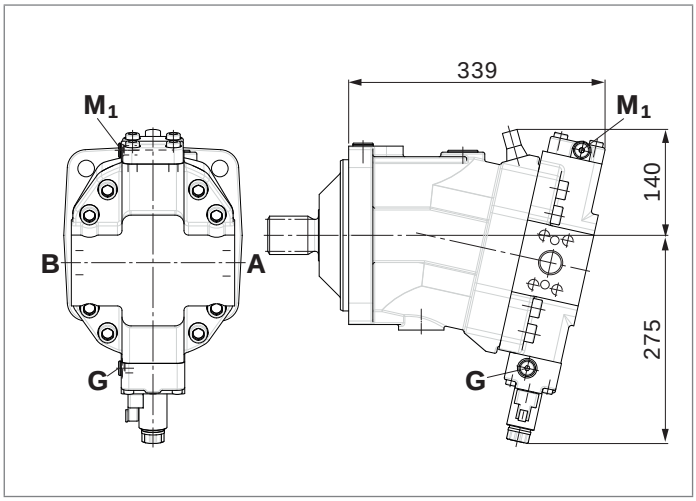


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

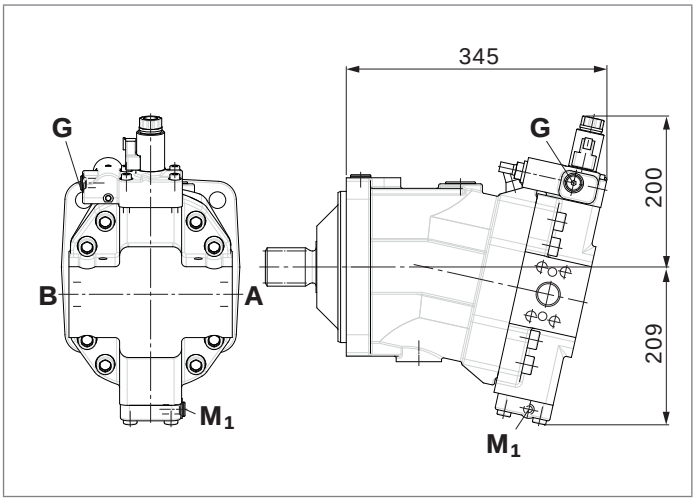
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	1 1/4 in M14 × 2; 19 deep	530	O
$\mathbf{T}_1$	Drain port	ISO 6149[4]	M33 × 2; 19 deep	3	X[3]
$\mathbf{T}_2$	Drain port	ISO 6149[4]	M42 × 2; 19.5 deep	3	O[3]
G	Synchronous control	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149[4]	M22 × 1.5; 15.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149[4]	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	3	X
$\mathbf{X}_1$, $\mathbf{X}_2$	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
$\mathbf{X}_1$	Pilot pressure port (DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	O
$\mathbf{X}_3$	Pilot pressure port (DA0, DA1, DA2)	ISO 6149[4]	M14 × 1.5; 11.5 deep	40	X
$\mathbf{M}_1$	Measuring port, control pressure	ISO 6149[4]	M14 × 1.5; 11.5 deep	530	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port, pressure A, B	ISO 6149[4]	M22 × 1.5; 15.5 deep	530	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, $\mathbf{T}_1$ or $\mathbf{T}_2$ must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

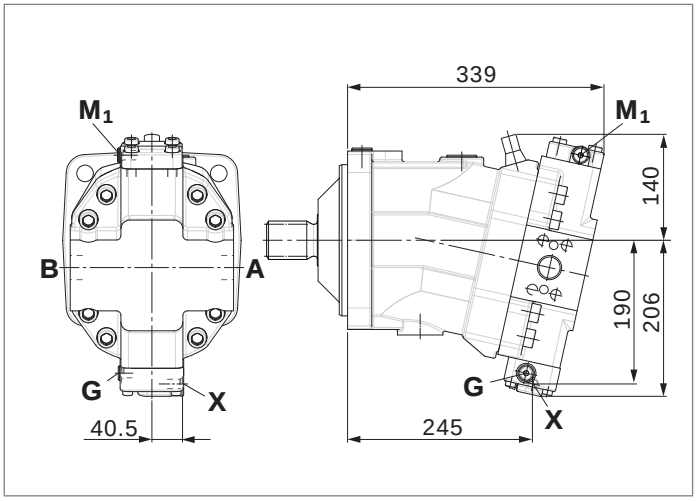
▼ **EP1, EP2** – Proportional electric control, positive control



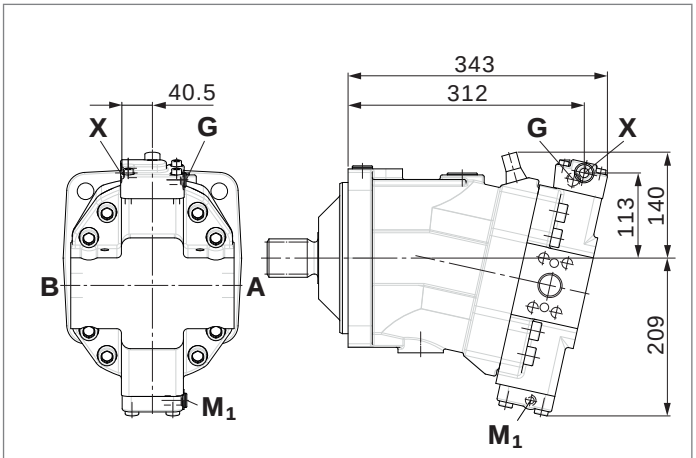
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



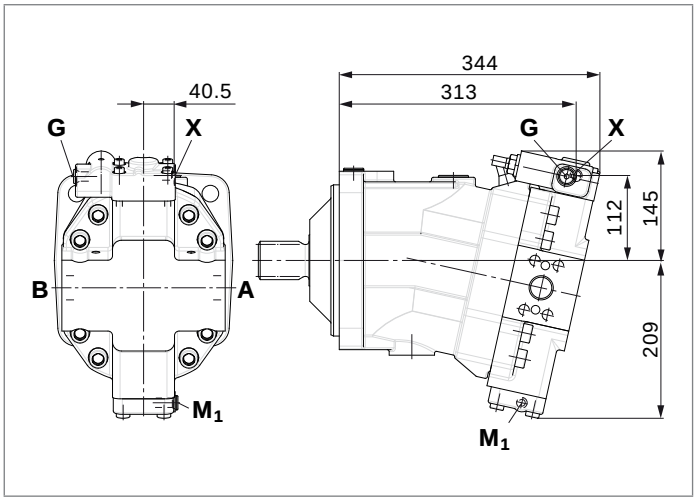
▼ **HP1, HP2** – Proportional hydraulic control, positive control



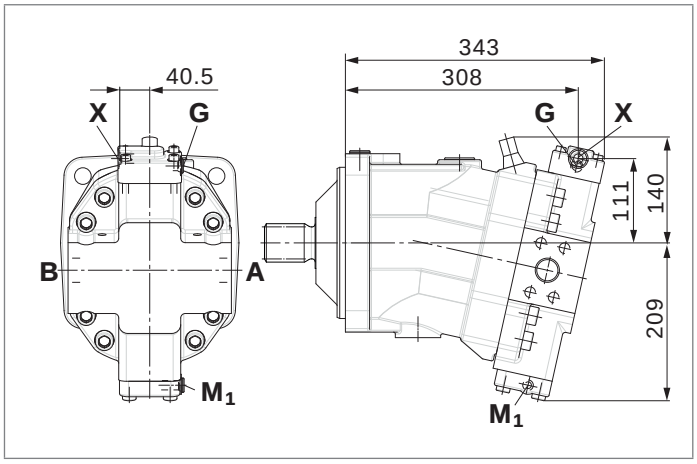
▼ **HP5, HP6** – Proportional hydraulic control, negative control



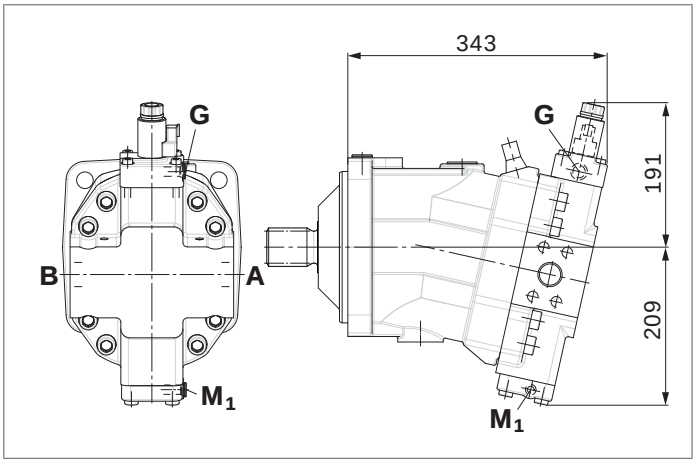
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



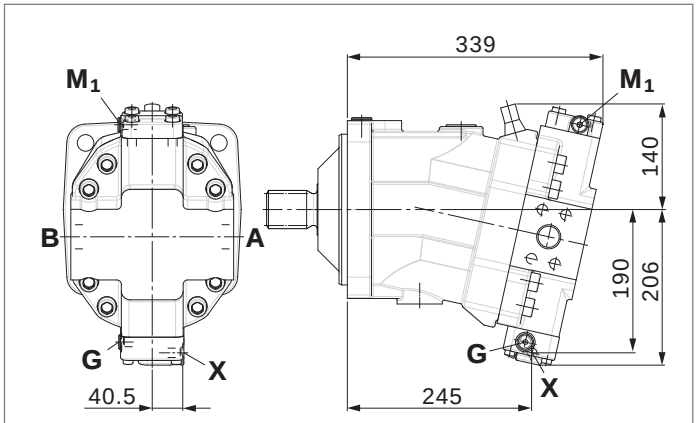
▼ **HZ5** – Two-point control, hydraulic, negative control



