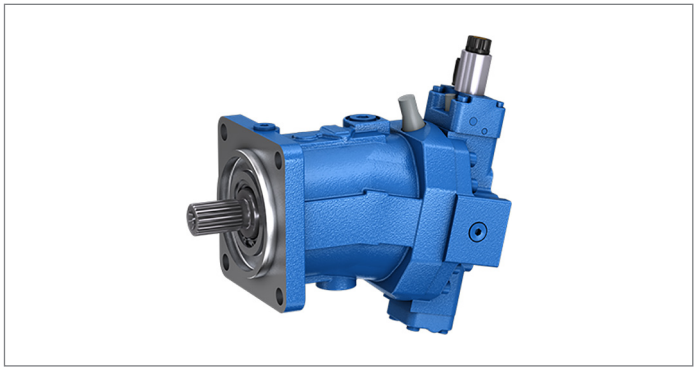
RE-A 91610/2022-02-03
Replaces: 12.2015

rexroth
A Bosch Company

Axial piston variable motor A6VM series 71

Americas



- All-purpose high pressure motor
- Sizes 60 to 215
- Nominal pressure 6500 psi (450 bar)
- Maximum pressure 7700 psi (530 bar)
- Open and closed circuits

Features

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

Contents

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

Type code

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

Axial piston unit

01	Bent-axis design, variable, nominal pressure 6500 psi (450 bar), maximum pressure 7700 psi (530 bar)	**A6V**

Operating mode

02	Motor	**M**

Size (NG)

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

Control device				060	085	115	150	170	215	
04	Proportional control, hydraulic	positive control	Δp_{St} = 145 psi (10 bar)	●	●	●	●	●	●	**HP1**
			Δp_{St} = 365 psi (25 bar)	●	●	●	●	●	●	**HP2**
		negative control	Δp_{St} = 145 psi (10 bar)	●	●	●	●	●	●	**HP5**
			Δp_{St} = 365 psi (25 bar)	●	●	●	●	●	●	**HP6**
	Proportional control, electric	positive control	U = 12 V	●	●	●	●	●	●	**EP1**
			U = 24 V	●	●	●	●	●	●	**EP2**
		negative control	U = 12 V	●	●	●	●	●	●	**EP5**
			U = 24 V	●	●	●	●	●	●	**EP6**
	Two-point control, hydraulic	negative control		–	–	–	●	●	●	**HZ5**
				●	●	●	–	–	–	**HZ7**
	Two-point control, electric	negative control	U = 12 V	–	–	–	●	●	●	**EZ5**
			U = 24 V	–	–	–	●	●	●	**EZ6**
			U = 12 V	●	●	●	–	–	–	**EZ7**
			U = 24 V	●	●	●	–	–	–	**EZ8**
	Automatic control high-pressure related, positive control	with minimum pressure increase	Δp ≤ approx. 145 psi (10 bar)	●	●	●	●	●	●	**HA1**
		with pressure increase	Δp ≤ approx. 1450 psi (10 bar)	●	●	●	●	●	●	**HA2**
	Automatic control speed-related, negative control p_{St} / p_{HD} = 5/100	hydr. travel direction valve		●	●	●	●	●	●	**DA0**
		electr. travel direction valve + electr. $V_{g\,max}$ override	U = 12 V	●	●	●	●	●	●	**DA1**
			U = 24 V	●	●	●	●	●	●	**DA2**

Pressure control/override				060	085	115	150	170	215	
05	Without pressure control/override			●	●	●	●	●	●	**00**
	Pressure control fixed setting, only for HP5, HP6, EP5 and EP6			●	●	●	●	●	●	**D1**
	Override of the HA1 and HA2 controls	Hydraulic remote control, proportional		●	●	●	●	●	●	**T3**
		electric, two-point	U = 12 V	●	●	●	●	●	●	**U1**
			U = 24 V	●	●	●	●	●	●	**U2**
		electric and travel direction valve, electric	U = 12 V	●	●	●	●	●	●	**R1**
			U = 24 V	●	●	●	●	●	●	**R2**

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

Connector for solenoids[1] (see page 63)

		060 to 215	
06	Without damping (without solenoid, only for hydraulic control)	●	**0**
	DEUTSCH - molded connector, 2-pin, without suppressor diode	●	**P**

Swivel angle detection (see page 64)

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

Additional function

		060 to 215	
08	Without additional function	●	**0**

Stroking time damping (for selection, see control)

			060 to 215	
09	Without damping (standard with HP and EP)		●	**0**
	Damping	HP, EP, HP5,6D. and EP5,6D., HZ, EZ, HA with counterbalance valves BVD/BVE	●	**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]

			060	085	115	150	170	215	
10	$V_{g\,max}$ setting screw	$V_{g\,min}$ setting screw							
	No setting screw	short (0-adjustable)	●	●	●	●	●	●	**A**
		moderate	●	●	●	●	●	●	**B**
		long	●	●	●	●	●	●	**C**
		extra long	–	–	●	●	●	●	**D**
	short	short (0-adjustable)	●	●	●	●	●	●	**E**
		moderate	●	●	●	●	●	●	**F**
		long	●	●	●	●	●	●	**G**
		extra long	–	–	●	●	●	●	**H**
	moderate	short (0-adjustable)	●	●	●	●	●	●	**J**
		moderate	●	●	●	●	●	●	**K**
		long	●	●	●	●	●	●	**L**
		extra long	–	–	●	●	●	●	**M**

Series

		060 to 215	
11	Series 7, Index 1	●	**71**

Version of ports and fastening threads

		060	085	115	150	170	215	
12	Ports with O-ring seal (ANSI) based on ISO 11926, metric fastening thread according to DIN 13	●	●	●	●	●	●	**C**

Direction of rotation

		060 to 215	
13	Viewed on drive shaft, bidirectional	●	**W**

Sealing material

		060 to 215	
14	FKM (fluoroelastomer)	●	**V**

Drive shaft bearing

		060 to 215	
15	Standard bearing	●	**0**

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1) Connectors for other electric components may deviate
2) The settings for the setting screws can be found in the table (page 76 and 77).

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

Mounting flange			**060**	**085**	**115**	**150**	**170**	**215**	
16	SAE J744	127-4	●	–	–	–	–	–	**C4**
		127-2	–	●	–	–	–	–	**C2**
		152-4	–	–	●	●	●	–	**D4**
		165-4	–	–	–	–	–	●	**E4**
	ISO 3019-20	200-4	–	–	–	–	–	●	**S4**

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

Working port			**060**	**085**	**115**	**150**	**170**	**215**	
18	SAE working ports **A** and **B** at rear		●	●	●	●	●	●	**1**
	SAE working ports **A** and **B** at side, opposite		●	●	●	●	●	●	**2**
	SAE working ports **A** and **B** at bottom, with integrated counterbalance valve[3]		–	–	–	●	●	–	**6**
	Port plate for mounting a counterbalance valve, with 1-stage pressure-relief valve (pilot operated)[4]	BVD 20	●	●	●	–	–	–	**7**
		BVD 25	–	–	●	●	●	–	**8**
		BVE 25	–	–	●	–	–	–	**8**
	Port plate for mounting a counterbalance valve, with 1-stage pressure-relief valve (direct operated)[4]	BVE 25	–	–	–	●	●	●	**5**
		BVD 25	–	–	–	–	–	●	**5**
		BVD/BVE 32	–	–	–	–	–	●	**9**

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

4) Possible only in combination with HP, EP and HA control

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

Valve (see page 66 to 4)			060	085	115	150	170	215	
19	Without valve		●	●	●	●	●	●	**0**
	Integrated brake release valve (only with port plate 6)		–	–	–	●	●	–	**Y**
	With BVD/BVE counterbalance valves mounted[5]		●	●	●	●	●	●	**W**
	With flushing and boost-pressure valve mounted, flushing on both sides Flushing flow when: $\Delta p = p_{ND} - p_G$ = 365 psi (25 bar) and ν = 10 cCt (p_{ND} = low pressure, p_G = case pressure)	**Flushing flow q_v [gpm (l/min)]**							
		0.93 (3.5)	●	●	●	–	–	–	**A**
		1.32 (5)	●	●	●	–	–	–	**B**
		2.11 (8)	●	●	●	●	●	●	**C**
		2.64 (10)	●	●	●	●	●	●	**D**
		3.70 (14)	●	●	●	–	–	–	**F**
		3.96 (15)	–	–	●[6]	●	●	●	**G**
		4.23 (16)	●	●	●[6]	–	–	–	**H**
		4.75 (18)	–	–	●[6]	●	●	●	**I**
		5.55 (21)	–	–	●[6]	●	●	●	**J**
		7.13 (27)	–	–	●[6]	●	●	●	**K**
		8.19 (31)	–	–	●[6]	●	●	●	**L**
		9.77 (37)	–	–	–	●	●	●	**M**

Speed sensor (see page 75)		060	085	115	150	170	215	
20	Without speed sensor	●	●	●	●	●	●	**0**
	Prepared for DSA/12 speed sensor	▲	▲	▲	▲	▲	▲	**U**
	With DSA/12 speed sensor mounted[7]	▲	▲	▲	▲	▲	▲	**V**
	Prepared for DSA/20 speed sensor	●	●	●	●	●	●	**W**
	With DSA/20 speed sensor mounted	○	○	○	○	○	○	**C**

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

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Notice

- Note the project planning notes on page 80.
- 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

5) State ordering code for counterbalance valve separately in accordance with data sheet 95522 (BVD), 95525 (BVE/53) or 95528 (BVE/52, BVD/52). Note the restrictions described on page 70.

6) Not for EZ7, EZ8 and HZ7.

7) Specify the type code of sensor in accordance with data sheet 95133 (DSA) and observe the requirements for the electronics.

Hydraulic fluids

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

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

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

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

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).

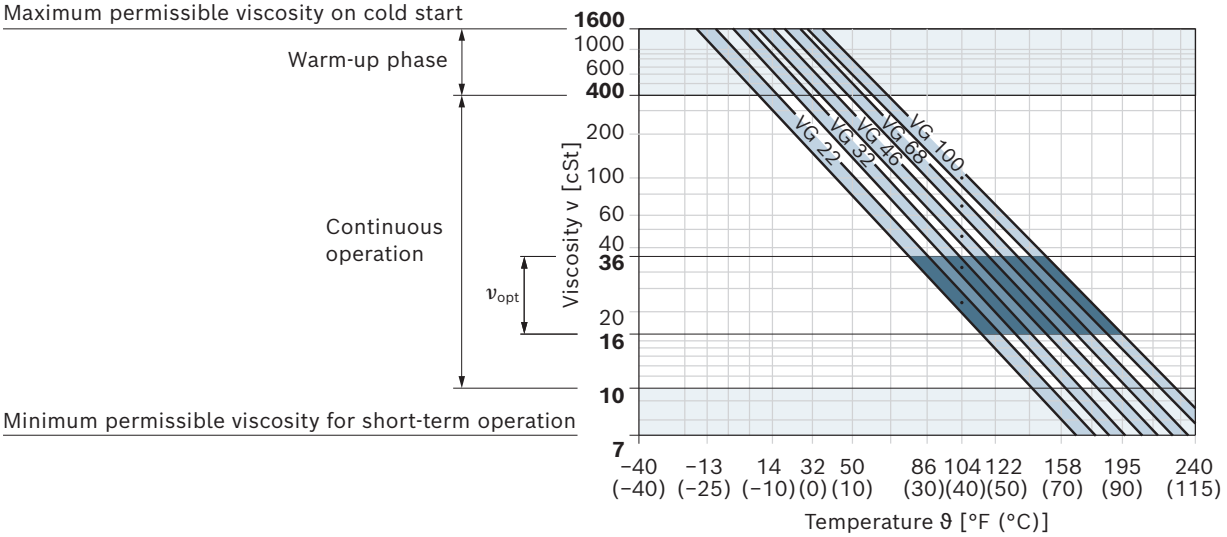
Notice
The axial piston unit is not suitable for operation with HFA hydraulic fluids. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed

Viscosity and temperature of hydraulic fluids

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

Notice: The maximum circuit temperature of 240 °F (+115 °C) must not be exceeded at the working ports **A** and **B** complying with the permissible viscosity.

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +39.2 °F ... +185 °F (+4 C ... +85 °C) (see selection diagram)
2) Special version, please contact us
3) If the temperature at extreme operating parameters cannot be adhered to, please contact us.

Filtration of the hydraulic fluid

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

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

For example, the viscosity is 10 cSt at corresponds to the following temperatures with the following media:

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

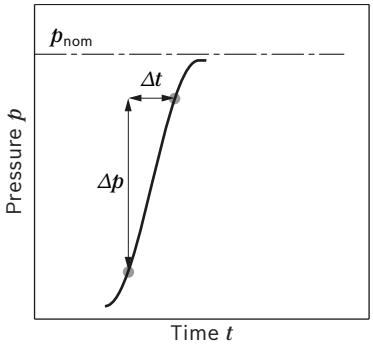
Flow direction

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

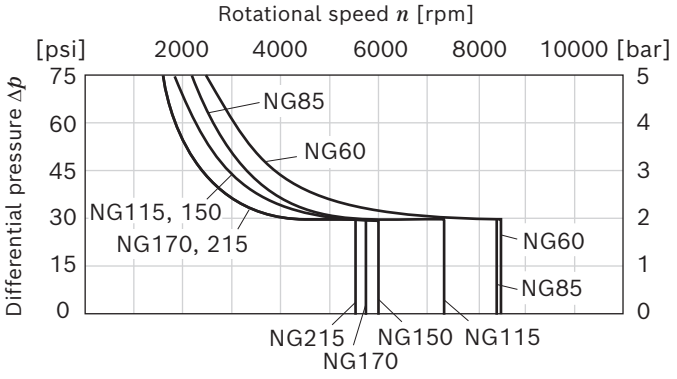
Working pressure range

Pressure at working ports A or B		Definition
Nominal pressure p_{nom}	6500 psi (450 bar)	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	7250 psi (500 bar)	The maximum pressure corresponds to the maximum working pressure during a single operating period. The sum of single operating periods must not exceed the total operating period. Within the total operating period of 300 h, a maximum pressure of 500 bar to 530 bar is permissible for a limited period of 50 h.
Maximum single operating period	10 s	
Total operating period	300 h	
Maximum pressure p_{max} (only valid for NG 60-215)	7700 psi (530 bar)	
Maximum single operating period	10 s	
Total operating period	50 h	
Minimum pressure (high-pressure side)	363 psi (25 bar)	Minimum pressure at the high-pressure side (**A** or **B**) which is required to prevent damage to the axial piston unit
Minimum pressure – pump operating mode (inlet)	see diagram (next page)	To prevent damage to the axial piston motor in pump operating mode (change of the high-pressure side at constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{Su}	10150 psi (700 bar)	The summation pressure is the sum of the pressures at the ports for the Working lines (**A** and **B**).
Rate of pressure change $R_{A\ max}$		Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
with integrated pressure relief valve	130530 psi/s (9000 bar/s)	
without pressure relief valve	232060 psi/s (16000 bar/s)	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T\ cont}$	30 psi (2 bar)	Maximum averaged differential pressure at the shaft seal (case to ambient pressure)
Maximum differential pressure $\Delta p_{T\ max}$	see diagram (next page)	
Pressure peaks $p_{T\ peak}$	145 psi (10 bar)	t < 0.1 s

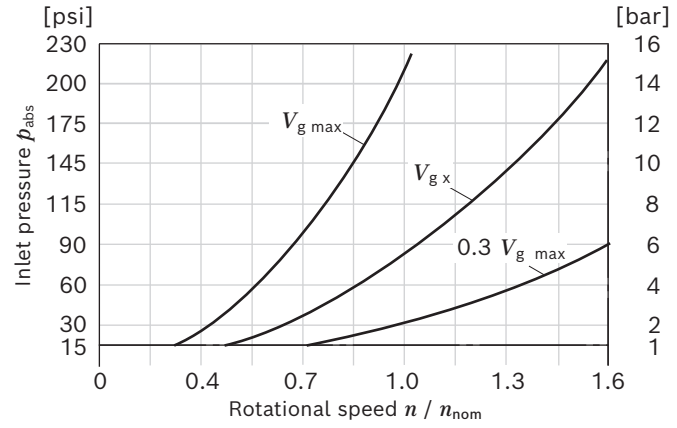
▼ **Rate of pressure change $R_{A\,max}$**



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

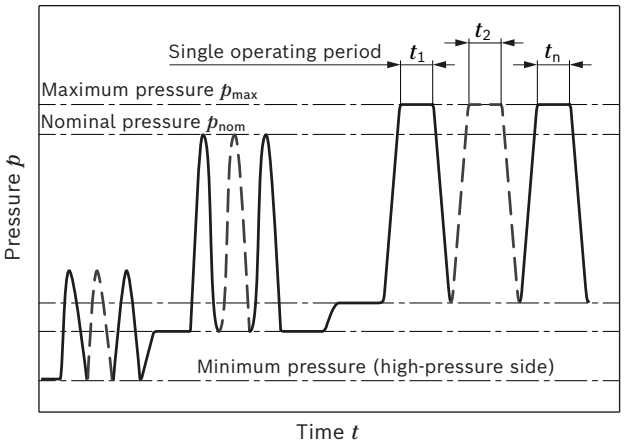


▼ **Minimum pressure – pump operating mode (inlet)**



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

▼ **Pressure definition**



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

Notice

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

Effect of case pressure on beginning of control

An increase in case pressure affects the beginning of control of the variable motor when using the following control options:
HP, HA.T3: increase
DA: decrease
With the following settings, an increase in case pressure will have no effect on the beginning of control:
HA.R and HA.U, EP, HA
The factory setting of the beginning of control is made at p_{abs} = 30 psi (2 bar) case pressure.