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

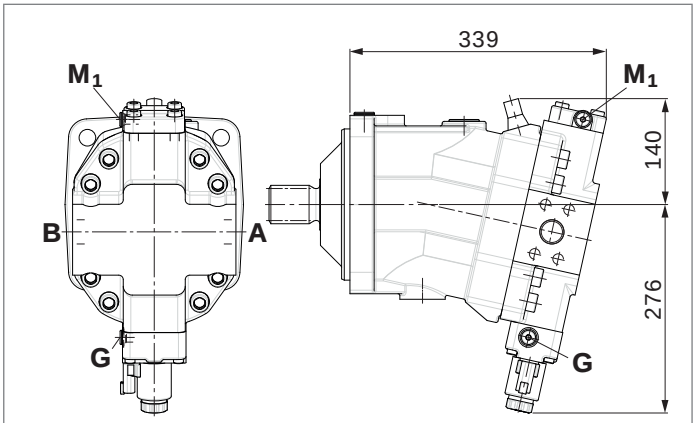


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

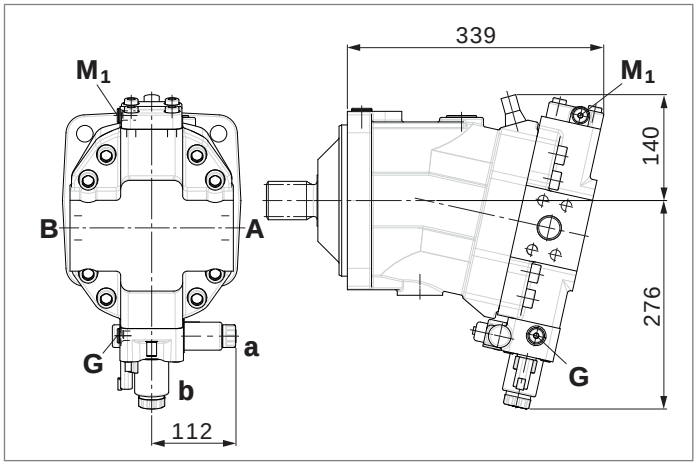


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

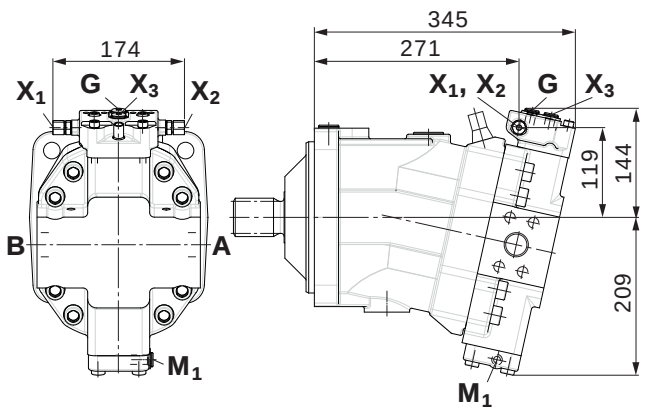
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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



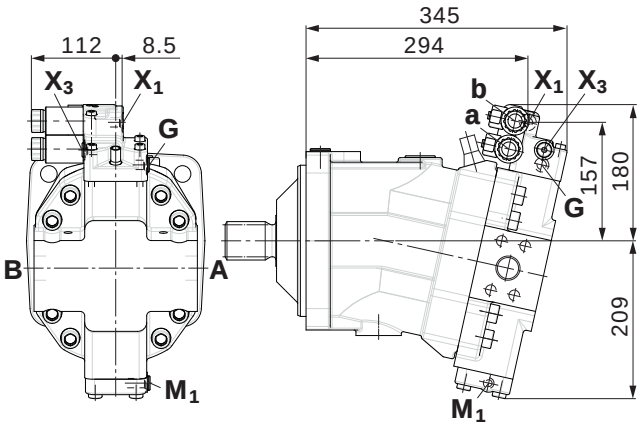
▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

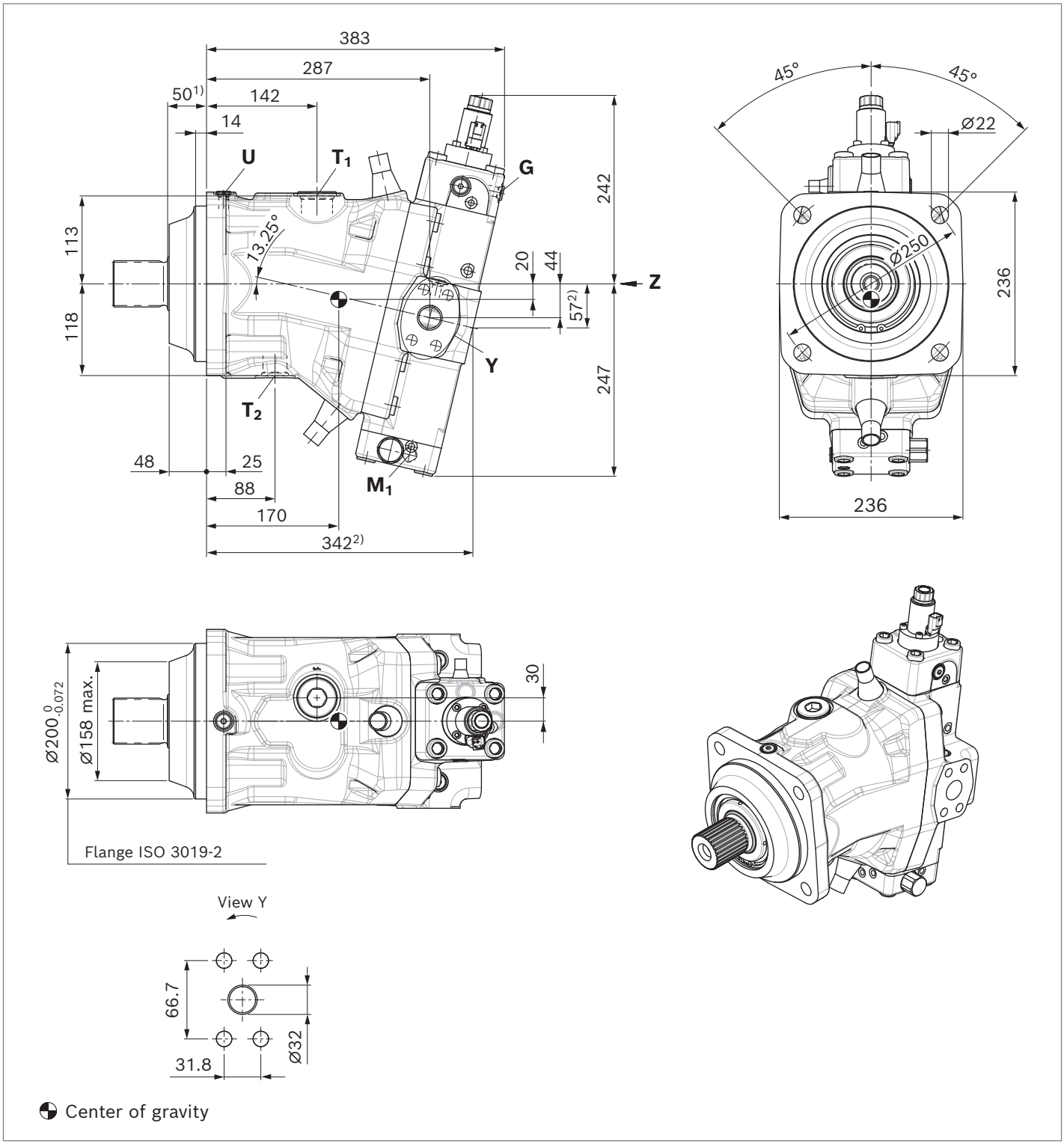


Dimensions

Series 71: Size 280

EP5, EP6 – Proportional electric control, negative control

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

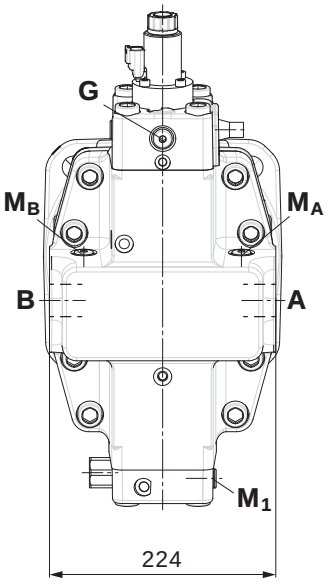


1) To shaft collar

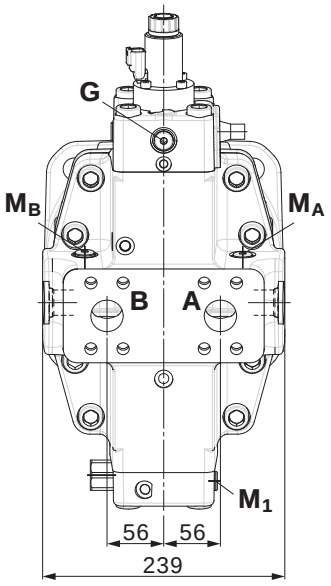
2) Port plate 1 – SAE working ports **A** and **B** at rear

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

2 SAE working ports **A** and **B** lateral, opposite

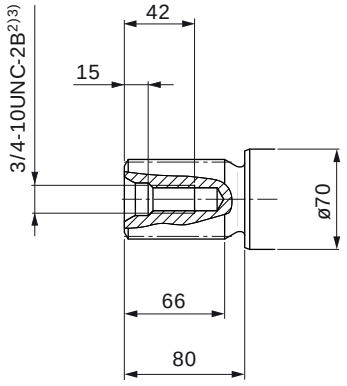


1 SAE working ports **A** and **B** at rear



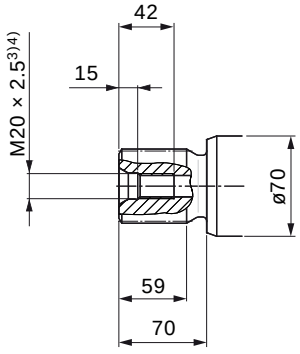
▼ **Splined shaft SAE J744**

T3 – 2 1/4 in 17T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

A4 – W60×2×28×9g

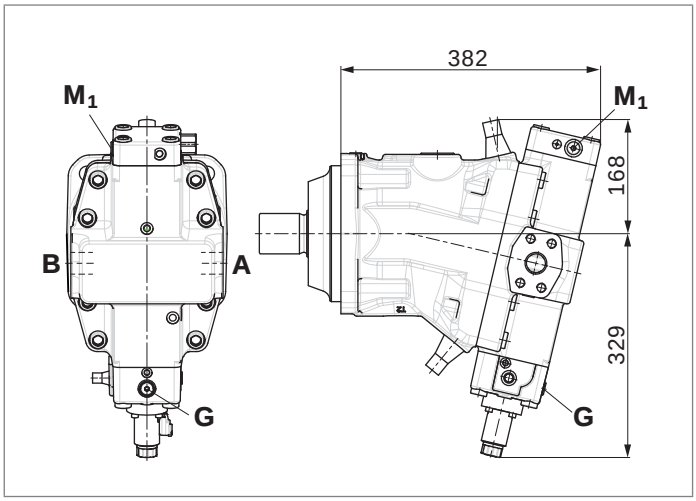


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Center bore according to DIN 332 (thread according to DIN 13)

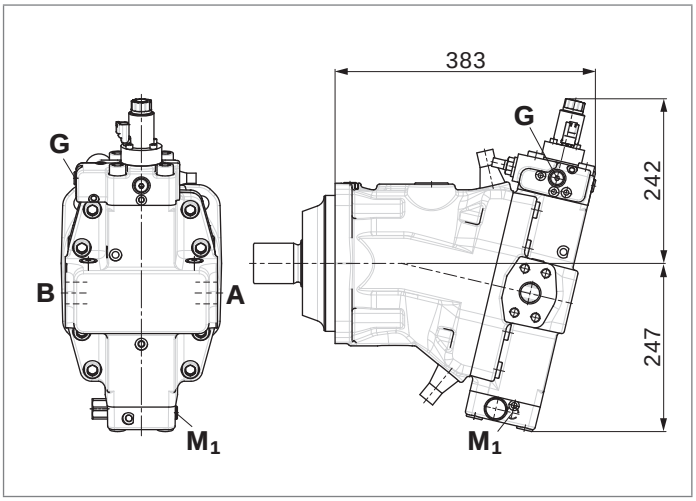
Ports		Standard	Size	p_{max} [bar][1]	State[5]
A, B	Working port Fastening thread A/B	SAE J518[2] DIN 13	1 1/4 in M14 × 2; 19 deep	500	O
T_1	Drain port	ISO 6149[4]	M42 × 2; 19.5 deep	3	X[3]
T_2	Drain port	ISO 6149[4]	M33 × 2; 19 deep	3	O[3]
G	Synchronous control	ISO 6149[4]	M14 × 1.5; 11.5 deep	500	X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

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
3) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 100).
4) The countersink may be deeper than specified in the standard.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

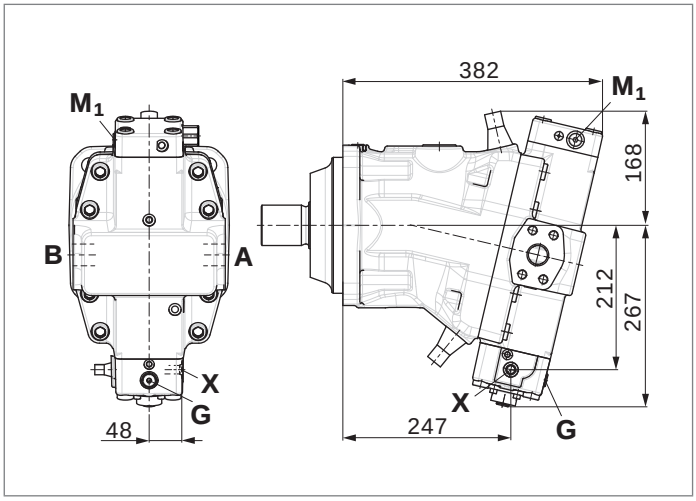
▼ **EP1, EP2** – Proportional electric control, positive control



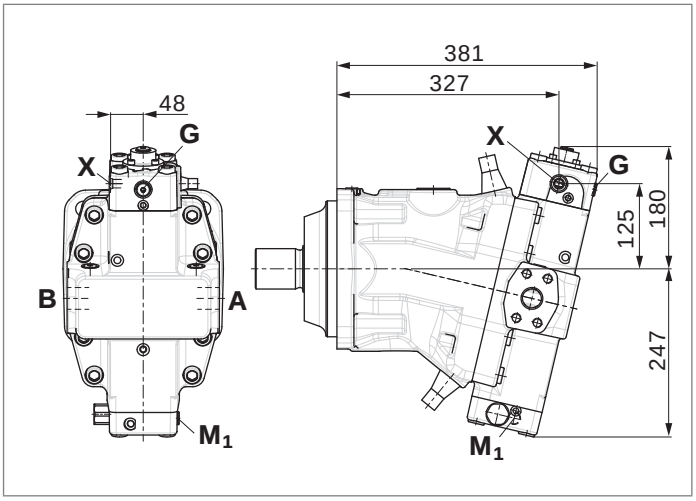
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



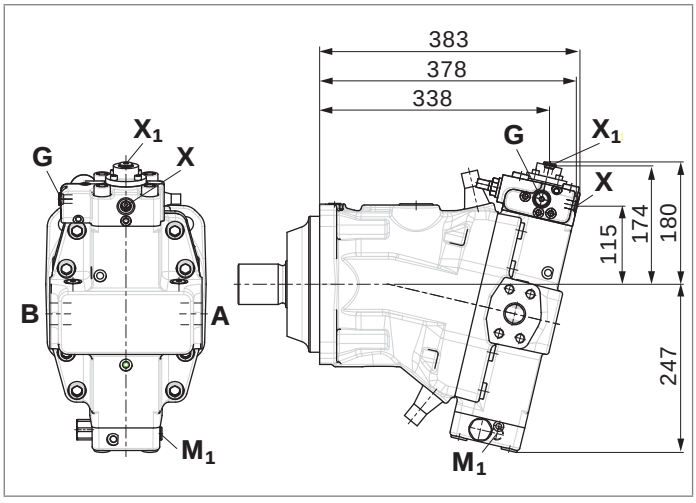
▼ **HP1, HP2** – Proportional hydraulic control, positive control



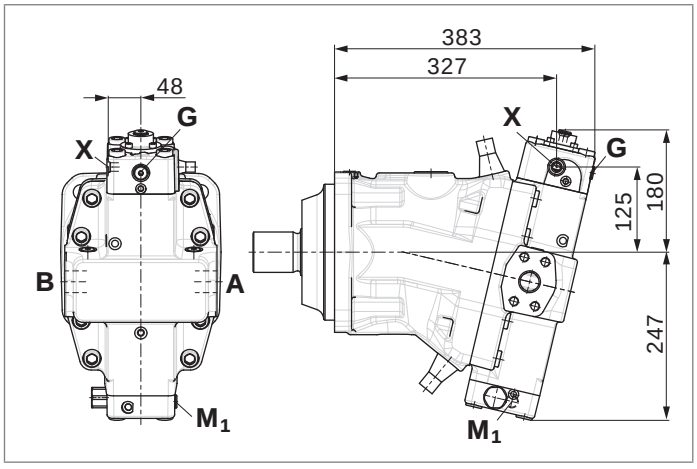
▼ **HP5, HP6** – Proportional hydraulic control, negative control



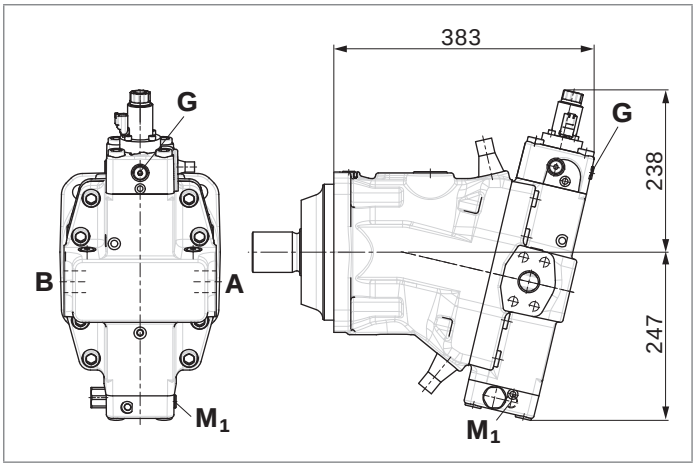
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



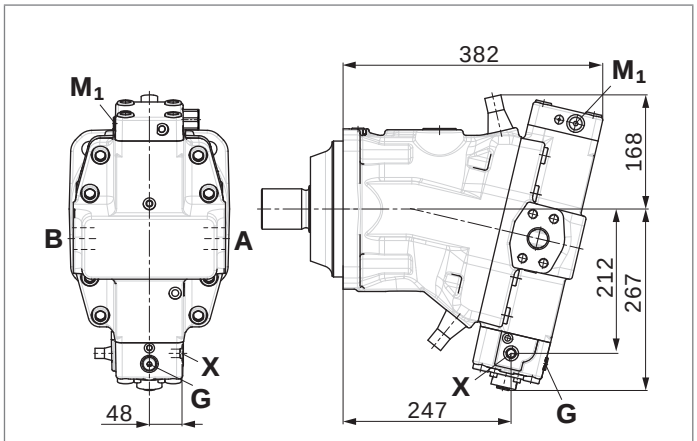
▼ **HZ5** – Two-point control, hydraulic, negative control



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



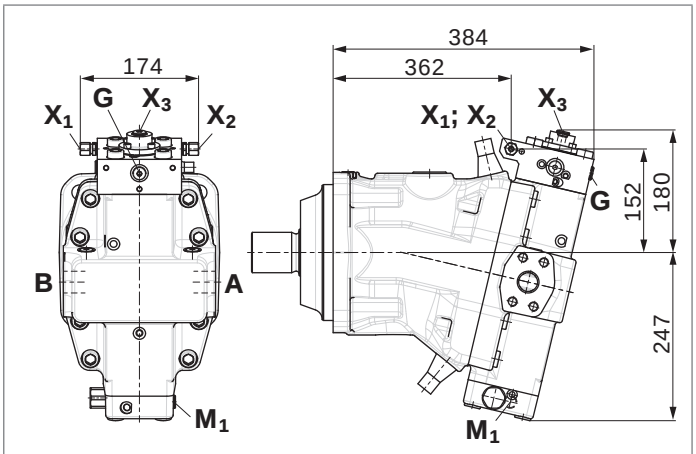
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



HA1 and HA2, **X** not existing

HA1T and HA2T, **X** open

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



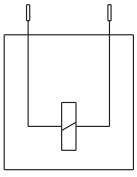
Connector for solenoids

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.
- See the operating instructions for the procedure.
- Only the dead weight (<1 N) of the connection cable with a length of 150 mm may act on the plug-in connection and the solenoid coil with coil nut. Other forces and vibrations are not permissible. This can be realized e.g. by suspension of the cable on the same vibration system.

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 gearbox 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 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
	maximum (momentary peaks)	10 bar[2)]

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

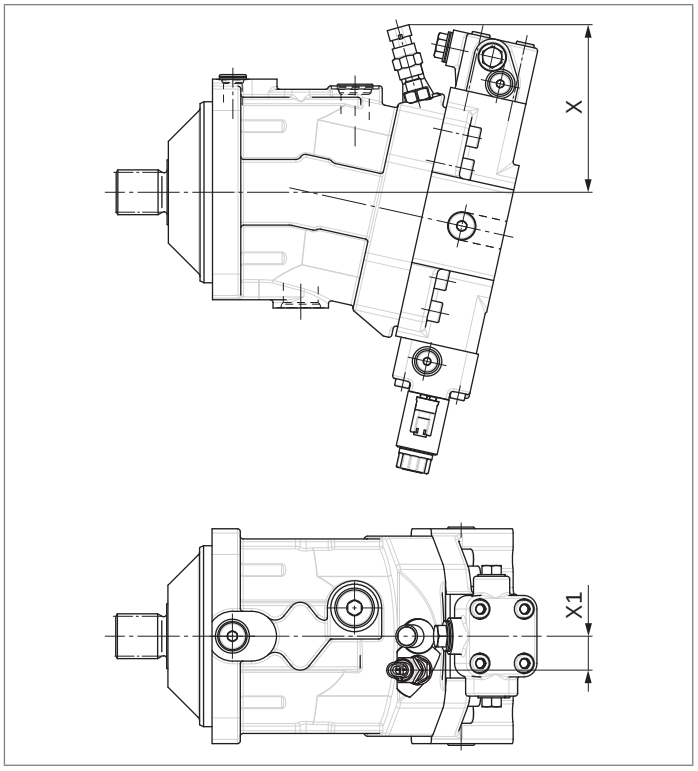
▼ **Mating connector**

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.

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.

▼ **Dimensions**
Version "N" with neutral position switch



Size	Adjustable angle		X [mm]		X1 [mm]
	min.	max.	at min angle	at max angle	
80, 85	0°	2°	144.7	141.4	28.0
107, 115	0°	4°	148.1	140.4	30.0
140, 150	0°	1°	153.1	150.9	30.0
160, 170	0°	0°		153.1	30.0
200, 215	0°	0°		159.1	30.0

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 housing and safeguarding the minimum boost pressure.
Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.
The valve is mounted on the port plate or integrated (depending on the control type and size).