Technical data

Size		NG		60	85	115	150	170	215
Displacement, geometric, per revolution		$V_{g\,max}$	in³	1.71	5.18	7.05	9.28	10.48	13.21
			(cm³)	(62)	(85.2)	(115.6)	(152.1)	(171.8)	(216.5)
		$V_{g\,min}$	in³ (cm³)	0	0	0	0	0	0
		$V_{g\,x}$	in³ (cm³)	2.26 (37)	3.11 (51)	4.21 (69)	5.55 (91)	3.96 (65)	7.93 (130)
Maximum rotational speed[1]	at $V_{g\,max}$	n_{nom}	rpm	4450	3900	3550	3250	3100	2900
	at $V_g < V_{g\,x}$ (see diagram)	n_{max}	rpm	7200	6800	6150	5600	4900	4800
	at $V_{g\,0}$	n_{max}	rpm	8400	8350	7350	6000	5750	5500
Inlet flow[2]	at n_{nom} and $V_{g\,max}$	q_v	gpm	72.65	87.71	108.31	131	140.80	165.9
			(l/min)	(275)	(332)	(410)	(494)	(533)	(628)
Torque[3]	at $V_{g\,max}$ and at Δp = 6500 psi (450 bar)	M	lb-ft	328	450	611	800	907	1143
			(Nm)	(444)	(610)	(828)	(1089)	(1230)	(1550)
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	klb-ft/rad	11.06	16.22	27.29	32084	38.35	51.63
			(kNm/rad)	(15)	(22)	(37)	(43500)	(52)	(70)
	$V_g/2$ to 0 (interpolated)	c_{min}	klb-ft/rad	33.19	50.15	76.71	91.46	115.06	144.56
			(kNm/rad)	(45)	(68)	(104)	(124)	(156)	(196)
Moment of inertia for rotary group		J_{TW}	lbs-ft²	0.102	0.171	0.261	0.4295	0.505	0.719
			(kgm²)	(0.0043)	(0.0072)	(0.0110)	(0.0181)	(0.0213)	(0.0303)
Case volume		V	gal (l)	0.21 (0.8)	0.26 (1.0)	0.39 (1.5)	0.45 (1.7)	0.08 (2.3)	0.08 (3.0)
Weight approx.	Without BVI	m	lbs (kg)	61.7 (28)	79.4 (36)	101.4 (46)	134 (61)	136.7 (62)	171.9 (78)
	With BVI	m	lbs (kg)	–	–	–	151.6 (68)	154.3 (70)	–

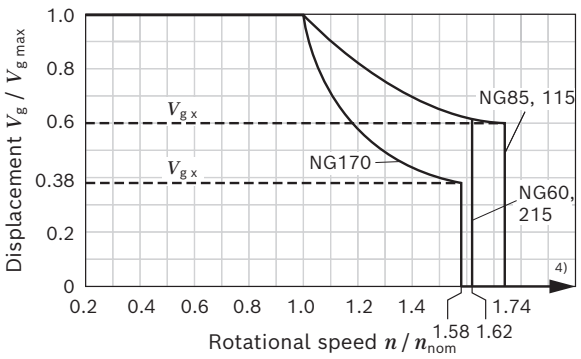
Speed range

The minimum rotational speed n_{min} is not limited. If uniformity of motion is required, speed nmin must not be less than 50 rpm.

Notices

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

▼ **Permissible displacement depending on the rotational speed**



Determining the operating characteristics

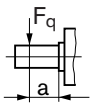
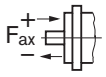
Inlet flow q_v	$= \frac{V_g \times n}{231 \times \eta_v}$ [gpm]	$\left(\frac{V_g \times n}{1000 \times \eta_v}\right)$ [l/min]
Rotational speed n	$= \frac{q_v \times 231 \times \eta_v}{V_g}$ [rpm]	$\left(\frac{q_v \times 1000 \times \eta_v}{V_g}\right)$ [rpm]
Torque M	$= \frac{V_g \times \Delta p \times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

Key

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

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

Permissible radial and axial loading on the drive shafts

Size	NG		60	85	115	150	150	170	215
Drive shaft		in	1 1/4 in	1 1/2	1 3/4	1 3/4	2	2	2
Maximum radial force at distance a (from shaft collar) 	$F_{q\,max}$	lb	1713	2802	3350	3585	3917	4355	5081
		N	7620	12463	14902	15948	17424	19370	22602
	a	in	0.94	1.06	1.32	1.32	1.32	1.32	1.32
		mm	24.0	27.0	33.5	33.5	33.5	33.5	33.5
Maximum torque at $F_{q\,max}$	$T_{q\,max}$	lb-ft	229	439	611	656	803	679	939
		Nm	310	595	828	890	1089	1230	1445
Maximum differential pressure at V_{gmax} and $F_{q\,max}$	$\Delta p_{q\,max}$	psi	4550	6400	6500	5350	6500	6500	6100
		bar	315	440	450	370	450	450	420
Maximum axial force at standstill or depressurized operation 	$+F_{ax\,max}$	lb	0	0	0	0	0	0	0
		N	0	0	0	0	0	0	0
	$-F_{ax\,max}$	lb	112	160	202	232	232	252	281
		N	500	710	900	1030	1030	1120	1250
Permissible axial force per psi (bar) working pressure	$+F_{ax\,perm}$/bar	lb/psi	0.12	0.15	0.18	0.21	0.21	0.23	0.26
		N/bar	7.5	9.6	11.3	13.3	13.3	15.1	17.0

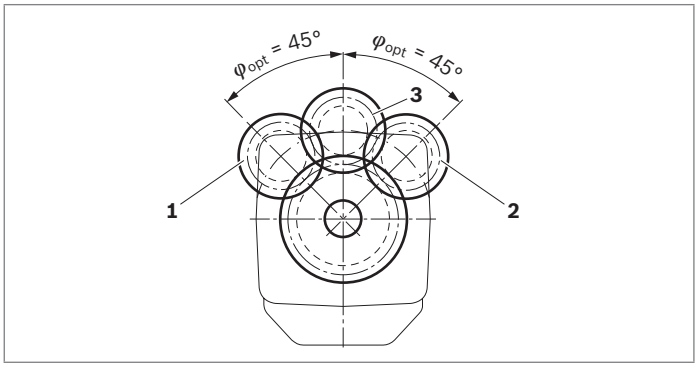
Effect of radial force F_q on bearing service life

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

Notices

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

▼ **Gear output drive**



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

1) Please contact us.

HP – Proportional hydraulic control

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

HP1, HP2 positive control

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

HP5, HP6 negative control

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

Notice

- Maximum permissible pilot pressure: p_{St} = 1450 psi (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 435 psi (30 bar) is necessary in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (30 bar) must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please keep in mind that pressures up to 7700 psi (530 bar) can occur at port **G**.
- Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 145 psi (10 bar).
- The beginning of control and the HP characteristic curve are influenced by the case pressure. An increase in the case pressure causes an increase in the beginning of control (see page 8) and thus a parallel displacement of the characteristic curve.
- A leakage flow of maximum 0.079 gmp (0.3 l/min) can occur at port **X** due to internal leakage (working pressure > pilot pressure). The control is to be suitably configured to avoid an independent build-up of pilot pressure.

Stroking time damping

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

Standard

HP without damping.
HP.D with throttle pin on both sides, symmetrical (see table)

Optional

HP with throttle pin on both sides, symmetrical (see table)

▼ **Throttle pin overview**

Size		60	85	115	150	170	215
Groove size	[inch]	0.018	0.018	0.022	0.022	0.022	0.026
	([mm])	(0.45)	(0.45)	(0.55)	(0.55)	(0.55)	(0.65)

HP1, HP5 pilot pressure increase Δp_{St} = 145 psi (10 bar)

HP1 positive control

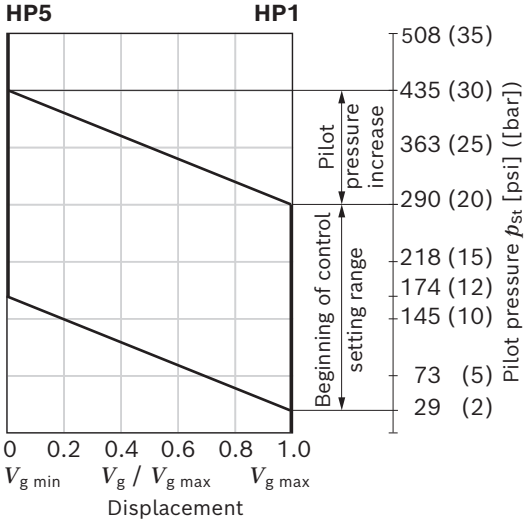
A pilot pressure increase of 145 psi (10 bar). at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP5 negative control

A pilot pressure increase of 145 psi (10 bar).r at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

- Beginning of control, setting range 30 to 290 psi (2 to 20 bar)
- Standard setting:
  Beginning of control at 45 psi (3 bar) (end of control at 190 psi (13 bar)).

▼ **Characteristic curve**



HP2, HP6 pilot pressure increase Δp_{St} = 25 bar

HP2 positive control

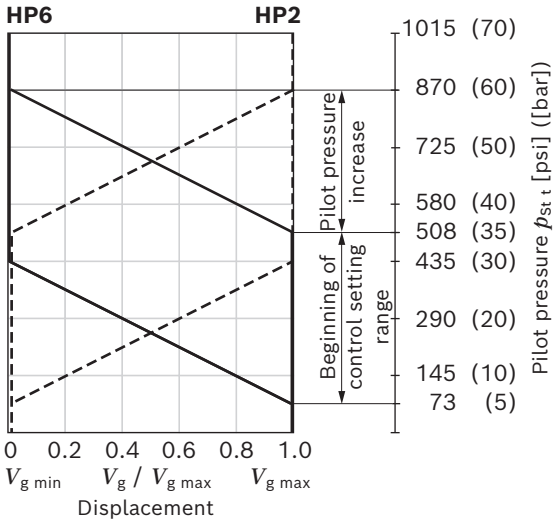
A pilot pressure increase of 363 psi (25 bar) at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP6 negative control

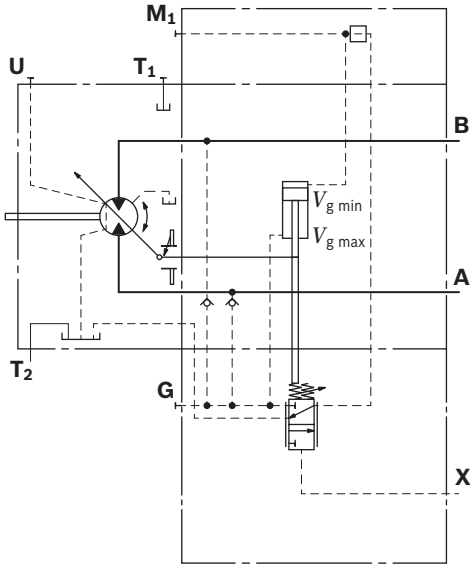
A pilot pressure increase of 363 psi (25 bar) at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

- Beginning of control, setting range 73 to 508 psi (5 to 35 bar)
- Standard setting:
  Beginning of control at 145 psi (10 bar) (end of control at 508 psi (35 bar))

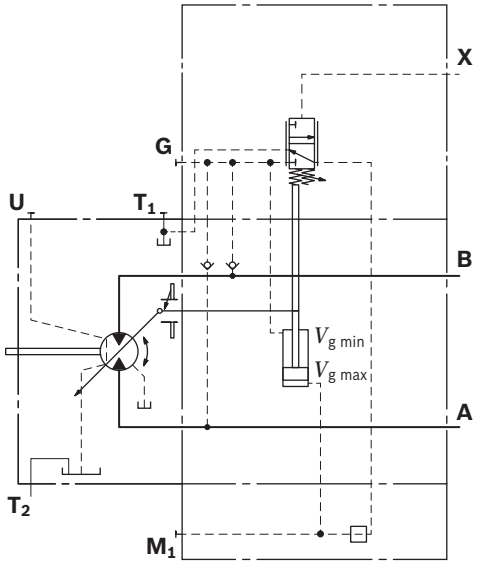
▼ **Characteristic curve**



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



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



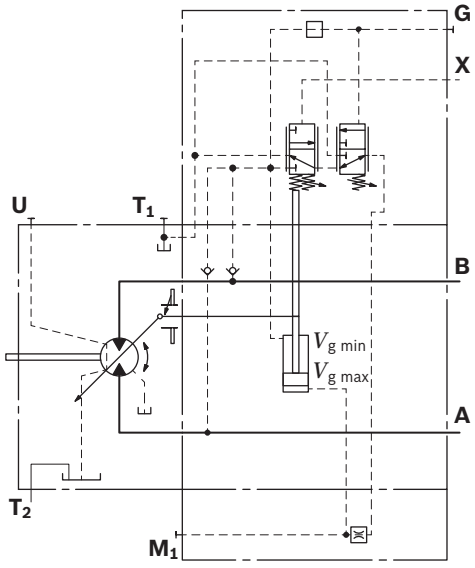
HP5D1, HP6D1 Pressure control, fixed setting

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

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

Setting range of the pressure control valve 1160 to 6527 psi (80 to 450 bar)

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



EP – Proportional control, electric

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

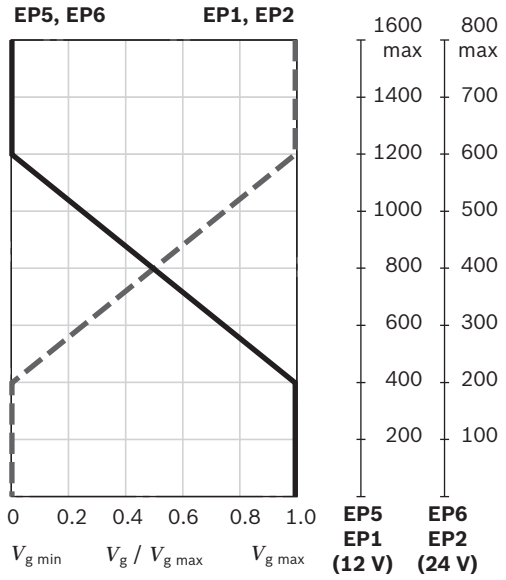
EP1, EP2 positive control

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

EP5, EP6 negative control

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

▼ **Characteristic curve**



Notice

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is necessary in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (30 bar) must be applied at port **G** using an external check valve. For lower pressures, please contact us.
- Please keep in mind that pressures up to 7700 psi (530 bar) can occur at port **G**.

Stroking time damping

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

Standard

EP without damping.

EP.D with throttle pin on both sides, symmetrical (see table)

Optional

EP with throttle pin on both sides, symmetrical (see table)

▼ **Throttle pin overview**

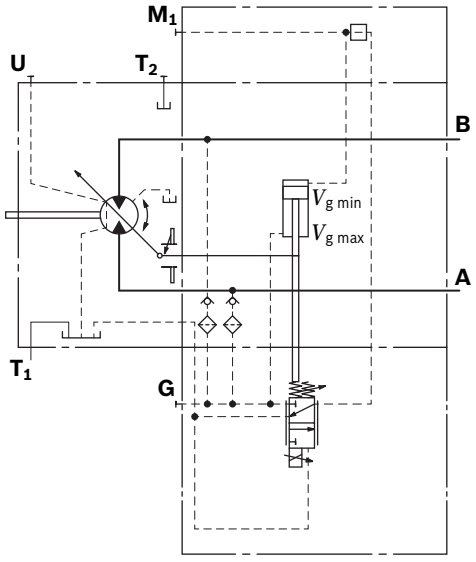
Size		60	85	115	150	170	215
Groove size	[inch]	0.018	0.018	0.022	0.022	0.022	0.026
	([mm])	(0.45)	(0.45)	(0.55)	(0.55)	(0.55)	(0.65)

Technical data, solenoid	EP1, EP5	EP2, EP6
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Beginning of control	400 mA	200 mA
End of control	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither		
Frequency	100 Hz	100 Hz
minimum oscillation range[1)]	240 mA	120 mA
Duty cycle	100%	100%
Type of protection: see connector version page 68		

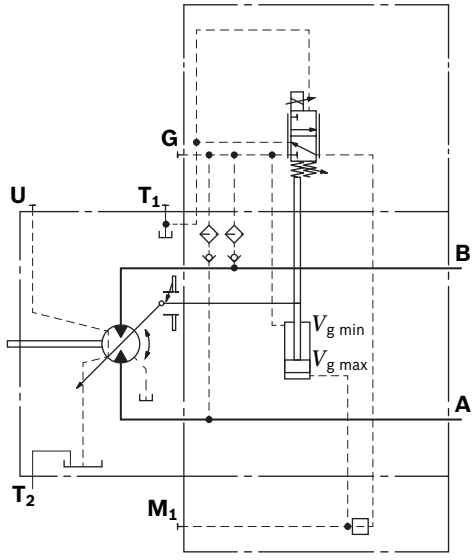
Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.

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

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



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



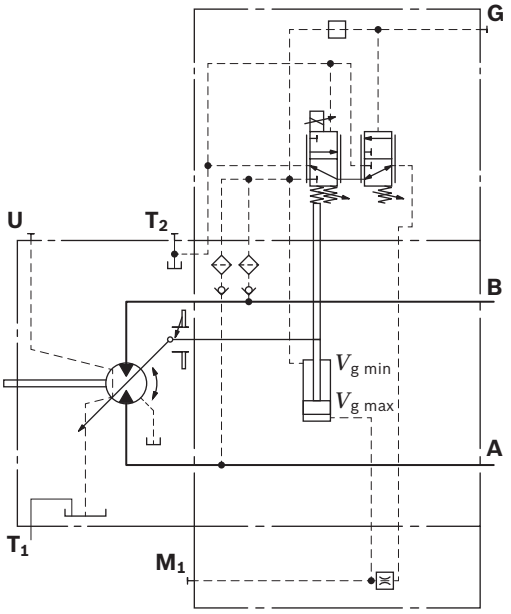
EP5D1, EP6D1 Pressure control, fixed setting

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

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

Setting range of the pressure control valve 1160 to 6527 psi (80 to 450 bar)

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



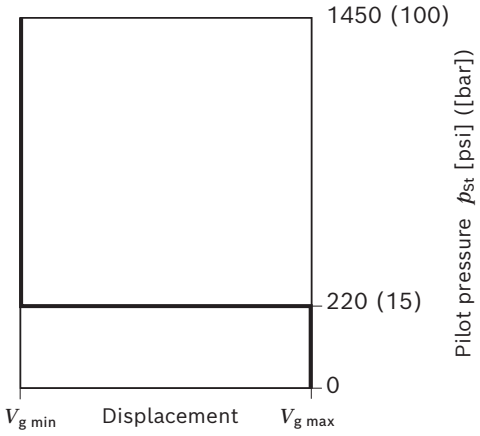
HZ – Two-point control, hydraulic

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

HZ5, HZ7 negative control

- Position at $V_{g\,max}$ (without pilot pressure, maximum torque, minimum rotational speed)
- Position at V_g min (with pilot pressure > 220 psi (15 bar) activated, minimum torque, maximum permissible rotational speed)

▼ **Characteristic curve HZ5, HZ7**



Notice

- Maximum permissible pilot pressure: p_{St} = 1450 psi (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 435 psi (30 bar) is necessary in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (30 bar) must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please keep in mind that pressures up to 7700 psi (530 bar) can occur at port **G**.
- A leakage flow of maximum 0.079 gmp (0.3 l/min) occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir.