Cracking pressure of pressure retention valve
(observe when setting the primary valve)
- Size 28 to 215, fixed setting 16 bar
- Size 280, adjustable 15 to 35 bar

Switching pressure, flushing spool Δp
- Size 28 to 115 (small flushing valve) 8 ± 1 bar
- Size 107 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)

Small flushing valve
Size 28 to 115

Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290106	1.2	3.5	A
R902290107	1.4	5	B
R902290109	1.8	8	C
R902290110	2.0	10	D
R902290112	2.4	14	F[1)]
R902290113	3.0	16	H[1)]

Medium flushing valve
Size 107 and 115

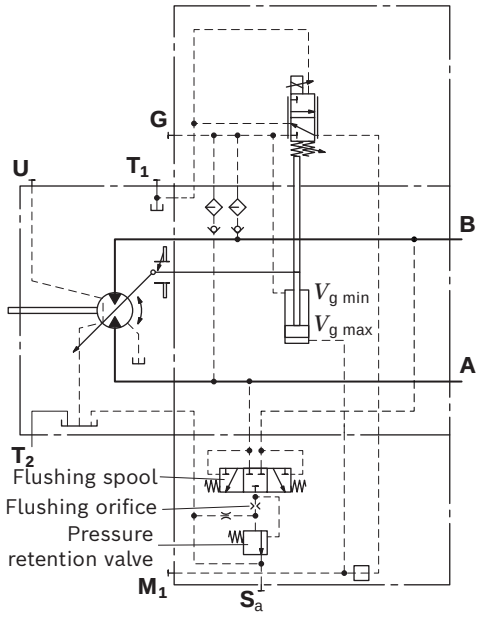
Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290123	2.8	18	I
R902290124	3.1	21	J
R902290125	3.5	27	K
R902290127	5.0	31	L

Large flushing valve
Size 140 to 215

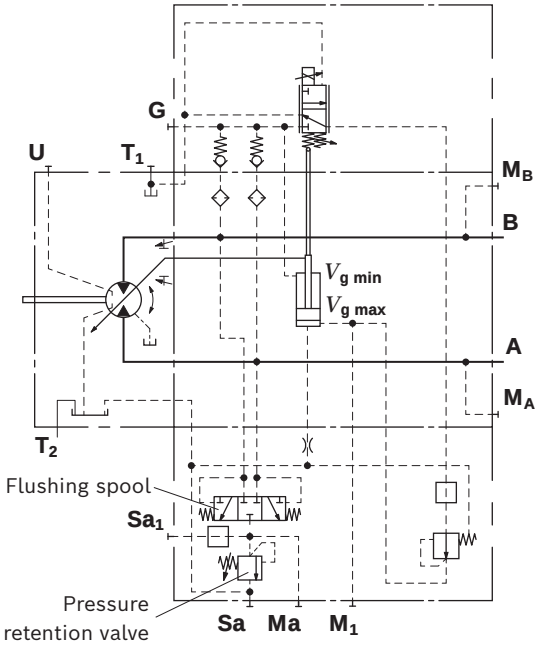
Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290118	1.8	8	C
R902290119	2.0	10	D
R902290121	2.5	15	G
R902290123	2.8	18	I
R902290124	3.1	21	J
R902290125	3.5	27	K
R902290126	4.0	31	L
R902290127	5.0	37	M

1) Not available for size 28

▼ **Circuit diagram EP**
Size 28 to 215



▼ **Circuit diagram EP**
Size 280

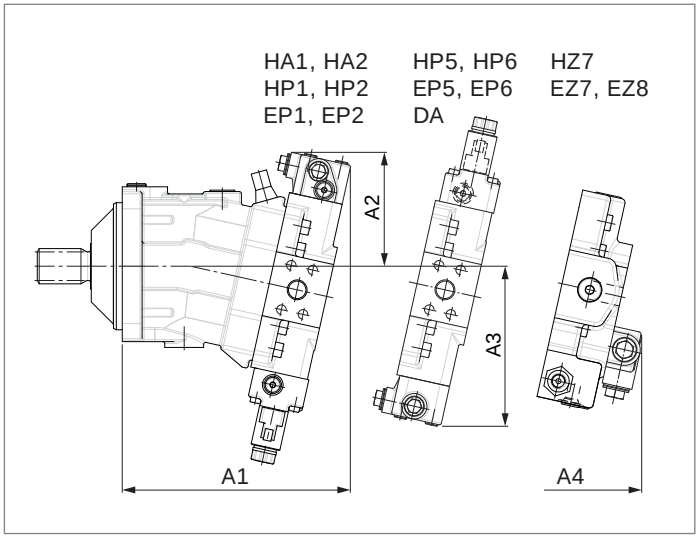


Notice

- Port **S**a only for size 140 to 280
- From a flushing flow of 35 l/min[1)], it is recommended that port $\mathbf{S}_a$ be connected in order to prevent an increase in case pressure. An increased case pressure reduces the flushing flow.

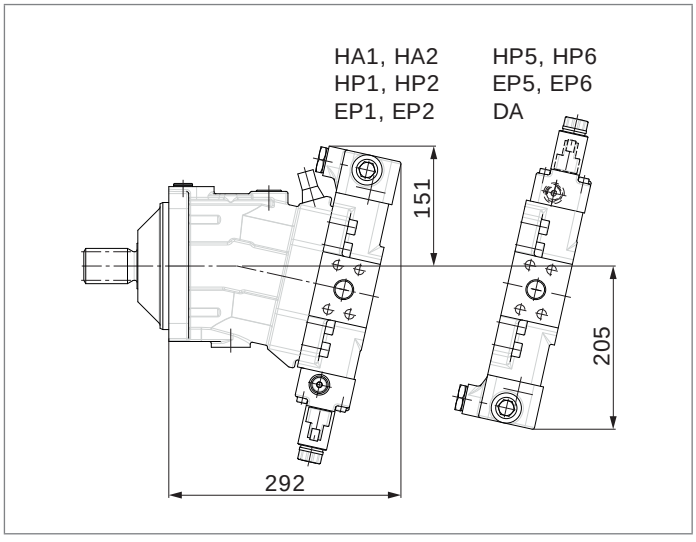
1) Please contact us concerning size 280

▼ **Dimensions (small flushing valve)**
Size 28 to 115

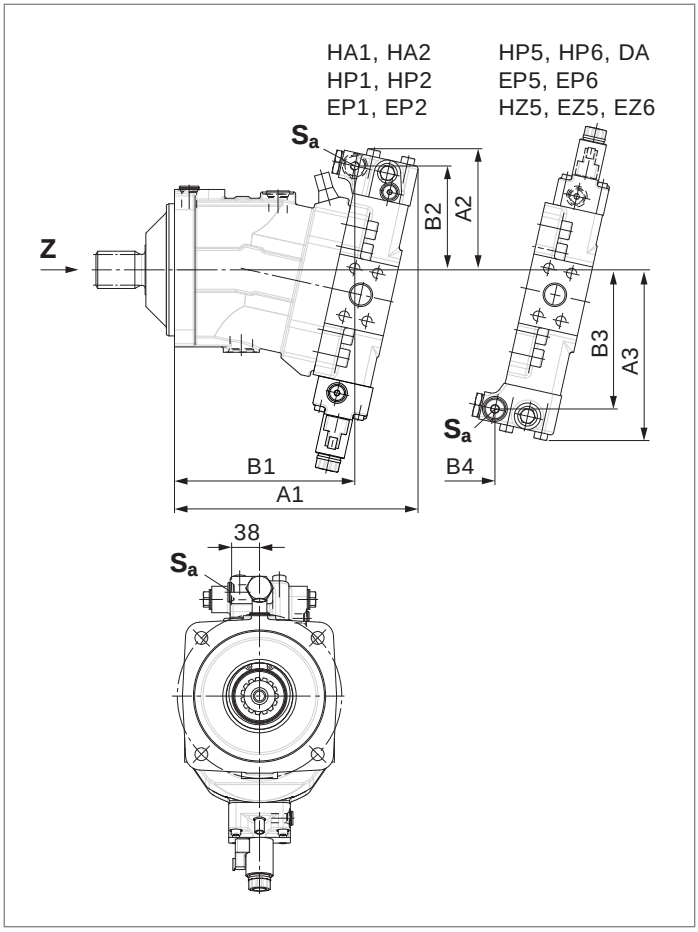


NG	A1	A2	A3	A4
28	214	125	161	–
55, 60	245	137	183	236
80, 85	273	142	194	254
107, 115	287	143	202	269

▼ **Dimensions (medium flushing valve)**
Size 107 and 115



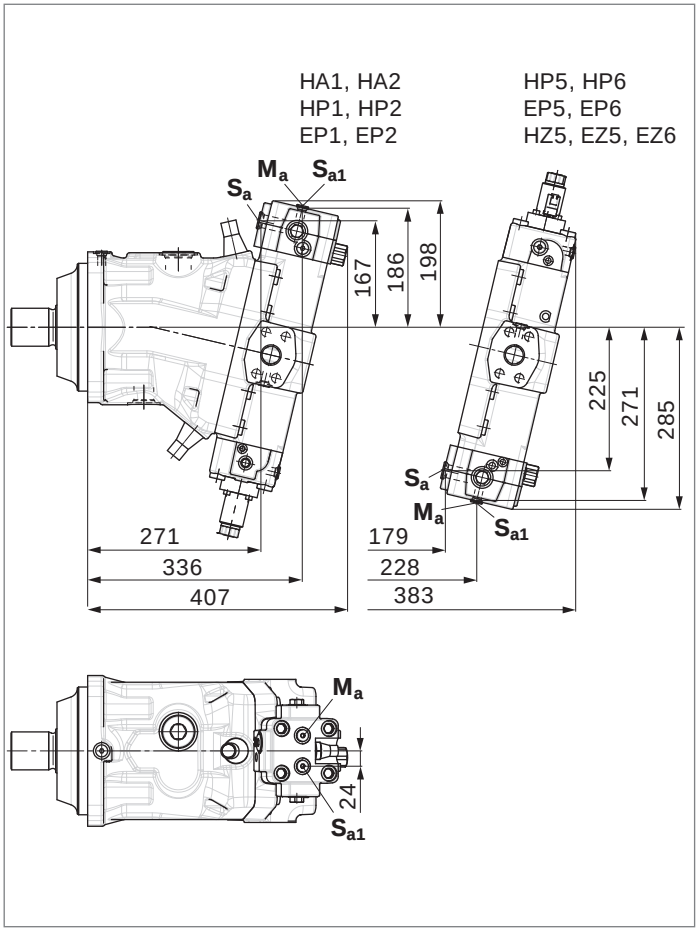
▼ **Dimensions (large flushing valve)**
Size 140 to 215



NG	A1	B1	A2	B2	A3
140, 150	325	239	165	142	230
160, 170	332	246	165	142	233
200, 215	349	263	172	148	244

NG	B3	B4	Sa[1)]
140, 150	187	166	M22 × 1.5; 15.5 deep
160, 170	190	172	M22 × 1.5; 15.5 deep
200, 215	201	185	M22 × 1.5; 15.5 deep

▼ **Dimensions (large flushing valve)**
Size 280



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

BVD and BVE counterbalance valve

Function

Counterbalance valves for travel drives and winches should reduce the danger of overspeed and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking, when going downhill or during the load-lowering process, the motor speed is greater than it should be for the given inlet flow and thus the supply pressure falls sharply.
If the supply pressure falls below the value specified for the relevant counterbalance valve, the counterbalance spool moves into the closed position. The cross-sectional area of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor reaches the specified value for the given inlet flow.

Notice

- BVD available for size 55 to 280 and BVE available for size 107 to 280.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
- Order example: A6VM080HA1T30004A/65MWV0N4S 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 detailed information on the counterbalance valve in data sheets 95522 (BVD20, BVD25), 95525 (BVE25) and 95528 (BVD/BVE32)!
  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)

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 operating instructions.

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

Series 65

Motor	Without valve		Limited values when using pressure relief valve and BVD/BVE						
			Pressure relief valve			BVD[1]/BVE[2]			
NG	p_{nom}/p_{max} [bar]	$q_{V\,max}$ [l/min]	p_{nom}/p_{max} [bar]	q_V [l/min]	Code	NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code
55	400/530	244	350/420	240	7	20 (BVD)	350/420	220	7W
80		312							
107		380		400					
107		380			8	25 (BVD/BVE)		320	8W
140		455				25 (BVD)			
160		496							
140		455	300/460	550	5	25 (BVE)	350/400	320	5W
160		496							
200		580				25 (BVD/BVE)			
200		580			9	32 (BVD/BVE)	350/420	628	9W

Series 71

Motor	Without valve		Limited values when using pressure relief valve and BVD/BVE						
			Pressure relief valve			BVD[1]/BVE[2]			
NG	p_{nom}/p_{max} [bar]	$q_{V\,max}$ [l/min]	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	350/420	240	7	20 (BVD)	350/420	220	7W
85		332							
115		410		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	

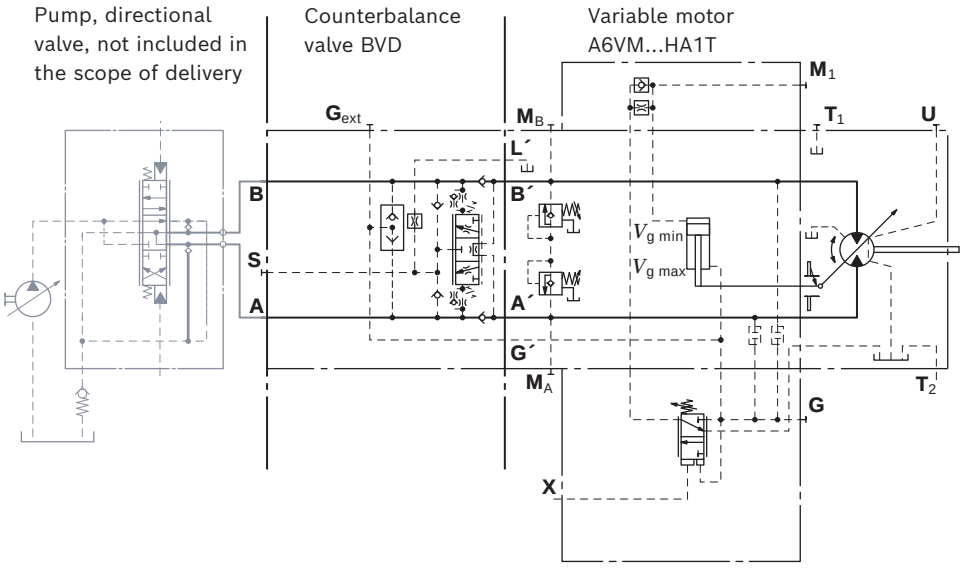
1) Counterbalance valve, double-acting
2) Counterbalance valve, one-sided

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**

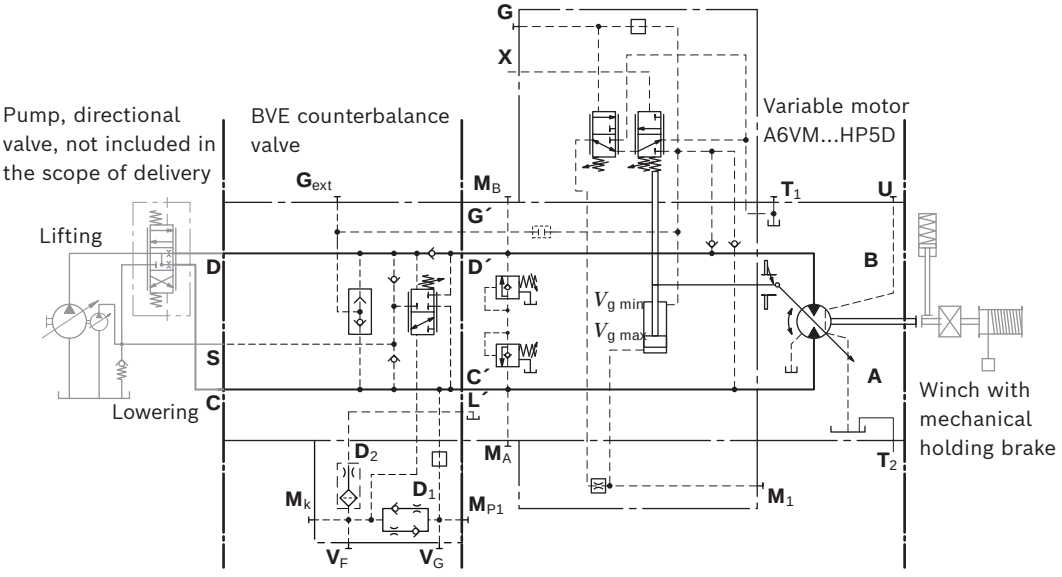


Counterbalance valve for winches and track drive BVD...W and BVE

Application option

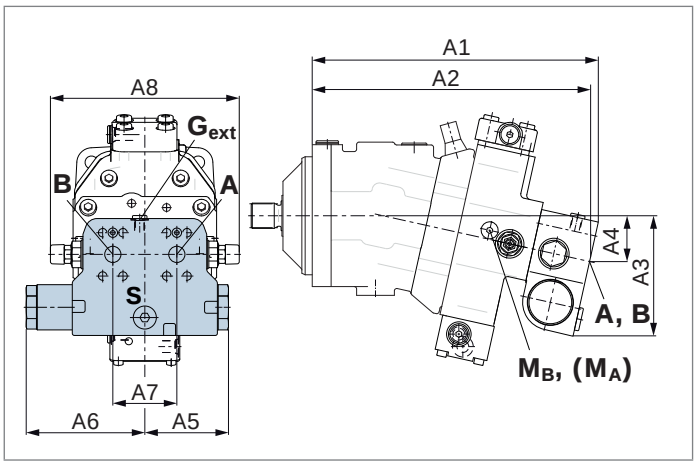
- Winch drives in cranes (BVD and BVE)
- Track drive in crawler excavators (BVD)

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

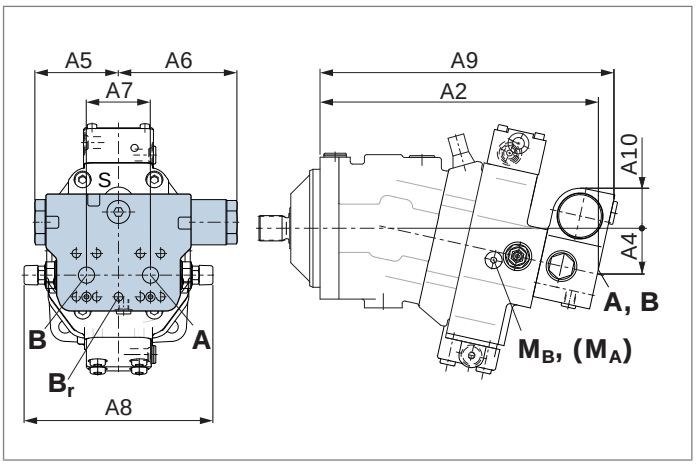


Dimensions

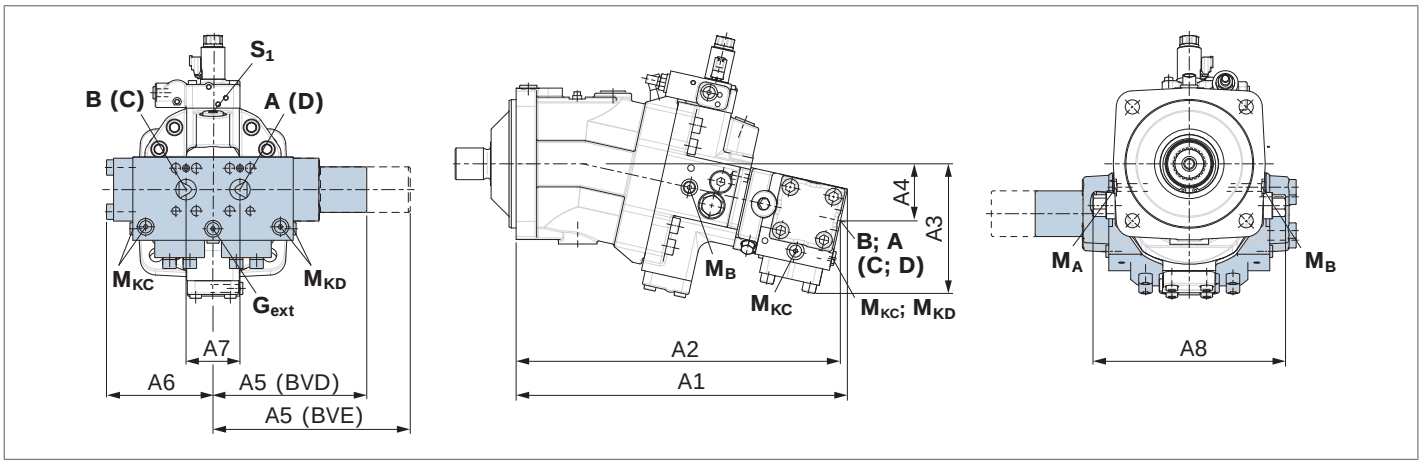
▼ **A6VM...HA, HP1, HP2 or EP1, EP2 with BVD20 or BVD/BVE25**



▼ **A6VM...HP5, HP6 or EP5, EP6[1] with BVD20 or BVD/BVE25**



▼ **A6VM...HA, HP5, HP6 or EP5, EP6 with BVD/BVE 32**



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!