Stroking time damping

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

Standard for sizes 150 to 215

HZ5 with throttle pin on both sides, symmetrical (see table)

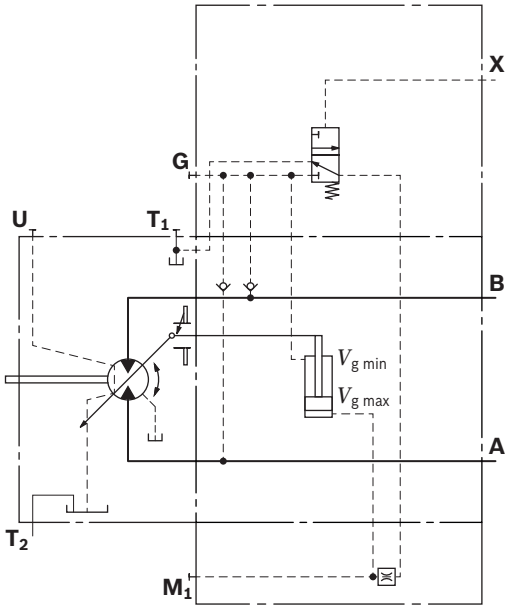
Standard for sizes 60 to 115

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

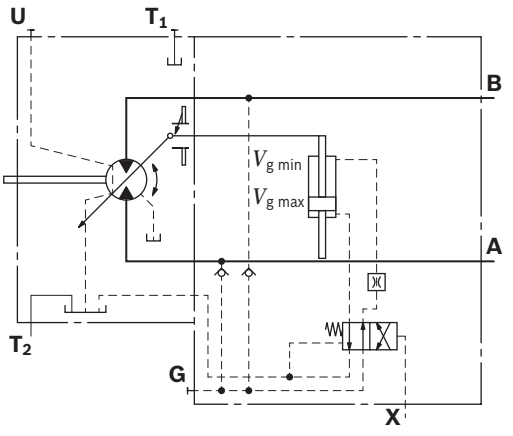
▼ **Throttle pin overview**

Size		60	85	115	150	170	215
Groove size	[inch]	0.012	0.012	0.012	0.022	0.022	0.026
	([mm])	(0.30)	(0.30)	(0.30)	(0.55)	(0.55)	(0.65)

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



▼ **Circuit diagram HZ7 (negative control)**



EZ – Two-point control, electric

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

Notice

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is necessary in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (30 bar) must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please keep in mind that pressures up to 7700 psi (530 bar) can occur at port **G**.

Stroking time damping

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

Standard for sizes 150 to 215

EZ5, EZ6 with throttle pin on both sides, symmetrical (see table)

Standard for sizes 60 to 115

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

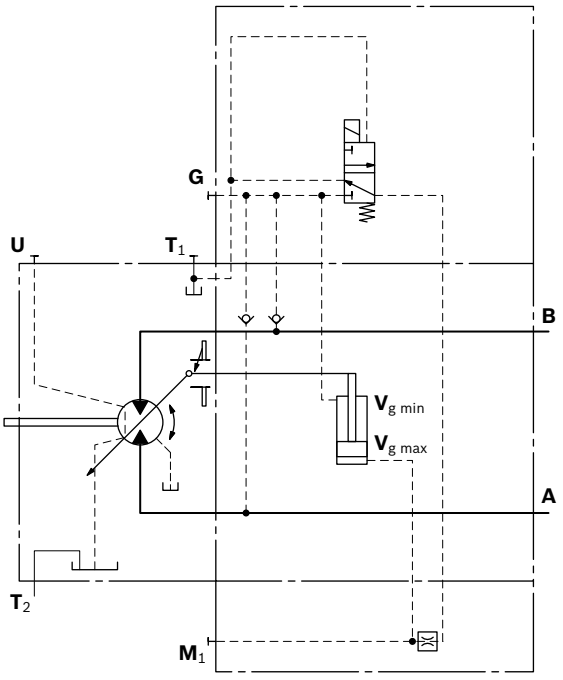
▼ **Throttle pin overview**

Size		60	85	115	150	170	215
Groove size	[inch]	0.012	0.012	0.012	0.022	0.022	0.026
	([mm])	(0.30)	(0.30)	(0.30)	(0.55)	(0.55)	(0.65)

Sizes 150 to 215

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 63		

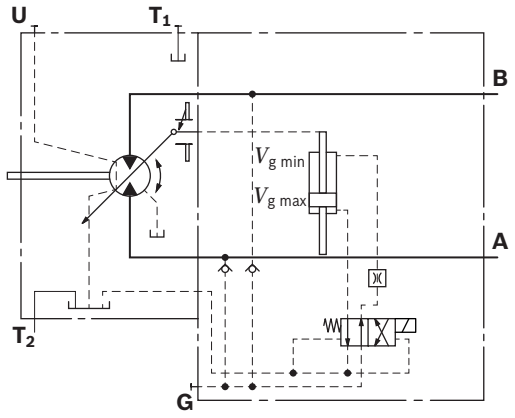
▼ **Circuit diagram EZ5, EZ6 (negative control)**



Sizes 60 to 115

Technical data, solenoid with ø45	EZ7	EZ8
Voltage	12 V (±20%)	24 V (±20%)
Position $V_{g\,max}$	de-energized	de-energized
Position $V_{g\,min}$	energized	energized
Nominal resistance (at 20 °C)	4.8 Ω	19.2 Ω
Nominal power	30 W	30 W
Minimum active current required	1.5 A	0.75 A
Duty cycle	100%	100%
Type of protection: see connector version page 63		

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



HA – Automatic high-pressure related control

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

HA1, HA2 positive control

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

Notice

- For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g\,min}$ (standard for HA).
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is necessary in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (30 bar) must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please keep in mind that pressures up to 7700 psi (530 bar) can occur at port **G**.
- The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in the case pressure causes an increase in the beginning of control (see page 8) and thus a parallel displacement of the characteristic curve.
- A leakage flow of maximum 0.079 gmp (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

HA1,2 with one-sided throttle pin, throttling occurs from $V_{g\,min}$ to $V_{g\,max}$ (see table). HA3 and HA3T3 with BVI and throttle pin on both sides, 0.012 in (0.30 mm), symmetrical

▼ **Throttle pin overview**

Size		60	85	115	150	170	215
Groove size	[inch]	0.017	0.017	0.022	0.022	0.022	0.026
	([mm])	(0.45)	(0.45)	(0.55)	(0.55)	(0.55)	(0.65)

Standard

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

▼ **Throttle screw**

Size		60	85	115	150	170	215
Diameter	[inch]	0.031	0.031	0.031	0.031	0.031	0.031
	([mm])	(0.80)	(0.80)	(0.80)	(0.80)	(0.80)	(0.80)

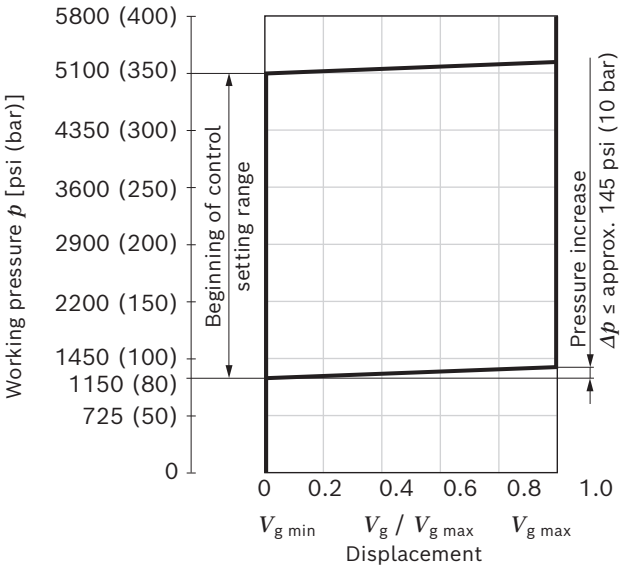
HA1 with minimum pressure increase, positive control

A working pressure increase of Δp ≤ approx. 145 psi (10 bar) results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

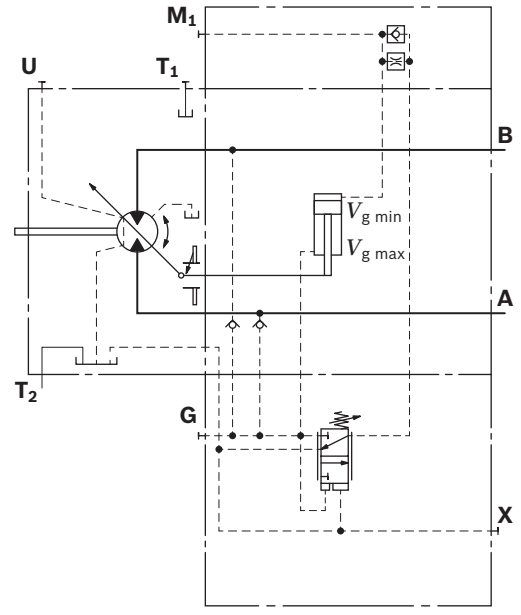
Beginning of control, setting range 1150 to 5100 psi (80 to 350 bar) bar

Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 4350 psi (300 bar).

▼ **Characteristic curve HA1**



▼ **Circuit diagram HA1**

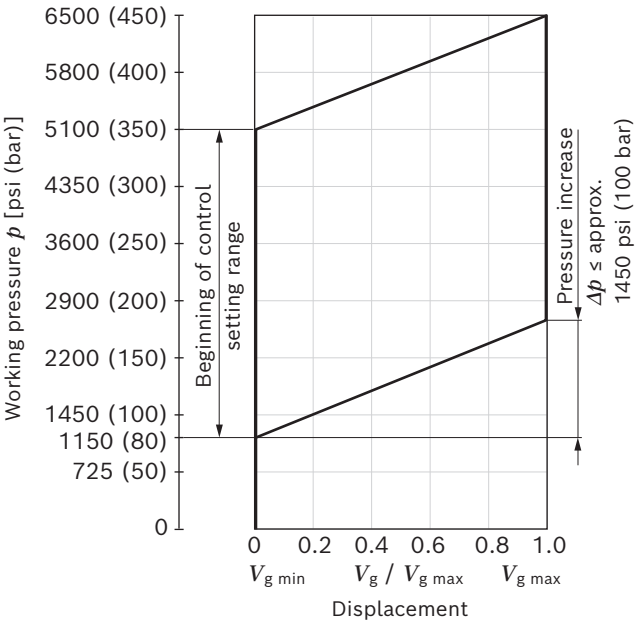


HA2 with pressure increase, positive control

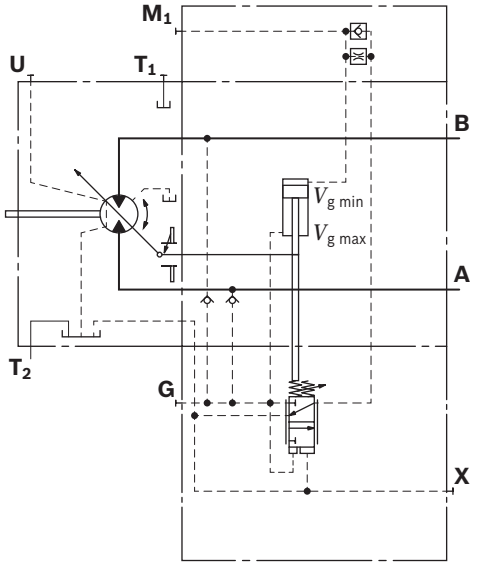
A working pressure increase of Δp aapprox. 1450 psi (100 bar) results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

Beginning of control, setting range 1150 to 5100 psi (80 to 350 bar) Please state the desired beginning of control in plain text when ordering, e.g.: beginning of control at 2900 psi (200 bar).

▼ **Characteristic curve HA2**



▼ **Circuit diagram HA2**



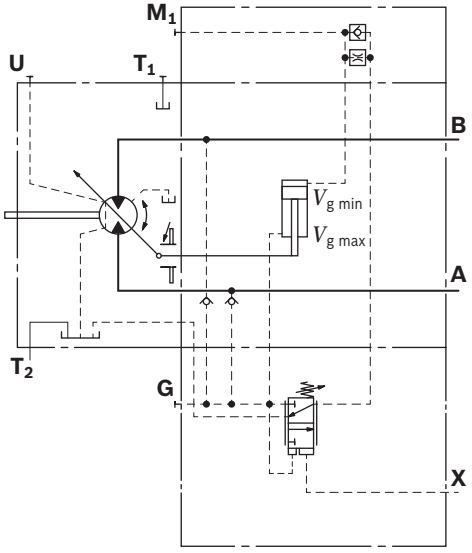
HA.T3 override, hydraulic, remote controlled, proportional

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 250 psi (17 bar) per 15 psi (1 bar) pilot pressure.

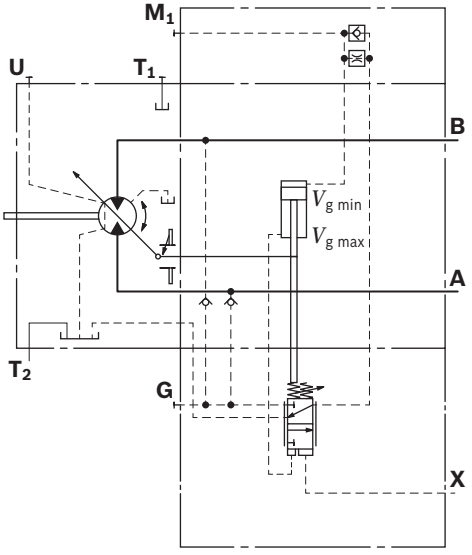
Settings for the beginning of control	4350 psi (300 bar)	4350 psi (300 bar)
Pilot pressure at port **X**	0 psi	145 psi
	(0 bar)	(10 bar)
Beginning of control at	4350 psi	1900 psi
	(300 bar)	(130 bar)

Notice
Maximum permissible pilot pressure 1450 psi (100 bar).

▼ **Circuit diagram HA1T3**



▼ **Circuit diagram HA2T3**

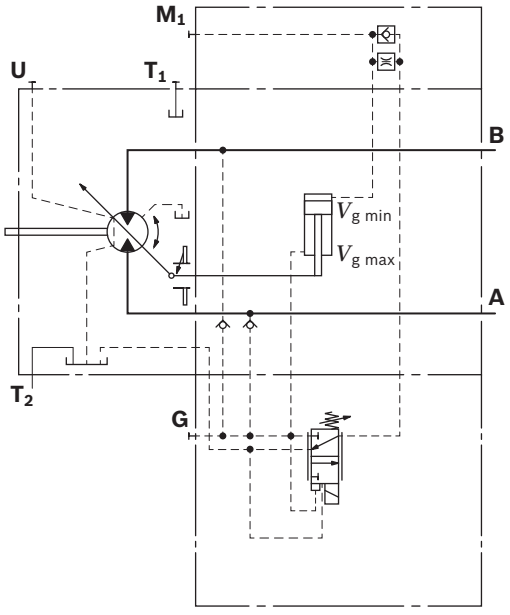


▼ HA.U1, HA.U2 electric override, two-point

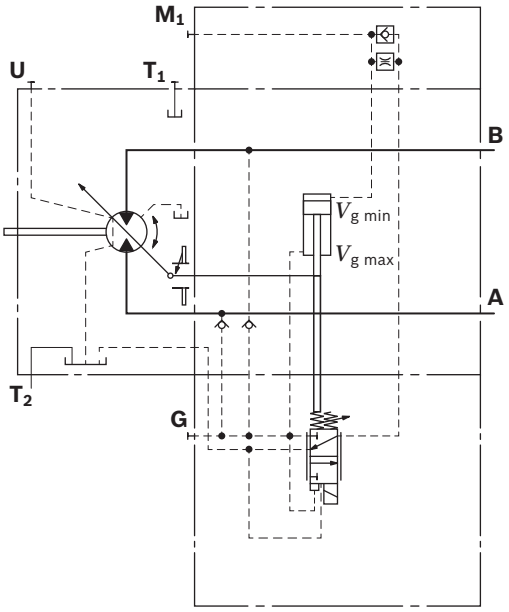
With the HA.U1 or HA.U2 control, the beginning of control can be overridden by an electric signal to a switching solenoid. When the override solenoid is energized, the variable motor swivels to maximum swivel angle, without intermediate position.
The beginning of control can be set between 1150 and 4350 psi (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 68 °F (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 63		

▼ 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 25).

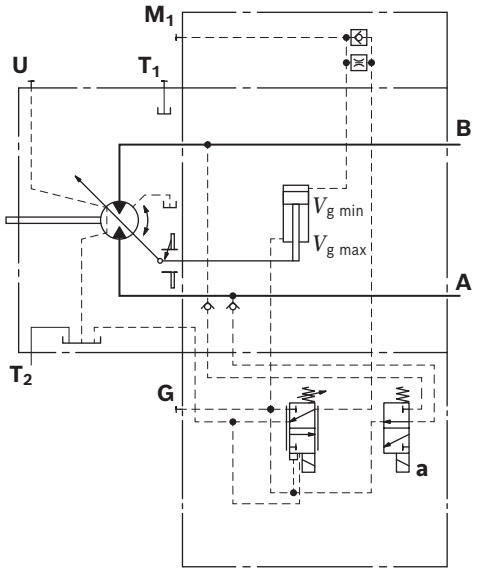
Electric override

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 68 °F (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 63		

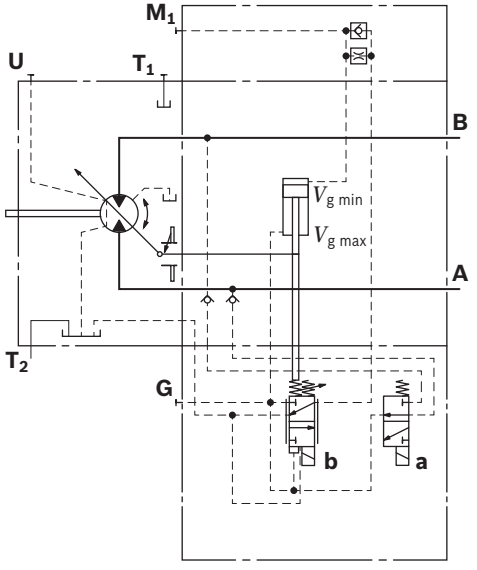
Travel direction valve, electric

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 68 °F (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 63			

▼ **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

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

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

Stroking time damping
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
Standard
DA with throttle pin on one side, throttling occurs from $V_{g\,min}$ to $V_{g\,max}$. (see table)

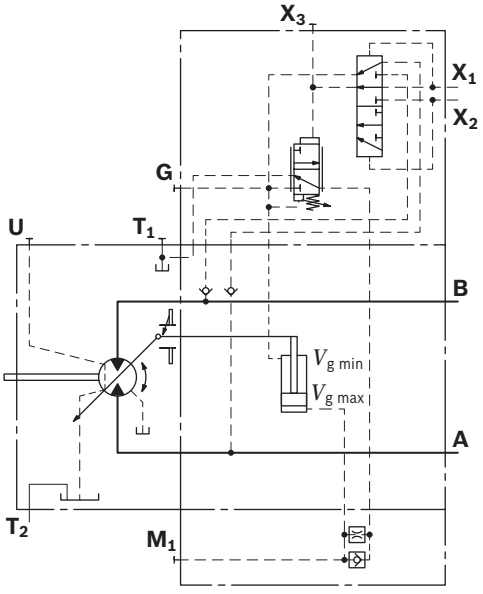
▼ **Throttle pin overview**

Size		60	85	115	150	170	215
Groove size	[inch]	0.018	0.018	0.022	0.022	0.022	0.026
	([mm])	(0.45)	(0.45)	(0.55)	(0.55)	(0.55)	(0.65)

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

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

▼ **Circuit diagram DA0**



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

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

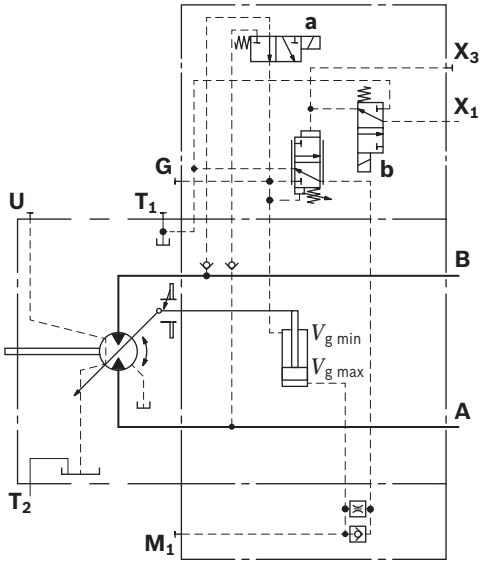
Travel direction valve, electric

Technical data, solenoid a with Ø37		DA1	DA2
Voltage		12 V (±20%)	24 V (±20%)
Direction of rotation	Working pressure in		
Counterclockwise	**B**	de-energized	de-energized
Clockwise	**A**	energized	energized
Nominal resistance	(at 68 °F (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 63			

Electric override

Technical data, solenoid b with Ø37	R1	R2
Voltage	12 V (±20%)	24 V (±20%)
No override	de-energized	de-energized
Position $V_{g\,max}$	energized	energized
Nominal resistance (at 68 °F (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 63		

▼ **Circuit diagram DA1, DA2**



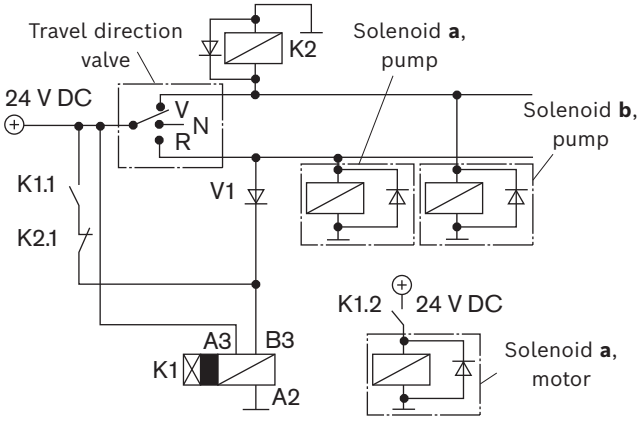
Electric travel direction valve (for DA, HA.R)

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

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

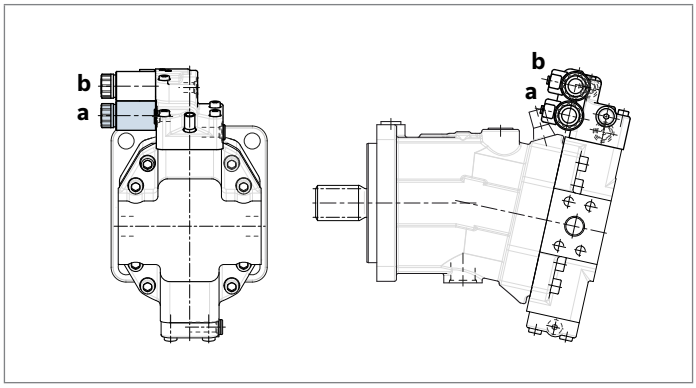
As a result, jerky deceleration or braking is prevented in both cases.

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

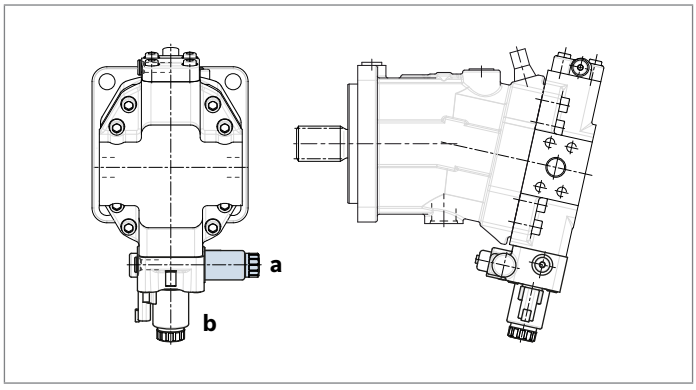


Notice
The shown diodes and relays are not included in the scope of delivery of the motor.

▼ **Control DA1, DA**



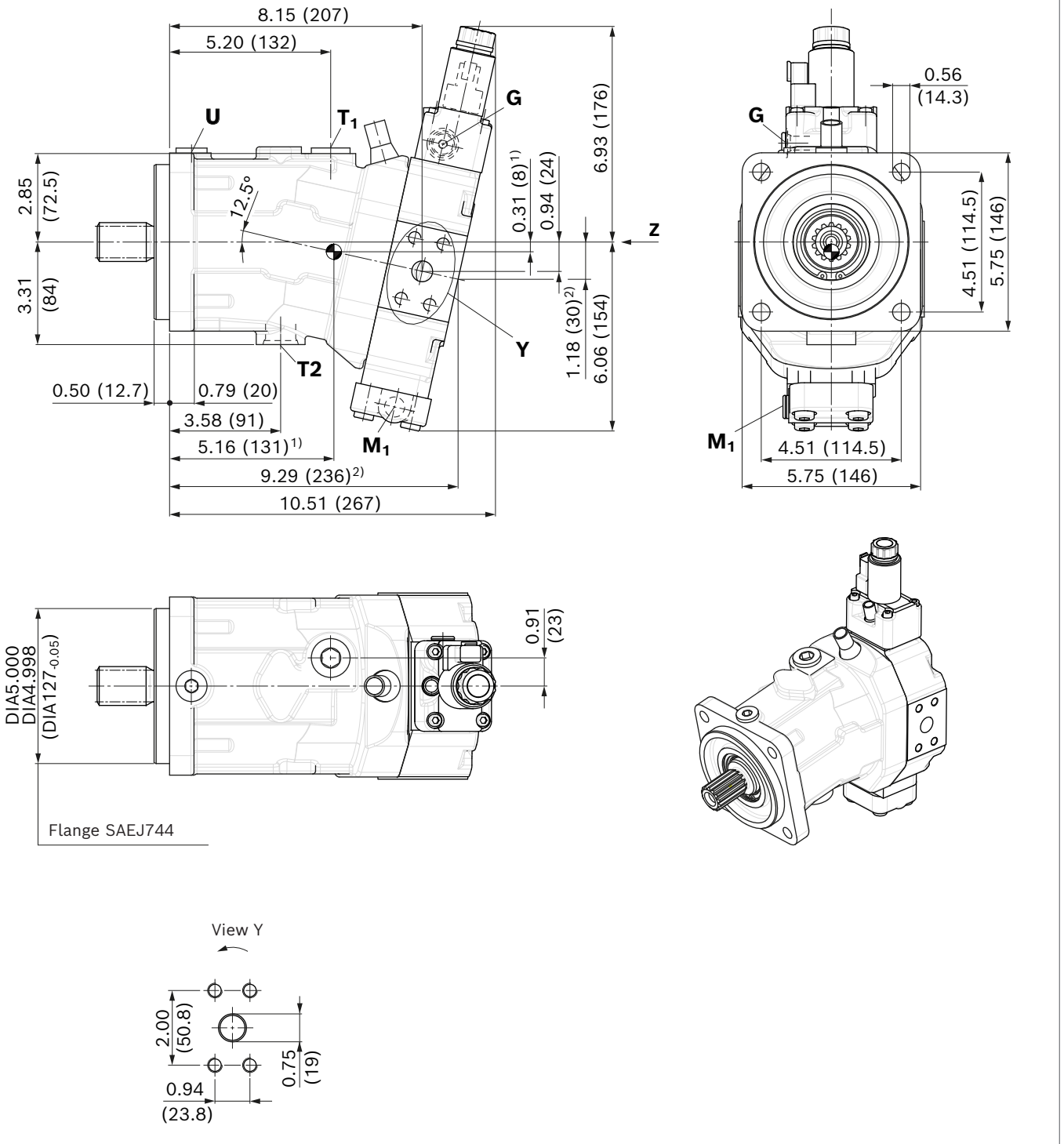
▼ **Control, HA1R., HA2R.**



Dimensions, size 60

EP5, EP6 – Proportional electric control, negative control

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

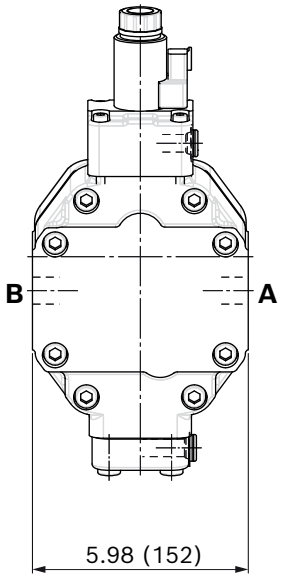


Center of gravity

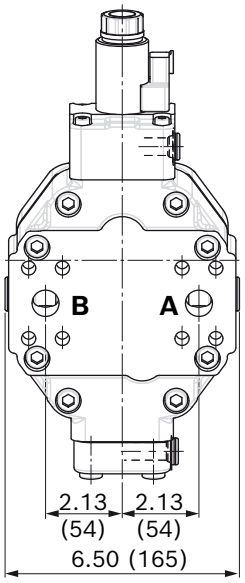
1) Port plate 1 – SAE working ports **A** and **B** at rear

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

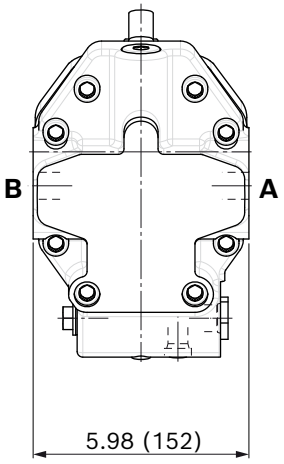
2 SAE working ports **A** and **B** at side, opposite



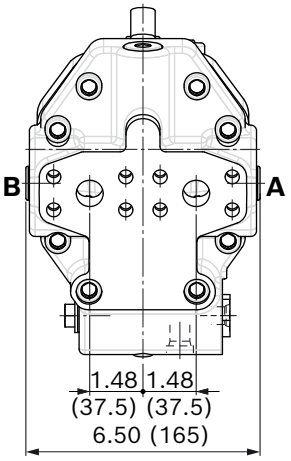
1 SAE working ports **A** and **B** at rear



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

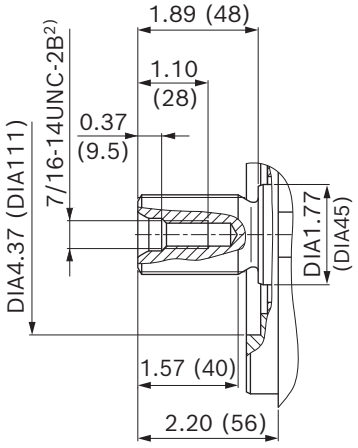


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



▼ **SAE J744 splined shaft**

S7 – 1 1/4 in 14T 12/24DP[1)]

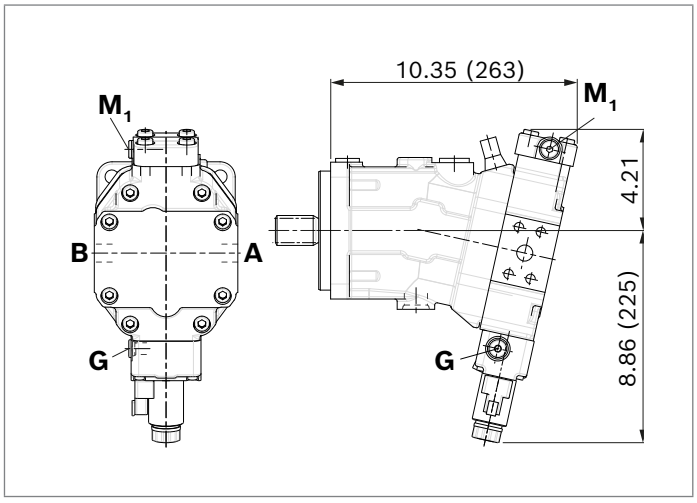


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

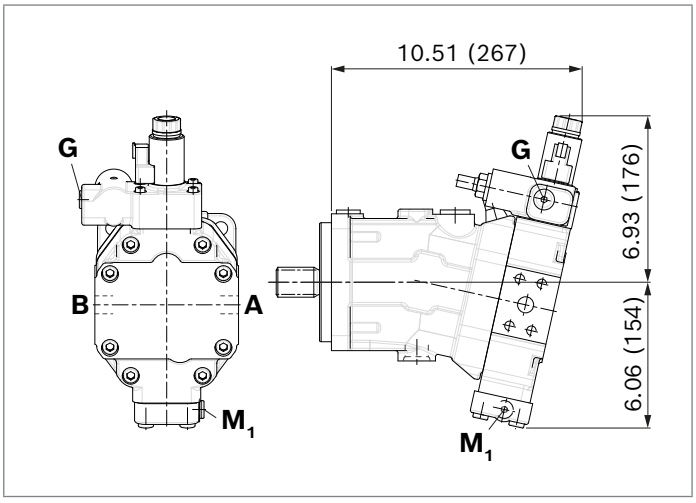
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	3/4 in M10 × 1.5; 0.67 (17) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

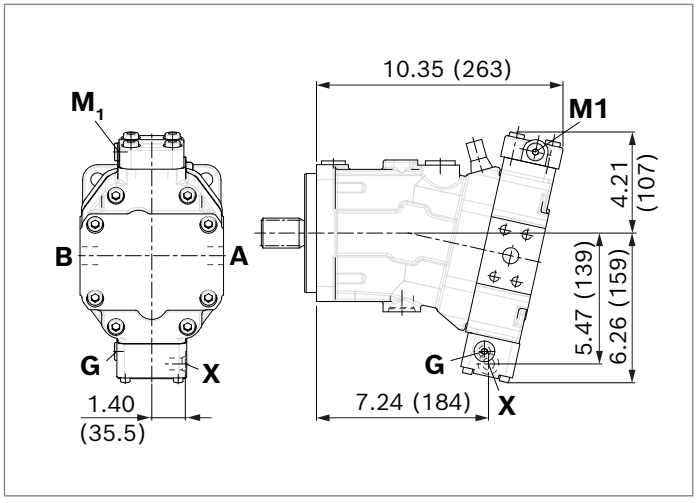
▼ **EP1, EP2** – Proportional electric control, positive control



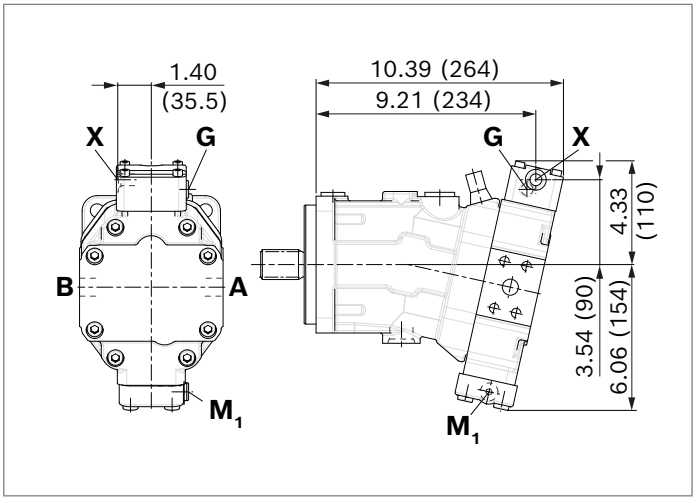
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



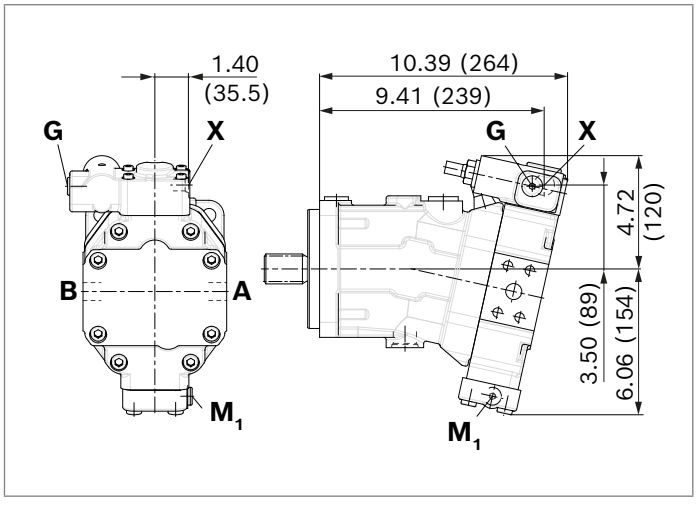
▼ **HP1, HP2** – Proportional hydraulic control, positive control



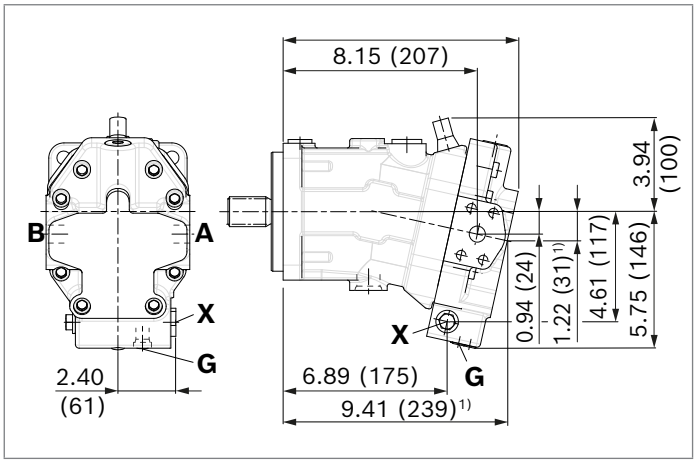
▼ **HP5, HP6** – Proportional hydraulic control, negative control



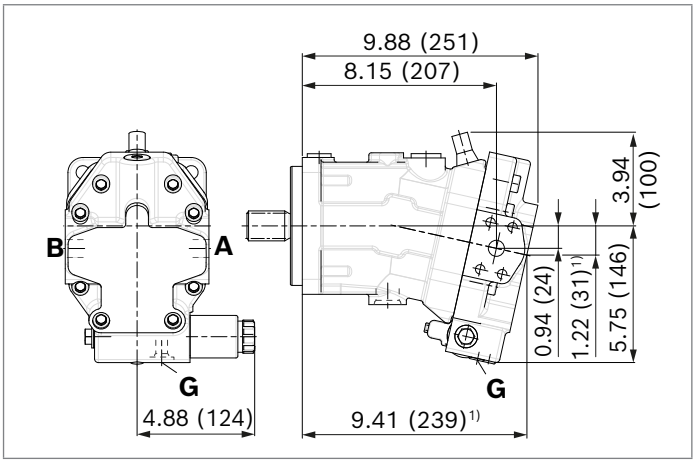
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