A6VM	Counterbalance valve											
NG...plate	Type	Ports	Dimensions									
		A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
55...7 and 60...7	BVD20...17	3/4 in	311	302	143	50	98	139	75	222	326	50
80...7 and 85...7	BVD20...27	1 in	340	331	148	55	98	139	75	222	355	46
107...7 and 115...7	BVD20...28	1 in	362	353	152	59	98	139	84	234	377	41
107...8 and 115...8	BVD25...38	1 1/4 in	380	370	165	63	120.5	175	84	238	395	56
140...8 and 150...8	BVD25...38	1 1/4 in	411	401	168	67	120.5	175	84	238	426	53
160...8 and 170...8	BVD25...38	1 1/4 in	417	407	170	68	120.5	175	84	238	432	51
200...5 and 215...5	BVD25...38	1 1/4 in	448	438	176	74	120.5	175	84	299	463	46
200...9 and 215...9	BVD32...38	1 1/4 in	516	505	202	89	240	166	84	299	–	46
280...9	BVD32...38	On request										
107...8 and 115...8	BVE25...38	1 1/4 in	380	370	171	63	137	214	84	238	397	63
140...5 and 150...5	BVE25...38	1 1/4 in	411	401	175	67	137	214	84	238	423	59
160...5 and 170...5	BVE25...38	1 1/4 in	417	407	176	68	137	214	84	238	432	59
200...5 and 215...5	BVE25...38	1 1/4 in	448	438	182	74	137	214	84	299	463	52
200...9 and 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	p_{max} [bar][1]	State[4]
A, B	Working port			SAE J518[2]	See table above	420	O
S	Boost pressure port	BVD20		DIN 3852[3]	M22 × 1.5; 14 deep	30	X
		BVD25, BVE25		DIN 3852[3]	M27 × 2; 16 deep	30	X
$\mathbf{S}_1$	Boost pressure port	BVE32		DIN 3852[3]	M22 × 1.5; 14 deep	30	X
$\mathbf{B}_r$	Brake release port, reduced high pressure	L	7	DIN 3852[3]	M12 × 1.5; 12.5 deep	30	O
			8	DIN 3852[3]	M12 × 1.5; 12 deep	30	O
$\mathbf{G}_{ext}$	Brake release port, high pressure	S		DIN 3852[3]	M12 × 1.5; 12.5 deep	420	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port, pressure **A** and **B**			ISO 6149[3]	M18 × 1.5; 14.5 deep	420	X
$\mathbf{M}_C$	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[3]	M14 × 1.5; 12 deep	350	X
$\mathbf{M}_K$	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[3]	M14 × 1.5; 12 deep	350	X
$\mathbf{M}_{KC}$	Measuring port, pressure counterbalance spool **C**	BVD32, BVE32		DIN 3852[3]	M14 × 1.5; 12 deep	350	X
$\mathbf{M}_{KD}$	Measuring port, pressure counterbalance spool **D**	BVE32, BVE32		DIN 3852[3]	M14 × 1.5; 12 deep	350	X
$\mathbf{M}_{P1}$	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[3]	M14 × 1.5; 12 deep	350	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
3) The countersink may be deeper than specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Integrated counterbalance valve BVI

Function

The integrated counterbalance valves for track drives in crawler excavators should reduce the danger of overspeed and cavitation of axial piston motors in open circuits.
Cavitation occurs if, during braking or driving downhill, the rotational speed of the motor is greater than it should be for the given inlet flow, causing the supply pressure to fall sharply.
If the supply pressure falls below the value specified for the relevant counterbalance valve, the counterbalance spool moves into the closed position. The cross-sectional area of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor reaches the specified value for the given inlet flow.

Notice

- BVI available in size 140 and 170
- The counterbalance valve must be ordered additionally. Order example:
  A6VM150HP6000001A/71MWV0R4A16Y0-0 +
  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 spool version		q_V **[l/min]**	**Material number**	
02	Volume preselection	≤ 150	R902038832	**51**
		= 150 – 210	R902038936	**52**
		= 210 – 270	R902038833	**53**
		= 270 – 330	R902038834	**54**
		= 330 – 400	R902038835	**55**
		≥ 400	R902038836	**56**

Throttle mounting

03	Constant throttle	R909432302	**0008**
	Throttle pin	R909651165	**0603**

Check valve

04	Without residual opening	**00**

Brake release valve

05	With brake release valve (standard HZ)	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**

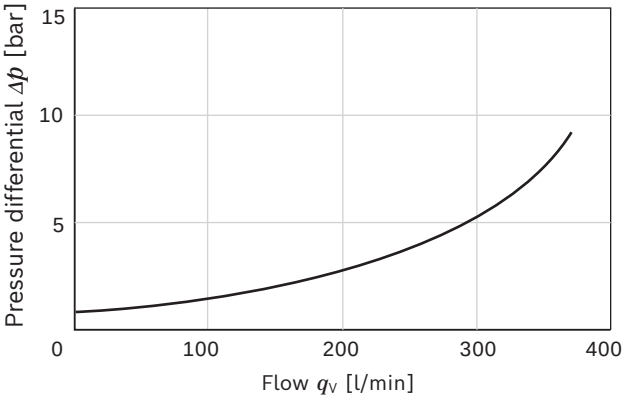
Technical data

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

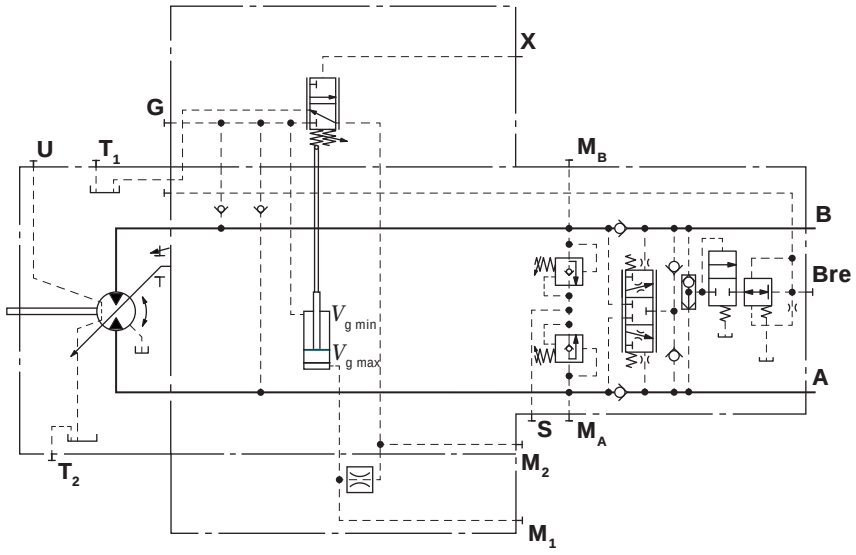
Permissible inlet flow or pressure when using pressure relief valve and BVI

		Without restrictions **Standard plate (1 + 2)**		**Restricted values** **Plate with integrated counterbalance valve (6)**	
					BVI + pressure relief valve
Motor	**NG**	p_{nom}/p_{max} **[bar]**	$q_{V\,max}$ **[l/min]**	p_{nom}/p_{max} **[bar]**	q_V **[l/min]**
Series 65	140	400/530	455	350/420	400
	160		496		
Series 71	150	450/530	494		
	170		533		