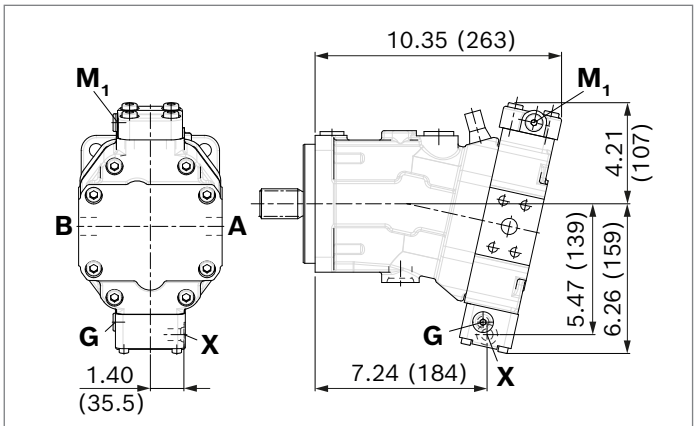
▼ **HZ7** – Two-point hydraulic control, negative control



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



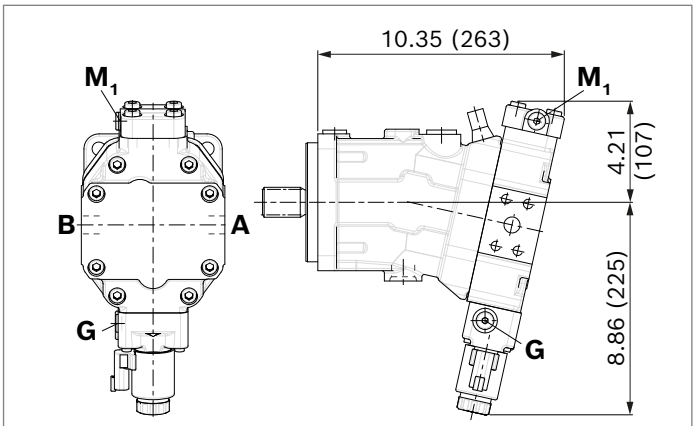
▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional



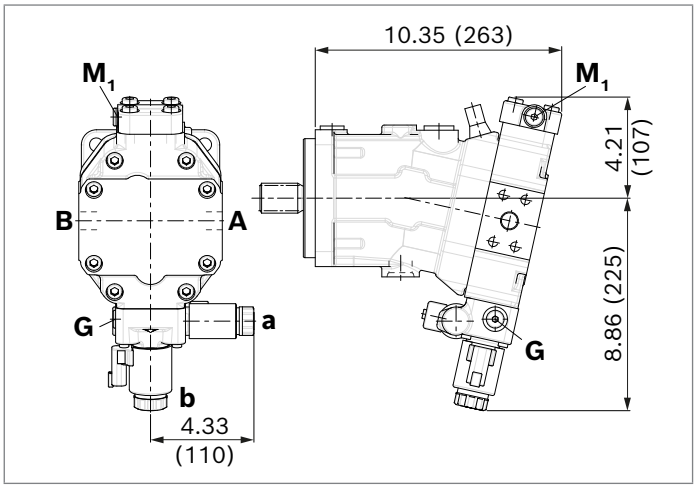
HA1 and HA2, **X** plugged

HA1T and HA2T, **X** open

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

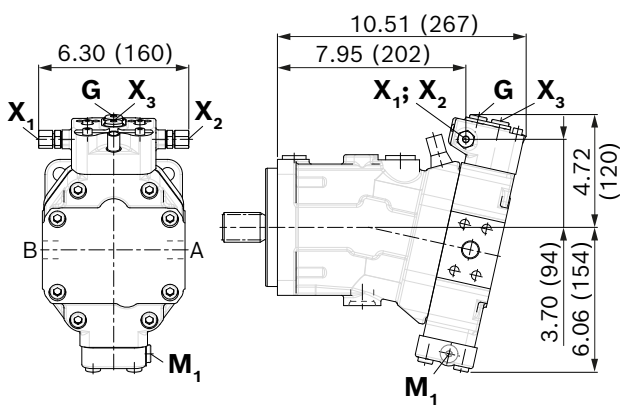


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



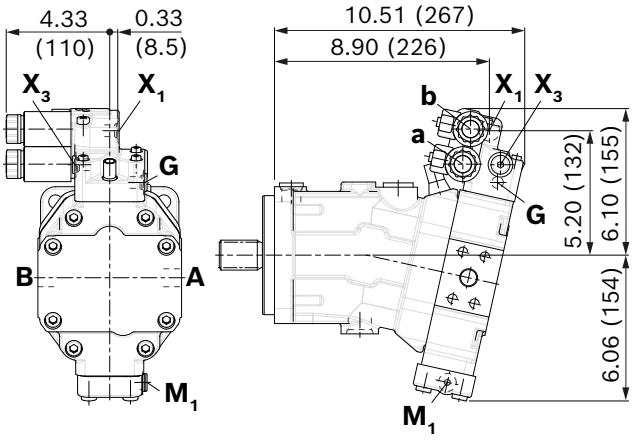
1) Port plate 1 - SAE working ports **A** and **B** at rear

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



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

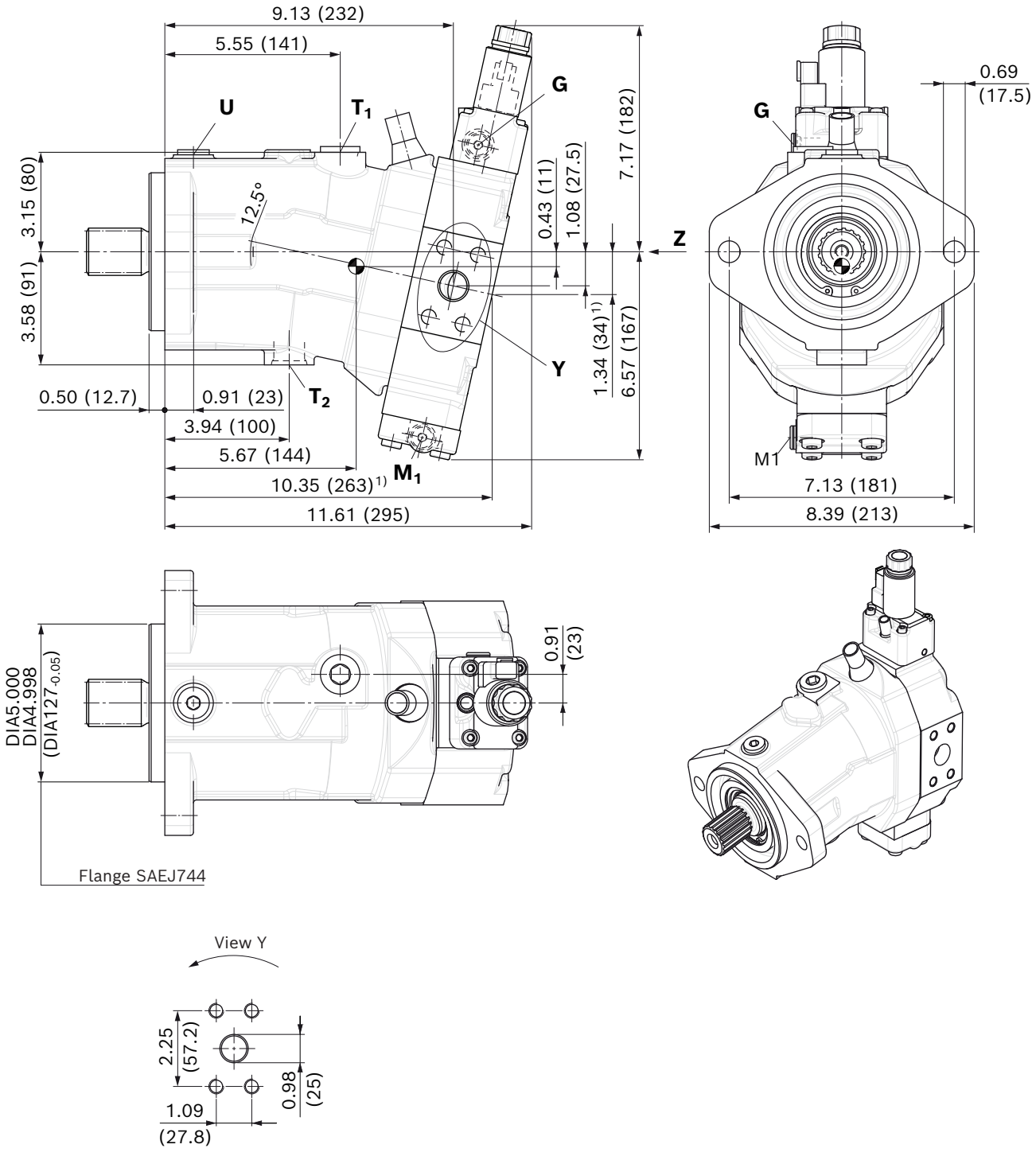
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 85

EP5, EP6 – Proportional electric control, negative control, with Mounting flange C2

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



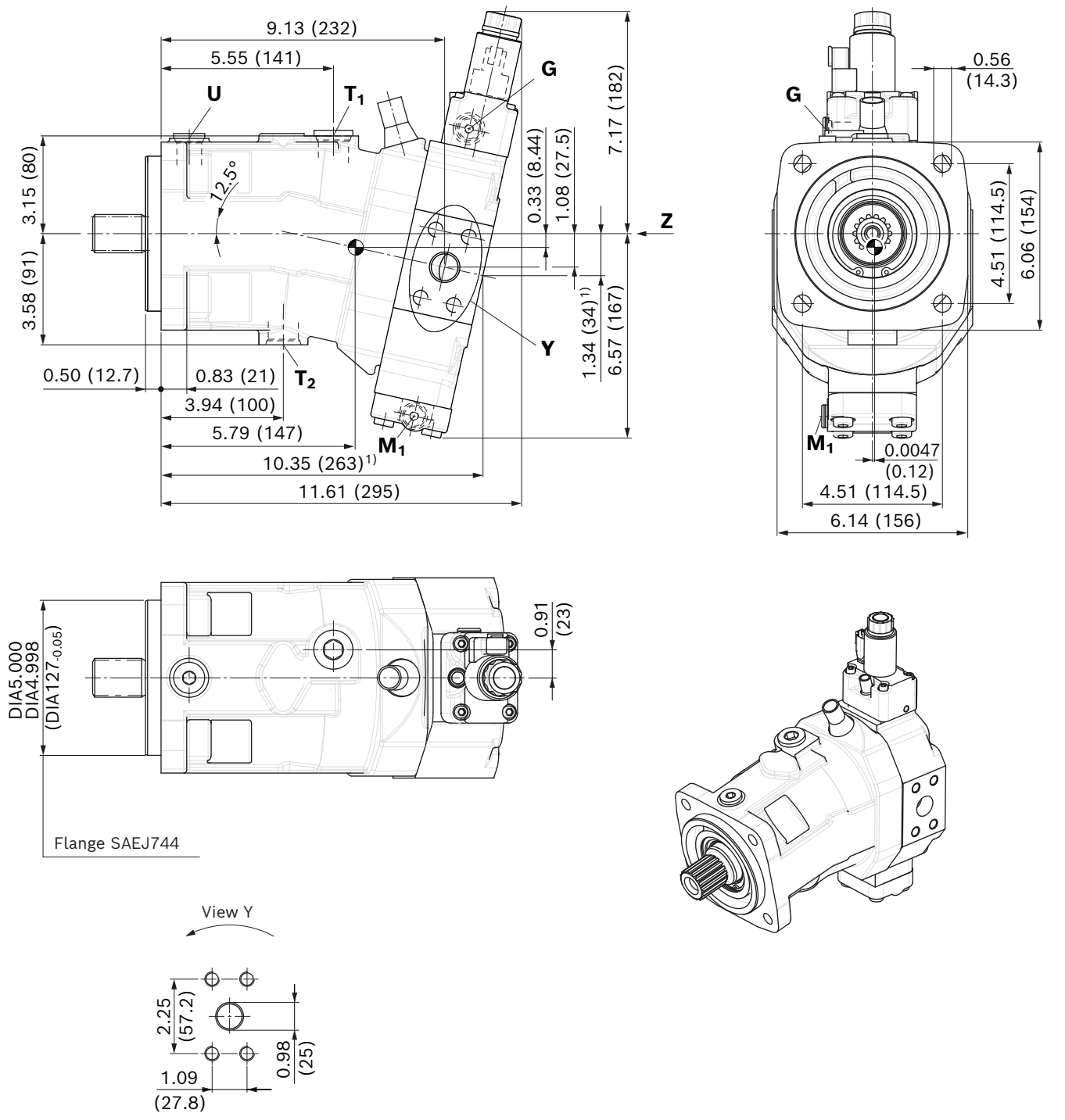
Center of gravity

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

Dimensions, size 85

EP5, EP6 – Proportional electric control, negative control, with Mounting flange C4

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

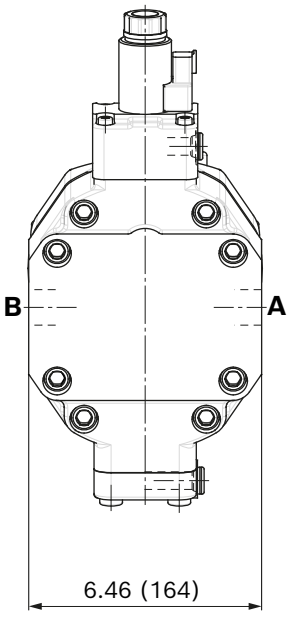


Center of gravity

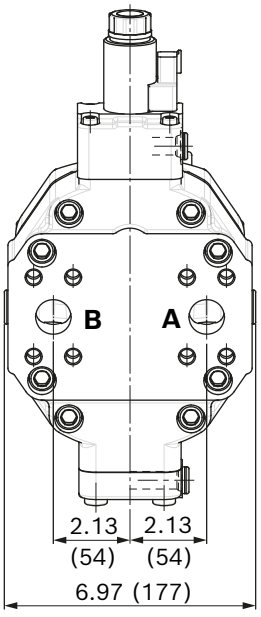
1) Port plate 1 — SAE working ports **A** and **B** at rear

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

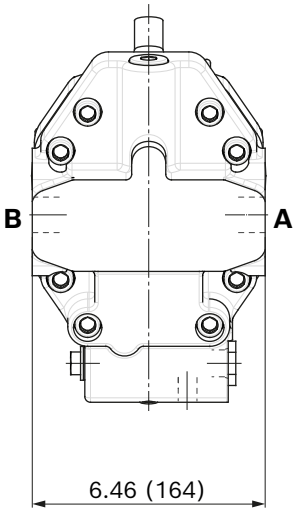
2 SAE working ports **A** and **B** at side, opposite



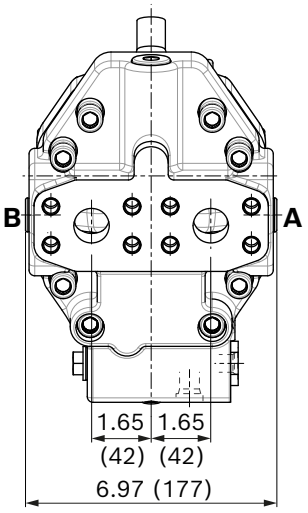
1 SAE working ports **A** and **B** at rear



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

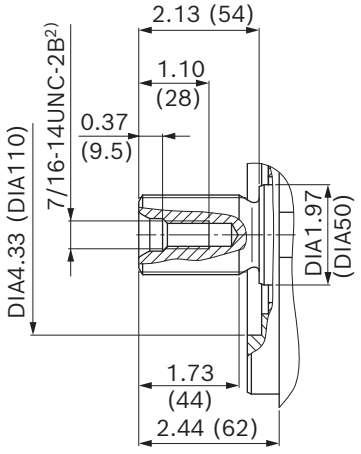


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



▼ **SAE J744 splined shaft**

S7 – 1 1/2 in 17T 12/24DP[1)]

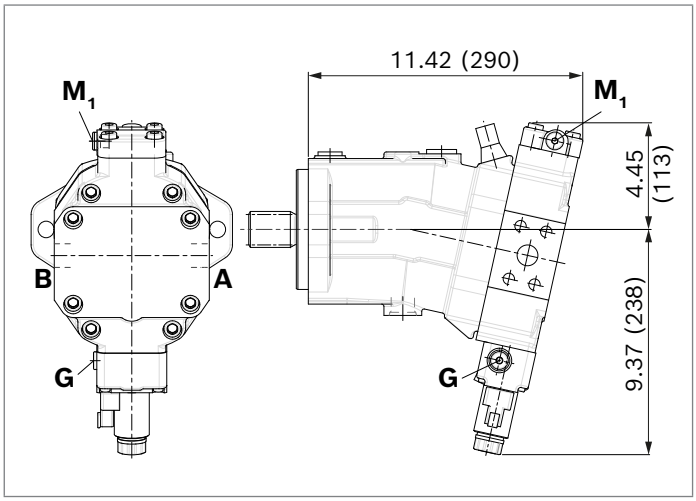


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

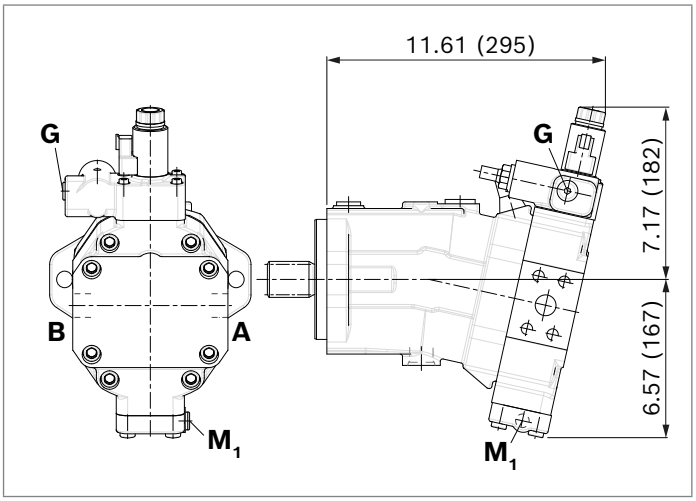
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	1 in M12 × 1.75; 0.67 (17) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)t	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