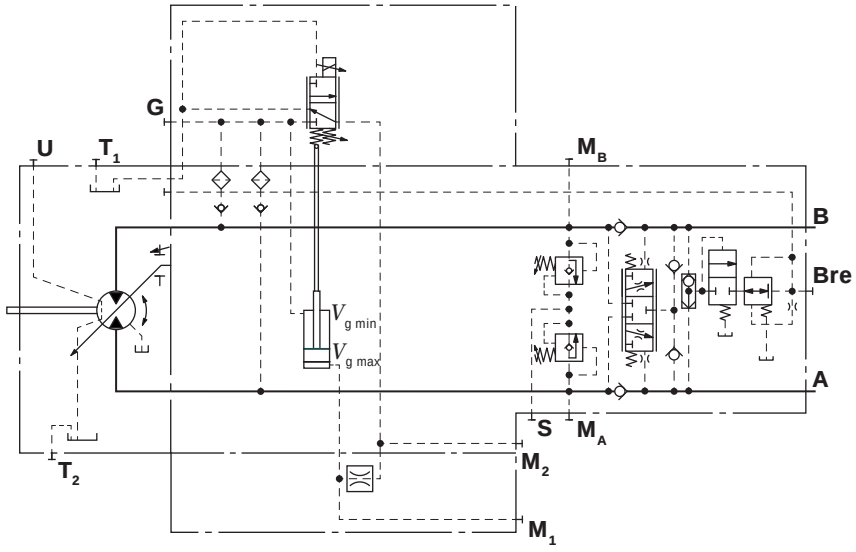
▼ **Boost characteristic**



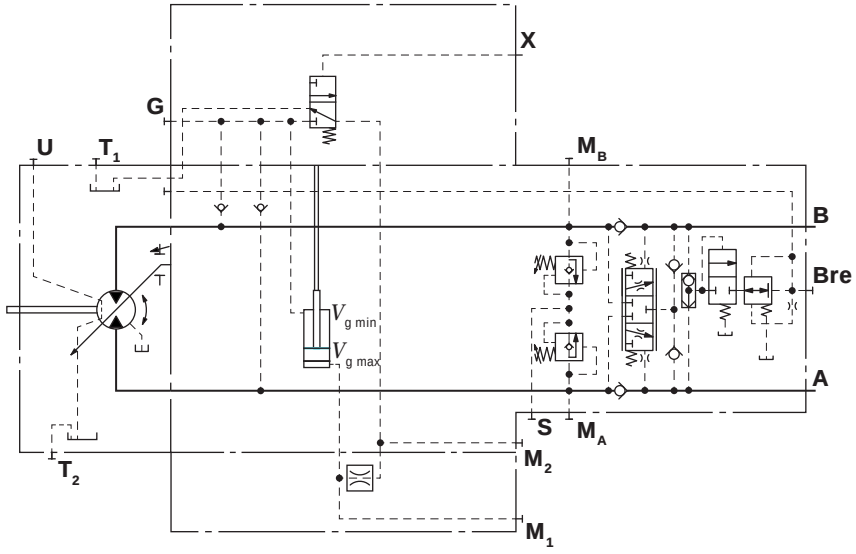
▼ **Circuit diagram HP5**



▼ **Circuit diagram EP5**



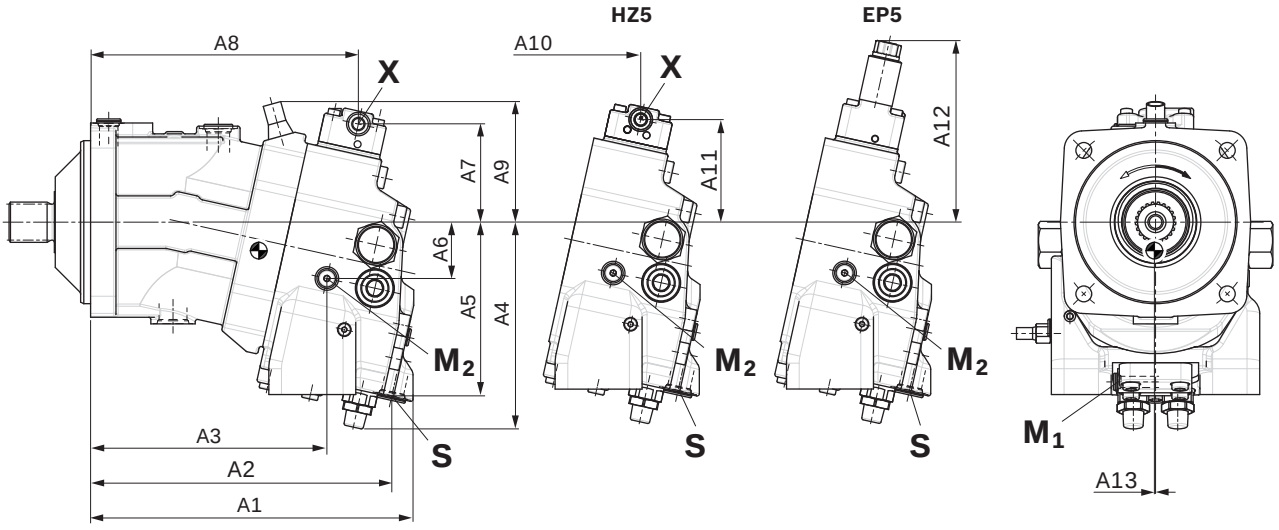
▼ **Circuit diagram HZ5**

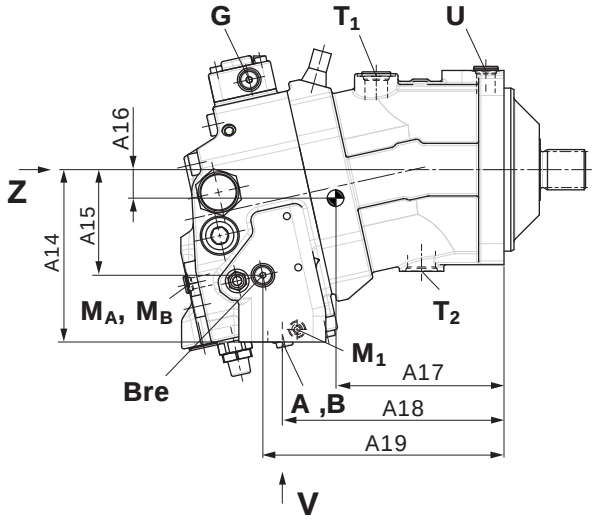


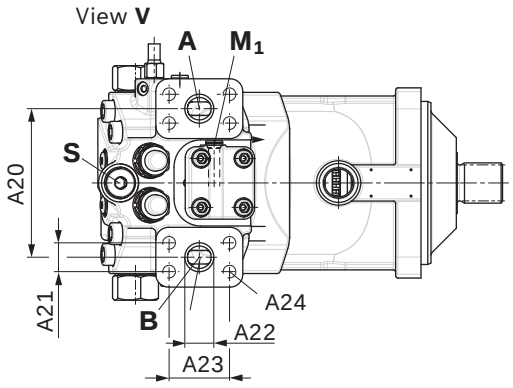
Integrated counterbalance valve BVI dimensions

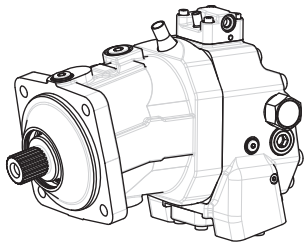
HP5 – Two-point control, hydraulic

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



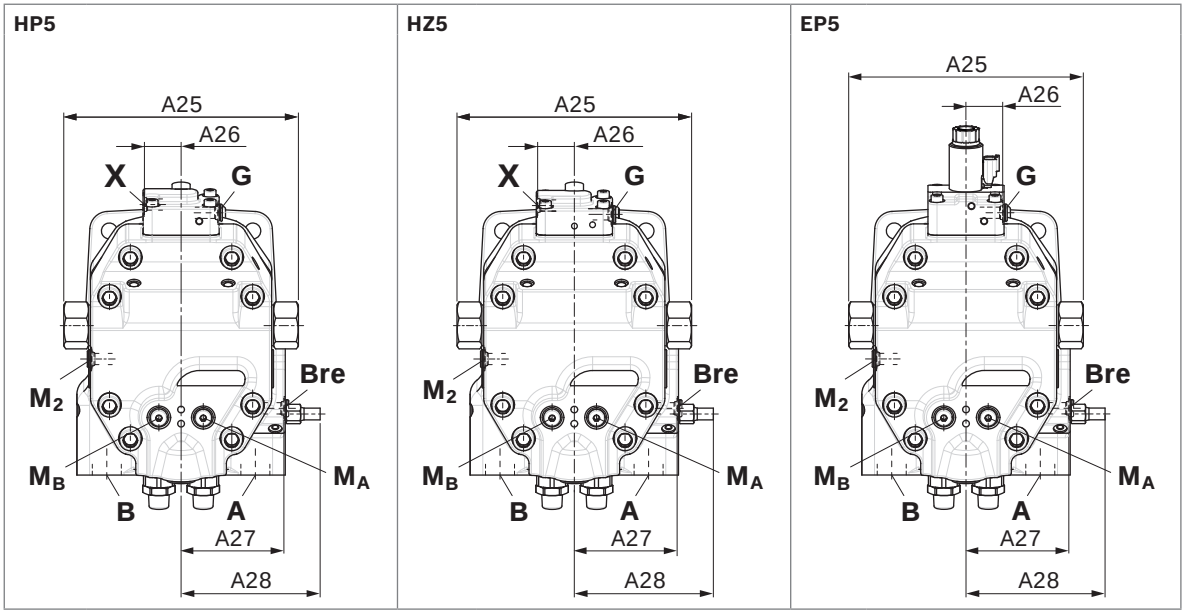






Center of gravity

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



Dimensions														
NG	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**A13**	**A14**
140, 150	350	326	254	227	190	61	109	289	max. 134	285	108	196	1.0	189
160, 170	357	332	261	228	192	62	108	296	max. 135	291	107	195	1.0	190

Dimensions														
NG	**A15**	**A16**	**A17**	**A18**	**A19**	**A20**	**A21**	**A22**	**A23**	**A24 (DIN 13)**	**A25**	**A26**	**A27**	**A28**
140, 150	115	25	170	238	260	164	31.8	32	66.7	M14 × 2; 19 deep	259	40.5	113.5	154
160, 170	117	29	191	245	266	164	31.8	32	66.7	M14 × 2; 19 deep	259	40.5	113.5	154

Ports	**Working port**	**Drain port**	**Drain port**	**Bearing flushing port**	**Pilot pressure port**	**Boost pressure supply**
	SAE J518[1]	**ISO 6149**[2]	**ISO 6149**[2]	**ISO 6149**[2]	**ISO 6149**[2]	**ISO 6149**[2]
NG	**A, B**	**T_1**	**T_2**	**U**	**X**	**S**
140, 150	1 1/4 in	M27 × 2; 19 deep	M33 × 2; 19 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
160, 170	1 1/4 in	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**	**Measuring port**	**Measuring port**	**Brake release, external**	**Synchronous control**
	ISO 6149[2]	**ISO 6149**[2]	**ISO 6149**[2]	**ISO 6149**[2]	**ISO 6149**[2]
NG	**$M_{A,}$ M_B**	**M_1**	**M_2**	**Bre**	**G**
140, 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
160, 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

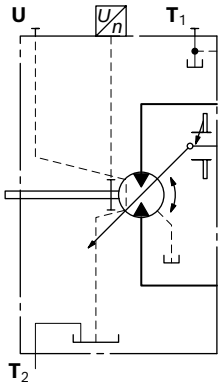
1) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard
2) The countersink may be deeper than specified in the standard.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 100).
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Speed sensor

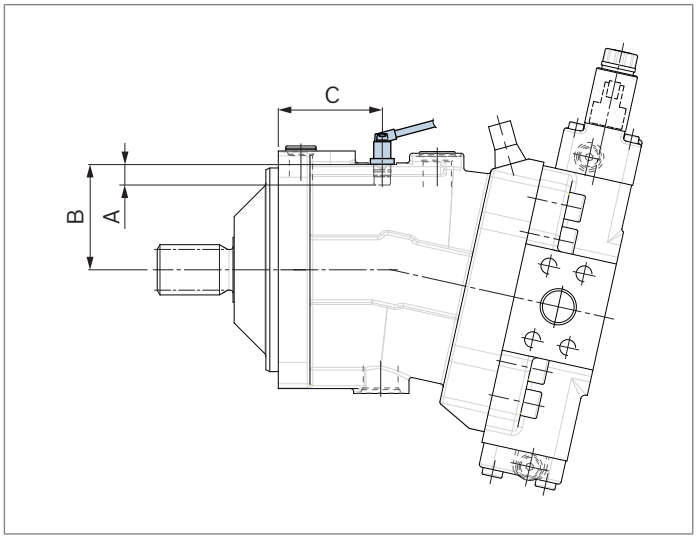
The rotational speed of the motor can be recorded by the mounted DST or DSA speed sensor. The proportional frequency signal required is generated by splines at the rotary group.
In addition to the rotational speed, the DST or DSA sensor detects the direction of rotation of the motor and the temperature at the installation location.
Type code, technical data, dimensions and details on the connector, plus safety instructions for the sensor can be found in the relevant data sheet 95131 (DST) or 95126 (DSA/20).
The sensor is mounted on the port provided for this purpose with a fixing screw. On deliveries without sensor, the port is plugged with a pressure-resistant cover.
We recommend ordering the A6VM variable motor complete with mounted sensor.
The following versions are available:

- with mounted speed sensor DSA/20: Code C
- with mounted speed sensor DST: Code E
- for speed sensor DST or DSA/20 (delivery without sensor): Code W

▼ **Circuit diagram**



▼ **Dimensions**[1)]
Size 28 to 280 with mounted speed sensor DSA/20 (Code C)



Size	28	55, 60	80, 85	107, 115	140, 150	160, 170	200, 215	280
Teeth number	40	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	18.4	32
B Contact surface	61	75	79	88	93	96	101	110.5
C	57.2	66.2	75.2	77.2	91.2	91.7	95.2	82