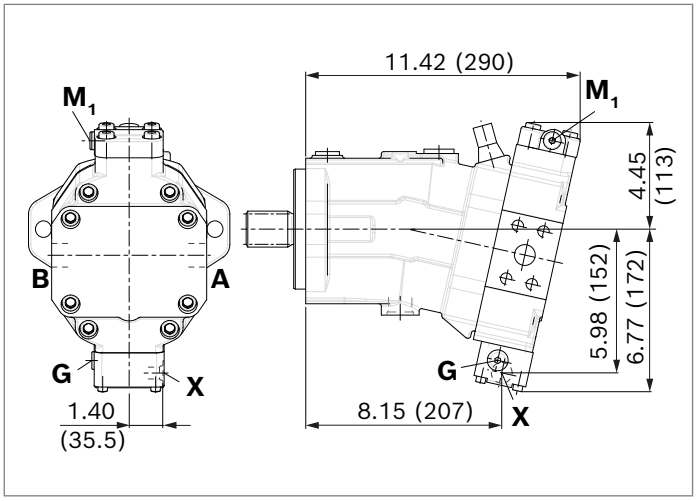
▼ **EP1, EP2** – Proportional electric control, positive control



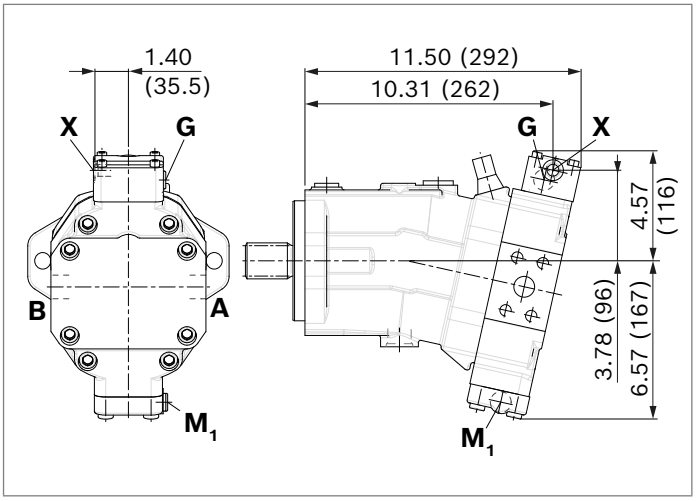
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



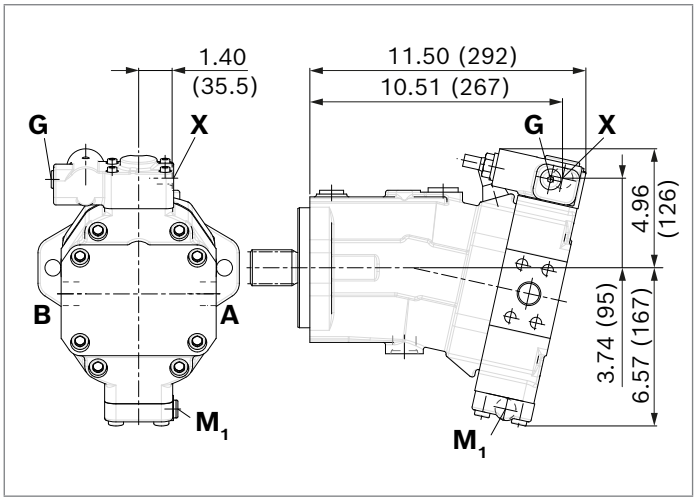
▼ **HP1, HP2** – Proportional hydraulic control, positive control



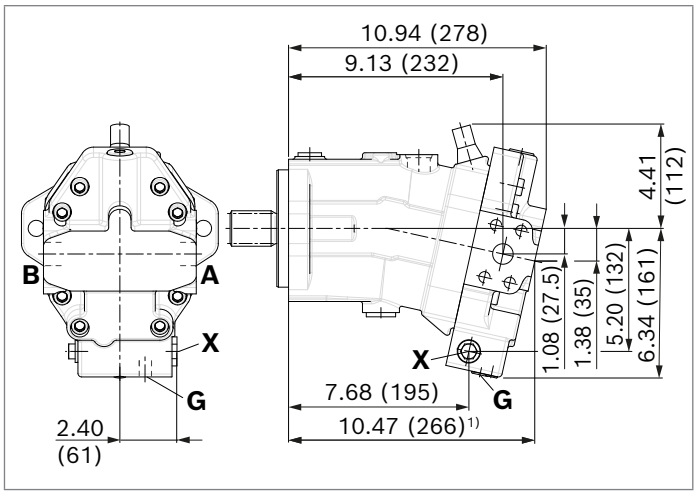
▼ **HP5, HP6** – Proportional hydraulic control, negative control



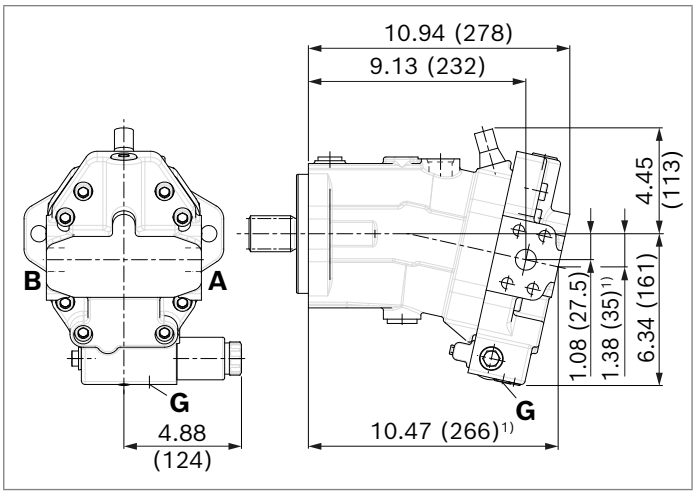
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



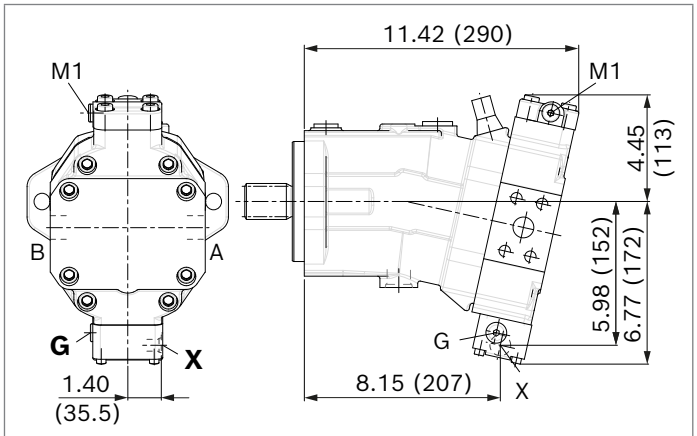
▼ **HZ7** – Two-point hydraulic control, negative control



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

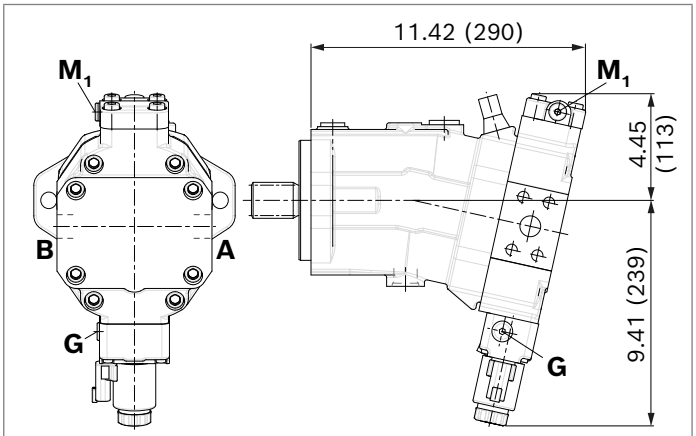


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

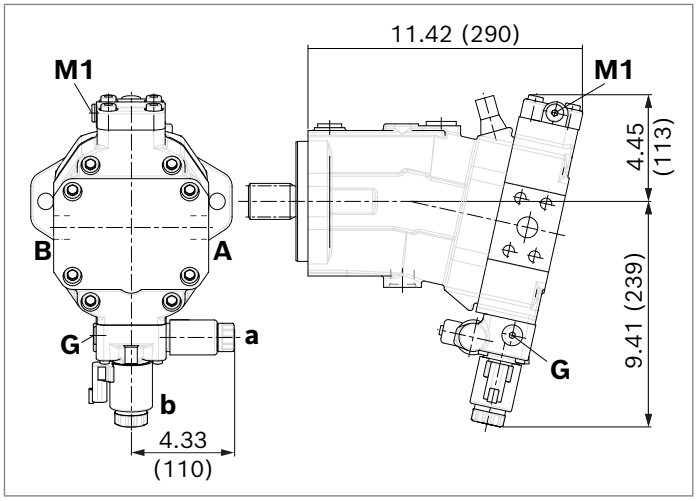


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

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

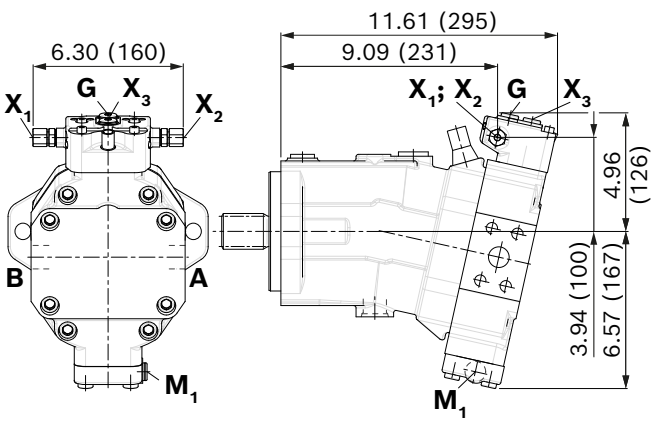


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



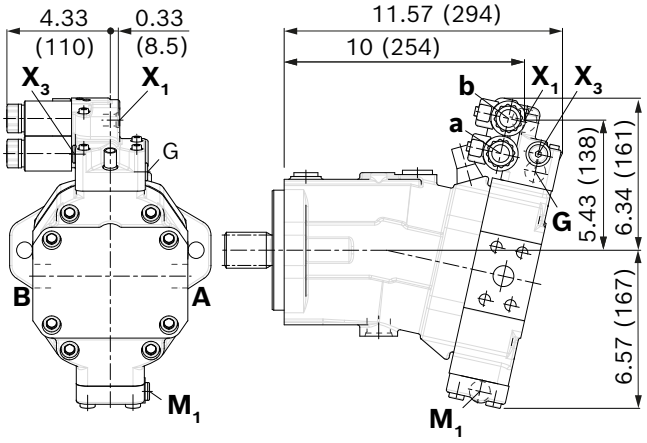
1) Port plate 1 - SAE working ports **A** and **B** at rear

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



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

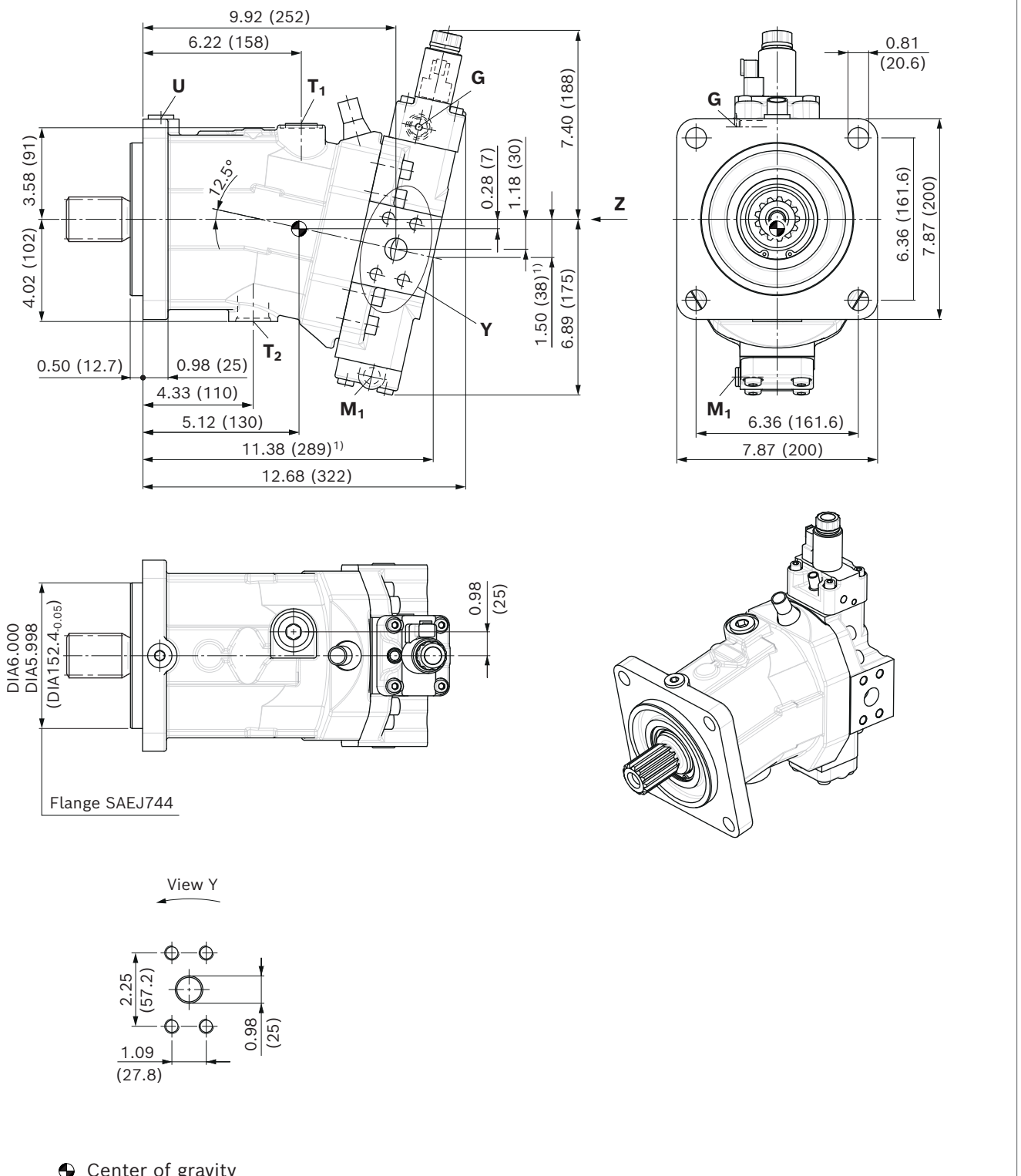
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 115

EP5, EP6 – Proportional electric control, negative control

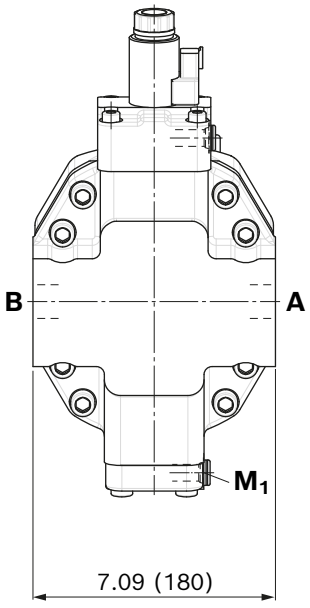
Port plate 2 — SAE working ports **A** and **B** at side, opposite



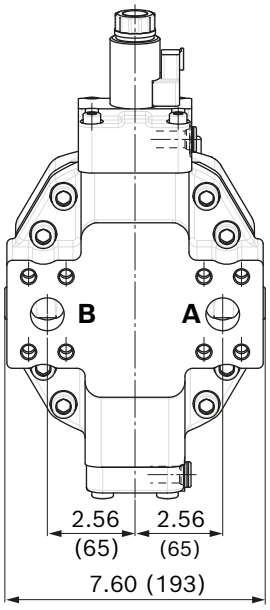
1) Port plate 1 — SAE working ports **A** and **B** at rear

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

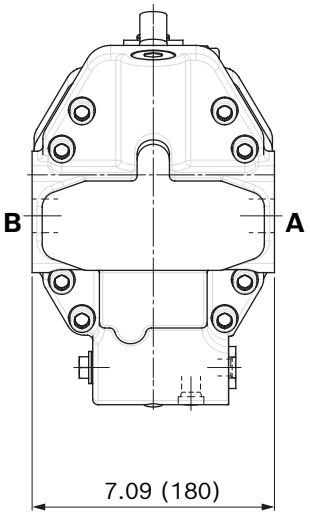
2 SAE working ports **A** and **B** at side, opposite



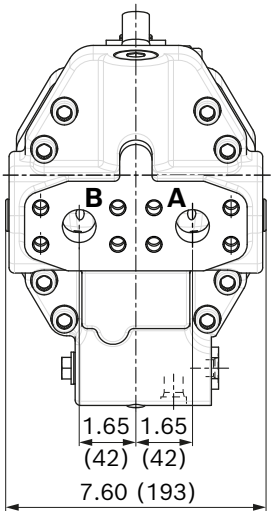
1 SAE working ports **A** and **B** at rear



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

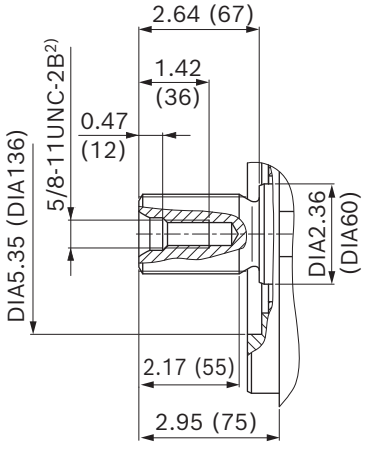


1 SAE working ports **A** and **B** at rear, only HZ7, EZ7/8



▼ **SAE J744 splined shaft**

T1 – 1 3/4 in 13T 8/16 DP[1)]

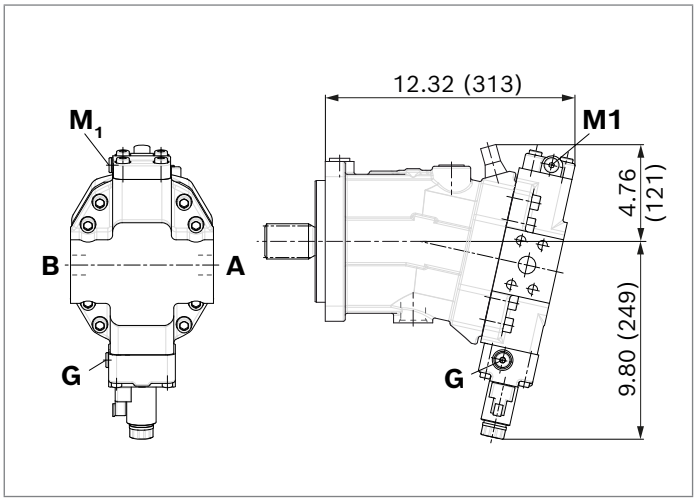


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

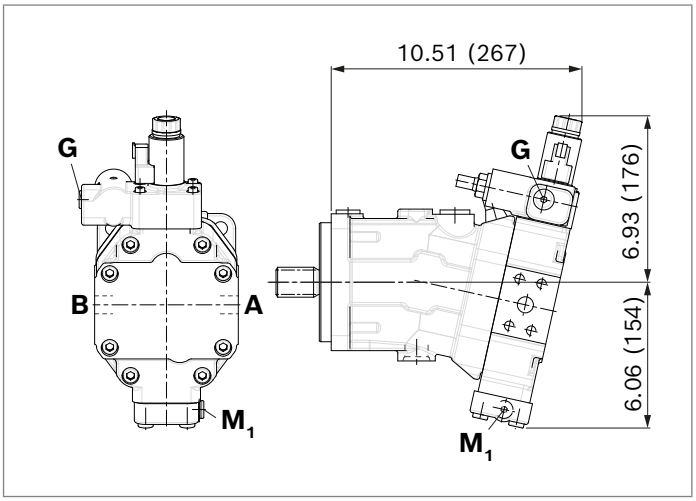
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	1 in M12 × 1.75; 0.67 (17) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