1) Dimensions also valid for version code E and code W

Setting range for displacement series 65

	28		55		80		107	
	$V_{g\,max}$ (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)	$V_{g\,max}$ (cm³/rev)	$V_{g\,min}$ (cm³/rev)
	from to	from to	from to	from to	from to	from to	from to	from to
A	28.1 28.1	0.0 6.9	54.8 54.8	0.0 13.3	80.0 80.0	0.0 9.0	107.0 107.0	0.0 22.2
	M8 × 40 R909086115	M8 × 50 R909153076	Without screw	M10 × 60 R909154690	Without screw	M12 × 60 R909083530	Without screw	M12 × 70 R909085976
B	28.1 28.1	> 6.9 15.0	54.8 54.8	> 13.3 27	80.0 80.0	> 9.0 26.0	107.0 107.0	> 22.2 43.8
	M8 × 40 R909086115	M8 × 60 R909153811	Without screw	M10 × 70 R909153779	Without screw	M12 × 70 R909085976	Without screw	M12 × 80 R909153075
C	28.1 28.1	> 15.0 20.0	54.8 54.8	> 27.0 38.0	80.0 80.0	> 26.0 44.0	107.0 107.0	> 43.8 65.5
	M8 × 40 R909086115	M8 × 70 R909154506	Without screw	M10 × 80 R909154058	Without screw	M12 × 80 R909153075	Without screw	M12 × 90 R909154041
D	x	x	x	x	80.0 80.0	> 44.0 56.0	107.0 107.0	> 65.5 75.0
					Without screw	M12 × 90 R909154041	Without screw	M12 × 100 R909153975
E	< 28.1 21.6	0.0 6.9	< 54.8 42.0	0.0 13.3	< 80.0 72.0	0.0 9.0	< 107.0 86.0	0.0 22.2
	M8 × 50 R909153076	M8 × 50 R909153076	M10 × 60 R909154690	M10 × 60 R909154690	M12 × 60 R909083530	M12 × 60 R909083530	M12 × 70 R909085976	M12 × 70 R909085976
F	< 28.1 21.6	> 6.9 15.0	< 54.8 42.0	> 13.3 27.0	< 80.0 72.0	> 9.0 26.0	< 107.0 86.0	> 22.2 43.8
	M8 × 50 R909153076	M8 × 60 R909153811	M10 × 60 R909154690	M10 × 70 R909153779	M12 × 60 R909083530	M12 × 70 R909085976	M12 × 70 R909085976	M12 × 80 R909153075
G	< 28.1 21.6	> 15.0 20.0	< 54.8 42.0	> 27.0 38.0	< 80.0 72.0	> 26.0 44.0	< 107.0 86.0	> 43.8 65.5
	M8 × 50 R909153076	M8 × 70 R909154506	M10 × 60 R909154690	M10 × 80 R909154058	M12 × 60 R909083530	M12 × 80 R909153075	M12 × 70 R909085976	M12 × 90 R909154041
H	x	x	x	x	< 80.0 72.0	> 44.0 56.0	< 107.0 86.0	> 65.5 75.0
					M12 × 60 R909083530	M12 × 90 R909154041	M12 × 70 R909085976	M12 × 100 R909153975
J	< 21.6 13.8	0.0 6.9	< 42.0 29.0	0.0 13.3	< 72.0 55.0	0.0 9.0	< 86.0 64.0	0.0 22.2
	M8 × 60 R909153811	M8 × 50 R909153076	M10 × 70 R909153779	M10 × 60 R909154690	M12 × 70 R909085976	M12 × 60 R909083530	M12 × 80 R909153075	M12 × 70 R909085976
K	< 21.6 13.8	> 6.9 15.0	< 42.0 29.0	> 13.3 27.0	< 72.0 55.0	> 9.0 26.0	< 86.0 64.0	> 22.2 43.8
	M8 × 60 R909153811	M8 × 60 R909153811	M10 × 70 R909153779	M10 × 70 R909153779	M12 × 70 R909085976	M12 × 70 R909085976	M12 × 80 R909153075	M12 × 80 R909153075
L	< 21.6 13.8	> 15.0 20.0	< 42.0 29.0	> 27.0 38.0	< 72.0 55.0	> 26.0 44.0	< 86.0 64.0	> 43.8 65.5
	M8 × 60 R909153811	M8 × 70 R909154506	M10 × 70 R909153779	M10 × 80 R909154058	M12 × 70 R909085976	M12 × 80 R909153075	M12 × 80 R909153075	M12 × 90 R909154041
M	x	x	x	x	< 72.0 55.0	> 44.0 56.0	< 86.0 64.0	> 65.5 75.0
					M12 × 70 R909085976	M12 × 90 R909154041	M12 × 80 R909153075	M12 × 100 R909153975

	140				160				200			
	V_{gmax} (cm³/rev)		$V_{g\,min}$ (cm³/rev)		V_{gmax} (cm³/rev)		V_{gmin} (cm³/U)		$V_{g\,max}$ (cm³/rev)		$V_{g\,min}$ (cm³/rev)	
	from	to	from	to	from	to	from	to	from	to	from	to
A	140.0	140.0	0.0	38.0	160.0	160.0	0.0	32.6	200.0	200.0	0.0	39.0
	Without screw		M12 × 80 R909153075		Without screw		M12 × 80 R909153075		Without screw		M12 × 80 R909153075	
B	140.0	140.0	> 38.0	63.5	160.0	160.0	> 32.6	59.2	200.0	200.0	> 39.0	72.0
	Without screw		M12 × 90 R909154041		Without screw		M12 × 90 R909154041		Without screw		M12 × 90 R909154041	
C	140.0	140.0	> 63.5	89.0	160.0	160.0	> 59.2	89.0	200.0	200.0	> 72.0	105.0
	Without screw		M12 × 100 R909153975		Without screw		M12 × 100 R909153975		Without screw		M12 × 100 R909153975	
D	140.0	140.0	> 89.0	98.0	160.0	160.0	> 89.0	112.0	200.0	200.0	> 105.0	140.0
	Without screw		M12 × 110 R909154212		Without screw		M12 × 110 R909154212		Without screw		M12 × 110 R909154212	
E	< 140.0	105.0	0.0	38.0	< 160.0	129.0	0.0	32.6	< 200.0	164.0	0.0	39.0
	M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075	
F	< 140.0	105.0	> 38.0	63.5	< 160.0	129.0	> 32.6	59.2	< 200.0	164.0	> 39.0	72.0
	M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041	
G	< 140.0	105.0	> 63.5	89.0	< 160.0	129.0	> 59.2	89.0	< 200.0	164.0	> 72.0	105.0
	M12 × 80 R909153075		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 100 R909153975	
H	< 140.0	105.0	> 89.0	98.0	< 160.0	129.0	> 89.0	112.0	< 200.0	164.0	> 105.0	140.0
	M12 × 80 R909153075		M12 × 110 R909154212		M12 × 80 R909153075		M12 × 110 R909154212		M12 × 80 R909153075		M12 × 110 R909154212	
J	< 105.0	80.0	0.0	38.0	< 129.0	100.0	0.0	32.6	< 164.0	130.5	0.0	39.0
	M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075	
K	< 105.0	80.0	> 38.0	63.5	< 129.0	100.0	> 32.6	59.2	< 164.0	130.5	> 39.0	72.0
	M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041	
L	< 105.0	80.0	> 63.5	89.0	< 129.0	100.0	> 59.2	89.0	< 164.0	130.5	> 72.0	105.0
	M12 × 90 R909154041		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 100 R909153975	
M	< 105.0	80.0	> 89.0	98.0	< 129.0	100.0	> 89.0	112.0	< 164.0	130.5	> 105.0	140.0
	M12 × 90 R909154041		M12 × 110 R909154212		M12 × 90 R909154041		M12 × 110 R909154212		M12 × 90 R909154041		M12 × 110 R909154212	

Setting range for displacement series 71

	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
					M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 110 R909154212	

	170				215				280			
	V_{gmax} (cm³/rev)		V_{gmin} (cm³/U)		$V_{g\,max}$ (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 110 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 × 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 × 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 e.g. 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 operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts).
Under all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

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

Key	
F	Filling/air bleeding
U	Bearing flushing / air bleed port
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)

Installation position

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

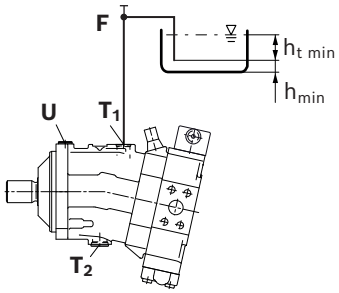
Notice
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Below-reservoir installation (standard)

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

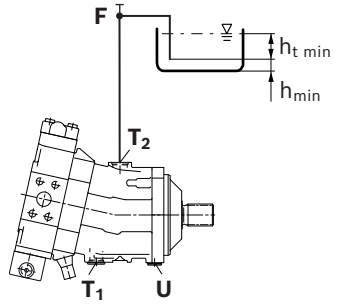
▼ **Installation position 1**

Air bleed	Filling
U	T_1 (**F**)



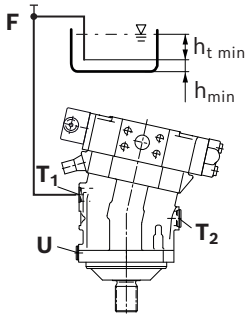
▼ **Installation position 2**

Air bleed	Filling
–	T_2 (**F**)



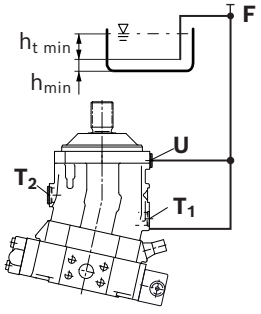
▼ **Installation position 3**

Air bleed	Filling
–	T_1 (**F**)



▼ **Installation position 4**

Air bleed	Filling
U	T_2 (**F**)

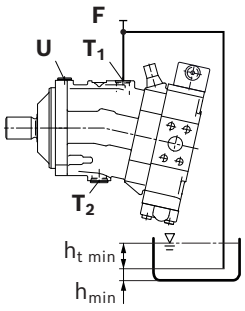


Above-reservoir installation

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.

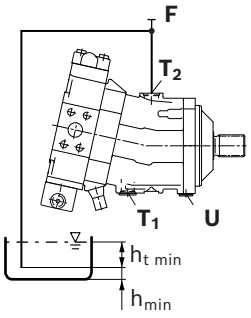
▼ **Installation position 5**

Air bleed	Filling
U, T_1 (**F**)	T_1 (**F**)



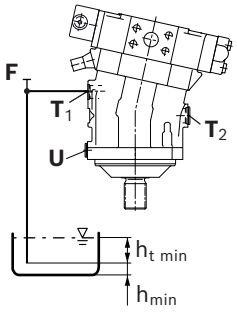
▼ **Installation position 6**

Air bleed	Filling
T_2 (**F**)	T_2 (**F**)



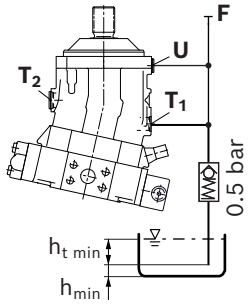
▼ **Installation position 7**

Air bleed	Filling
T_1 (**F**)	T_1 (**F**)



▼ **Installation position 8**

Air bleed	Filling
U, T_1 (**F**)	T_1 (**F**)



Project planning notes

- The motor A6VM is intended to be used in open and closed circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding operating instructions 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 information contained herein must be observed.
- For safety reasons, controls with beginning of control at $V_{g\,min}$ (e.g., HA) are not permissible for winch drives, e.g. anchor winches!
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the operating instructions.
- Not all configuration variants of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct current 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 current signal (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.
- Pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. Therefore, a pressure relief valve must be added to the hydraulic system (integrated into the pump or externally in the system). In this connection, observe the technical limits of the pressure relief valve.
- Please note that a hydraulic system is an oscillating system. This can lead e.g. to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times (series 65) or 9 times (series 71) the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the information regarding the tightening torques of connection threads and other screw connections in the operating instructions.
- The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service ports and function ports are only intended to accommodate hydraulic lines.
- Please note that the series connection of motors and the operation under summation pressure affect the efficiency of the units.
- The control behavior of the motor can change slightly due to natural influences, e.g. running-in or setting behavior over time. Calibration may be required.

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 permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst.
  The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.

Related documentation

Product-specific documentation

Document type	Title	Document number
Operating instructions	Variable motor A6VM series 63, 65 and 71	91610-01-B
Data sheet	Technical data for torsional vibration calculation	90261
	Storage and preservation of axial piston units	90312

Documentation for mounted components

Document type	Title	Document number
Data sheet	Counterbalance valve BVD series 41 (size 20, 25)	95522
	Counterbalance valve BVE series 53 (size 25)	95526
	Counterbalance valve BVD/BVE series 52 (size32)	95528
	BODAS speed sensor DSA series 20	95126
	BODAS speed sensor DST series 10	95131
	Neutral position switch NLS series 10	95152

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)	90222
	Fire-resistant hydraulic fluids – containing water (HFAE, HFAS, HFB, HFC, HFC-E)	90223
	Axial piston units for operation with fire-resistant hydraulic fluids (HFDR, HFDU, HFA, HFB, HFC, HFC-E)	90225
	Rating of hydraulic fluids used in Rexroth hydraulic components (pumps and engines)	90235
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245