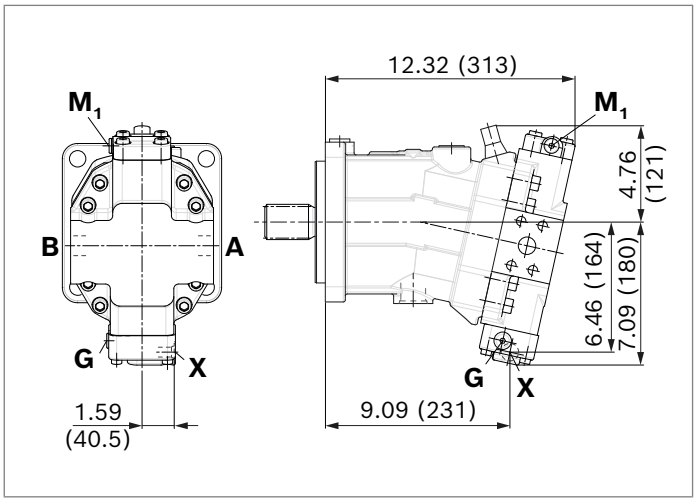
▼ **EP1, EP2** – Proportional electric control, positive control



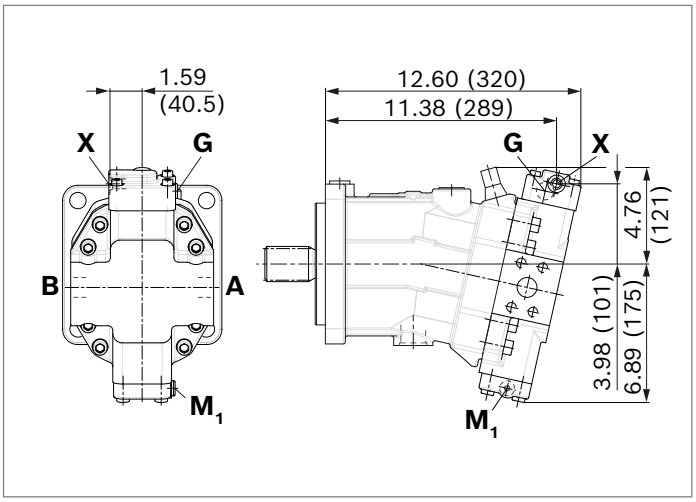
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



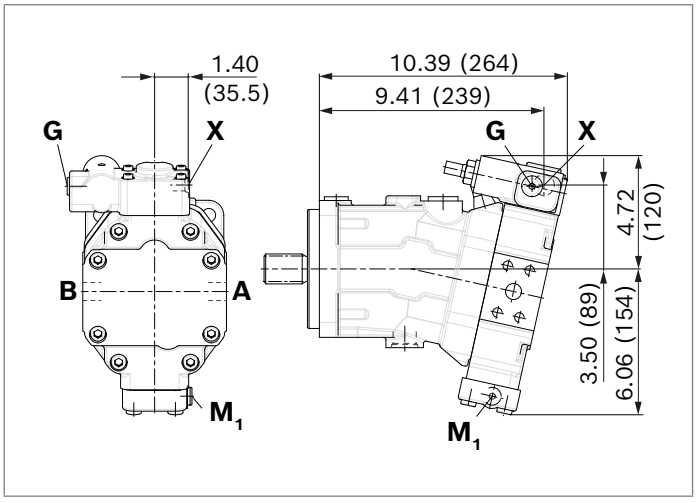
▼ **HP1, HP2** – Proportional hydraulic control, positive control



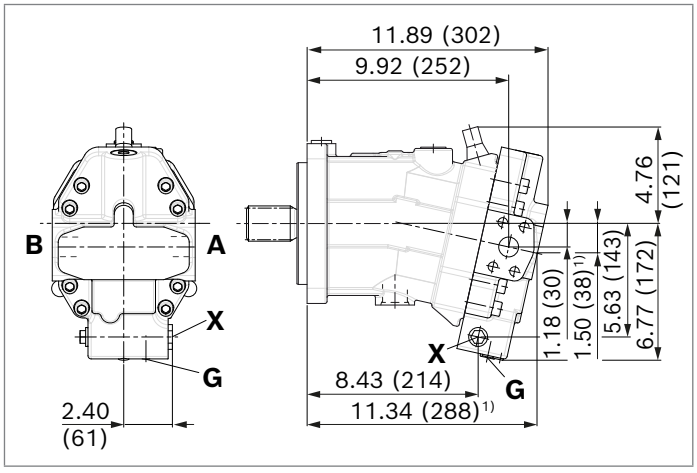
▼ **HP5, HP6** – Proportional hydraulic control, negative control



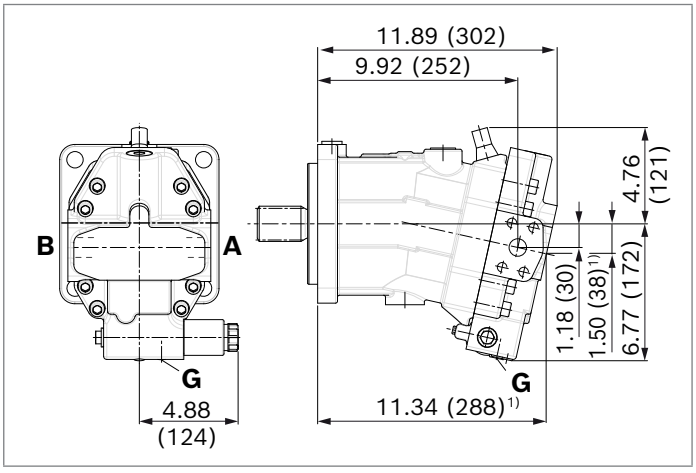
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



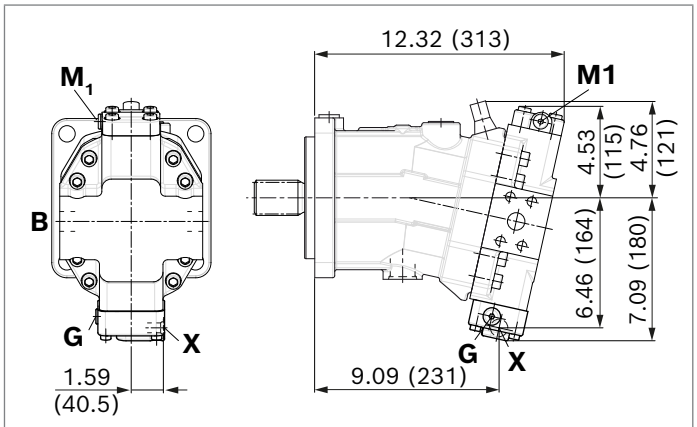
▼ **HZ7** – Two-point hydraulic control, negative control



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

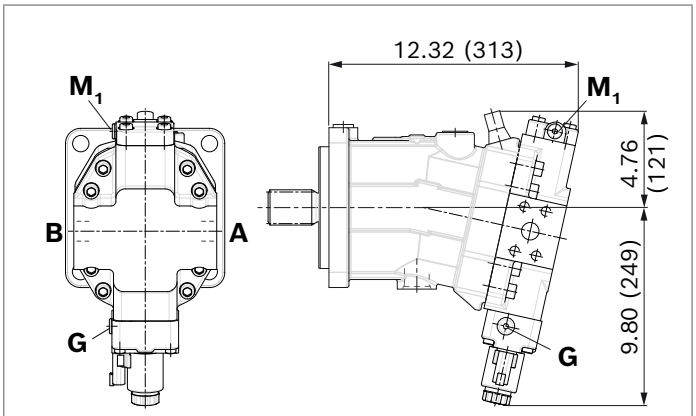


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

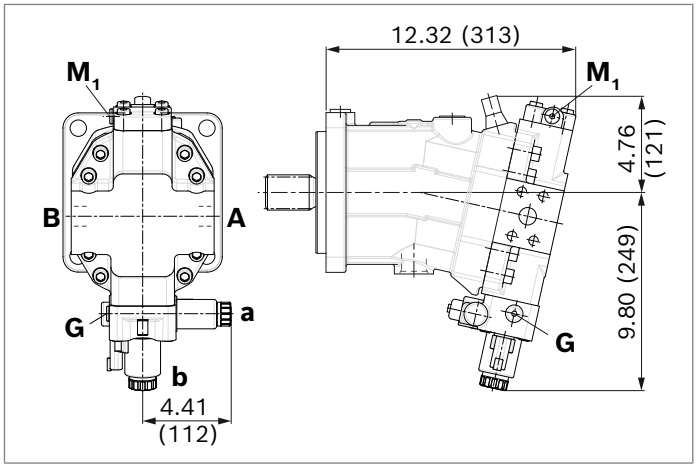


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

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

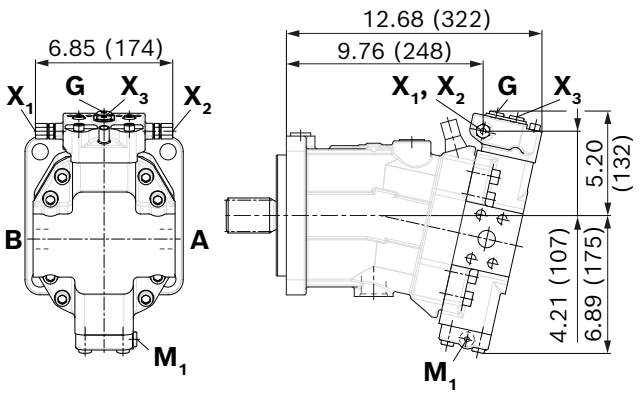


▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve



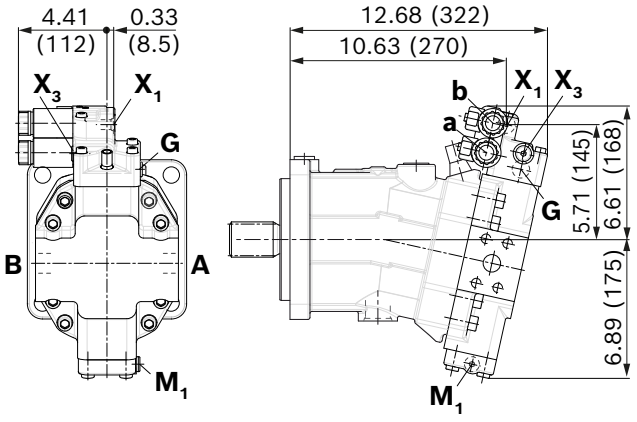
1) Port plate 1 - SAE working ports **A** and **B** at rear

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



X_1, X_2 Pipe fitting SDSC – L8×M12 – F acc. to ISO 8434-1
Use assembled fitting!

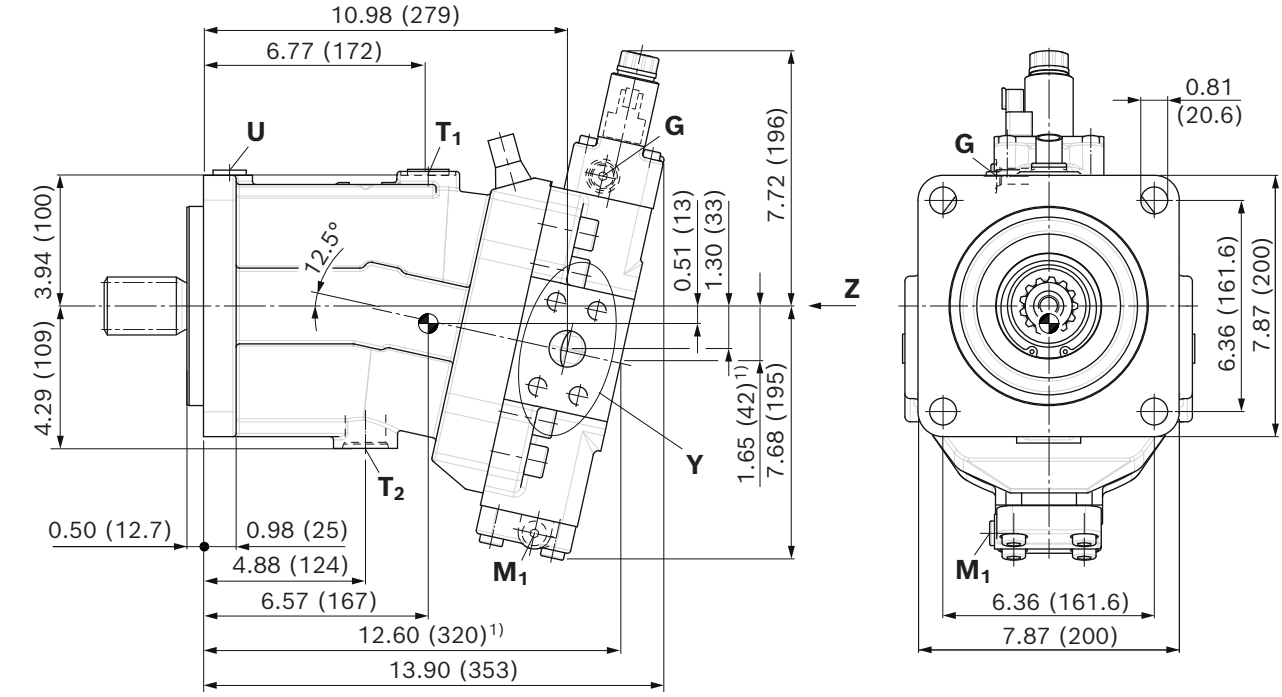
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override

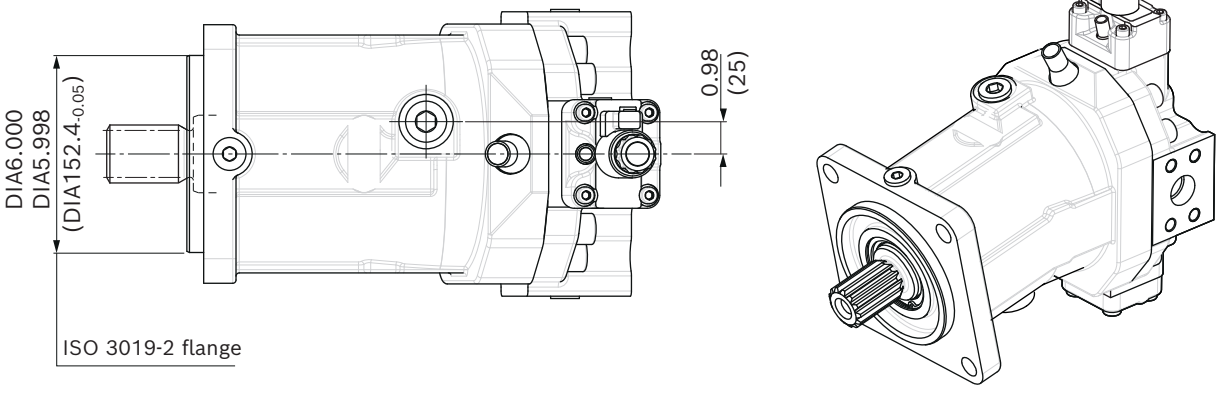


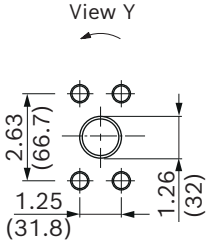
Dimensions, size 150

EP5, EP6 – Proportional electric control, negative control

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





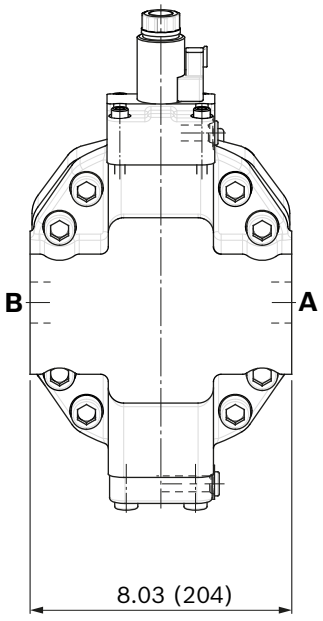


Center of gravity

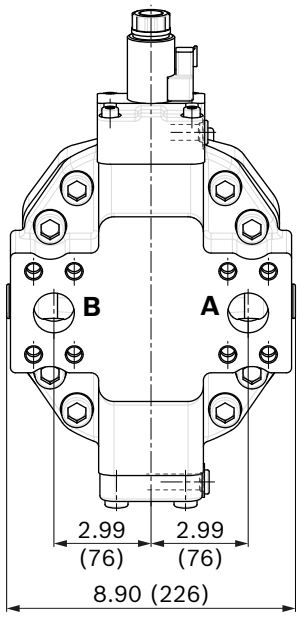
1) Port plate 1 – SAE working ports **A** and **B** at rear

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

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

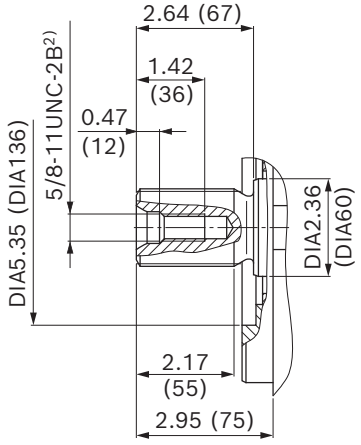


1 SAE working ports **A** and **B** at rear



▼ **SAE J744 splined shaft**

S7 – 1 3/4 in 13T 8/16DP[1)]

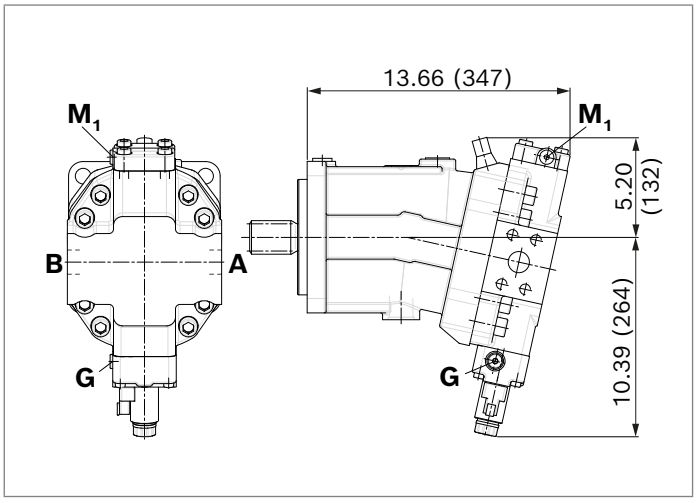


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

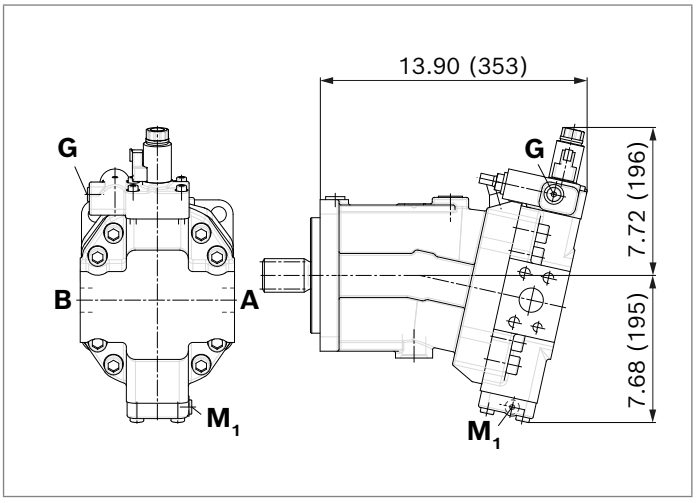
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	1 1/4 in M14 × 2; 0.75 (19) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

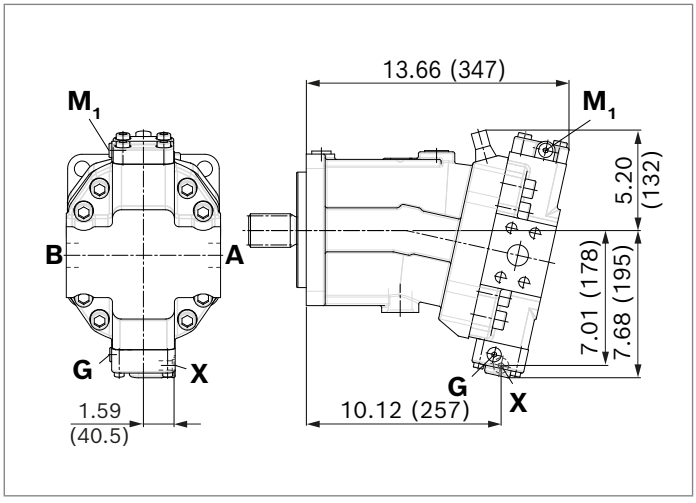
▼ **EP1, EP2** – Proportional electric control, positive control



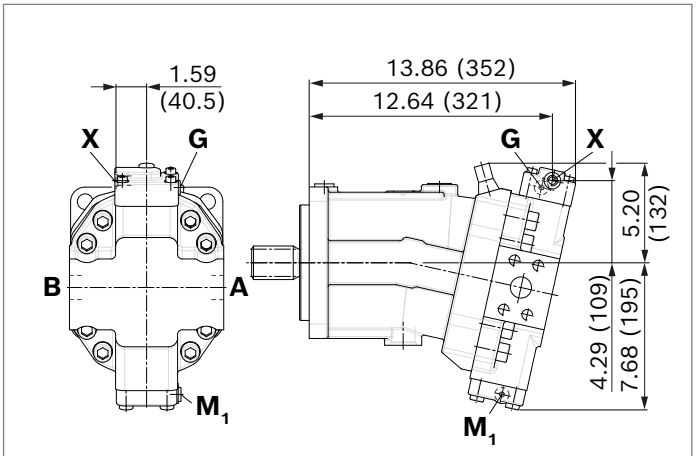
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



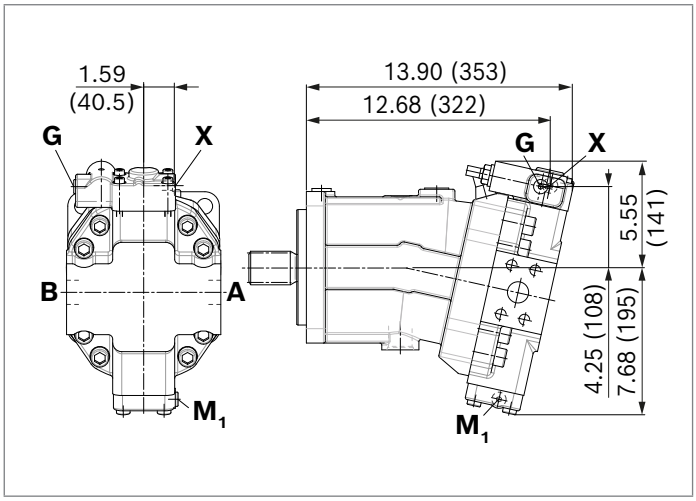
▼ **HP1, HP2** – Proportional hydraulic control, positive control



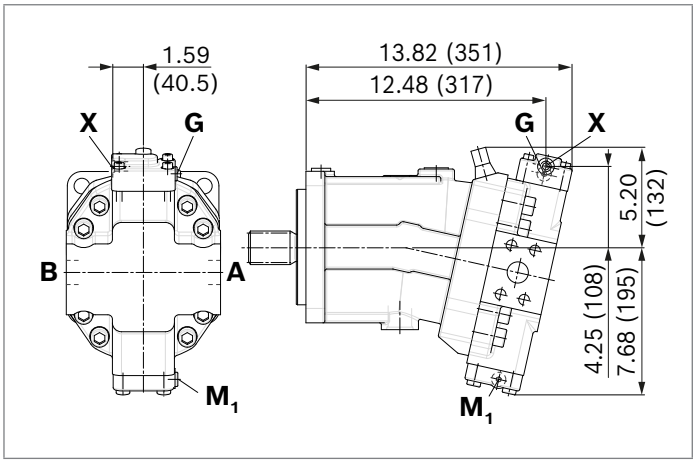
▼ **HP5, HP6** – Proportional hydraulic control, negative control



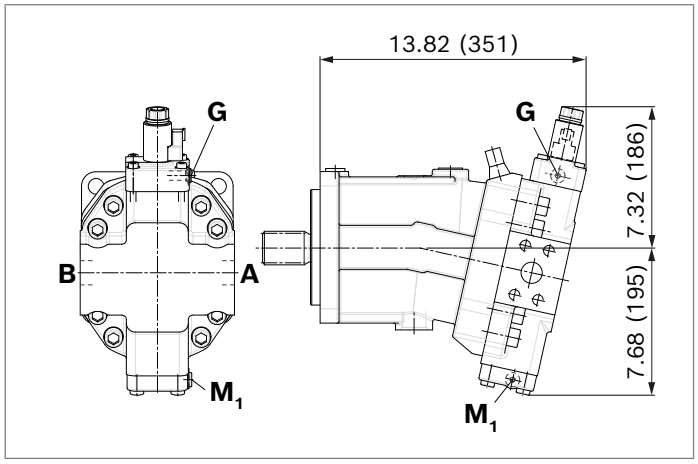
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



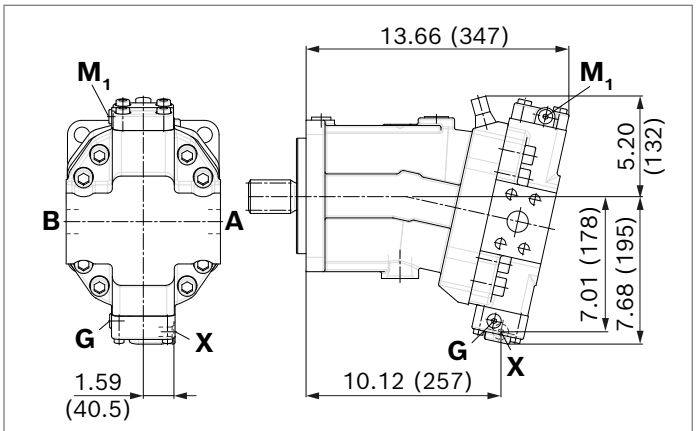
▼ **HZ5** – Two-point hydraulic control, negative control



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

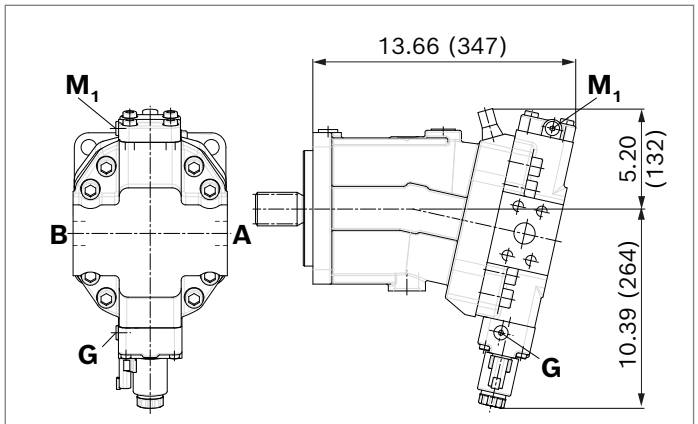


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

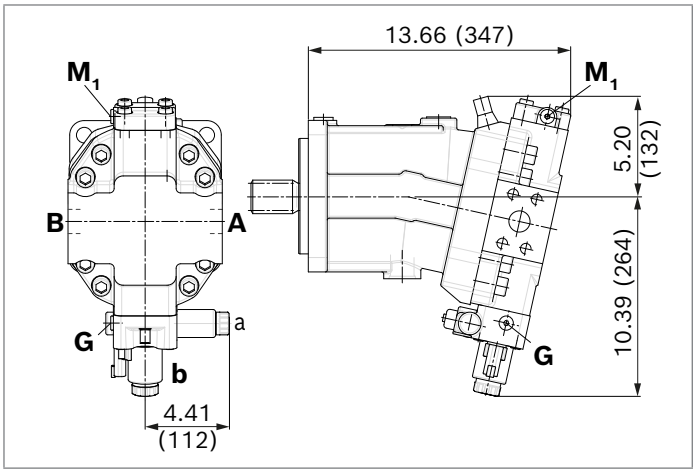


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

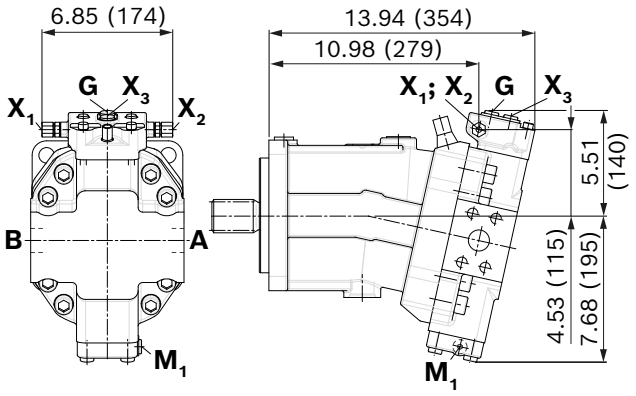
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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

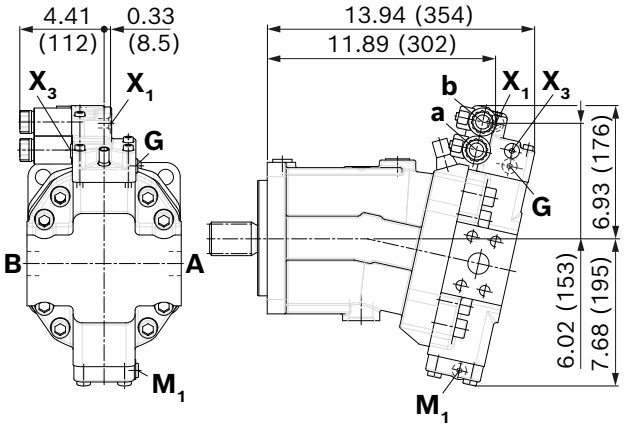


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

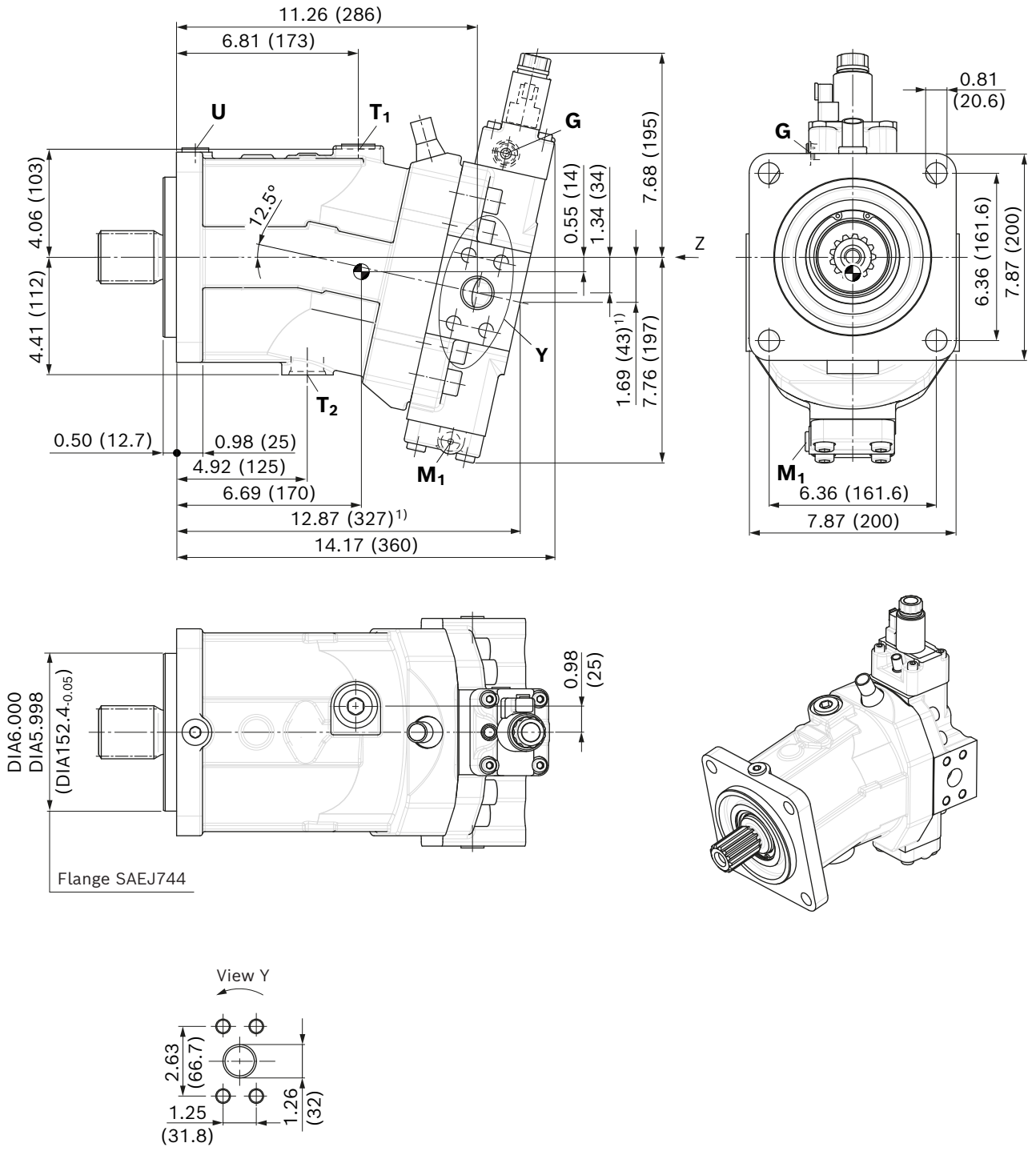
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 170

EP5, EP6 – Proportional electric control, negative control

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

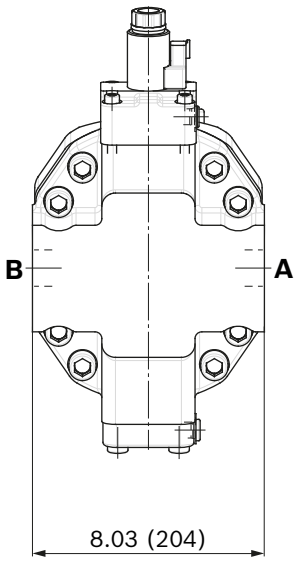


Center of gravity

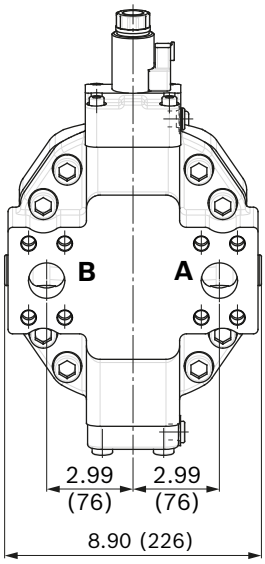
1) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

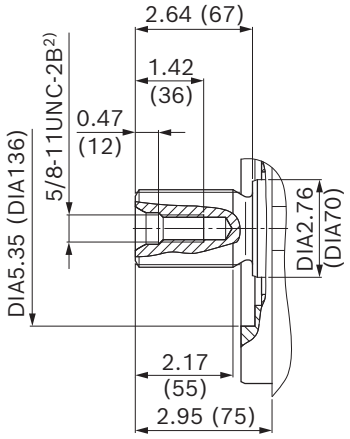


1 SAE working ports **A** and **B** at rear



▼ **SAE J744 splined shaft**

S7 – 2 in 15T 8/16DP[1)]

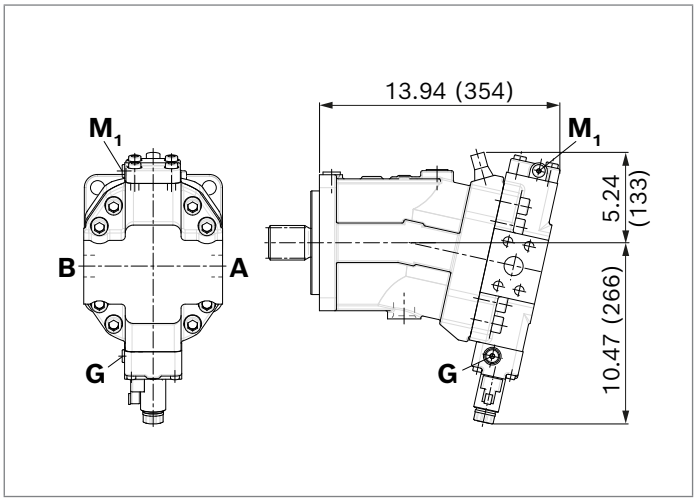


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

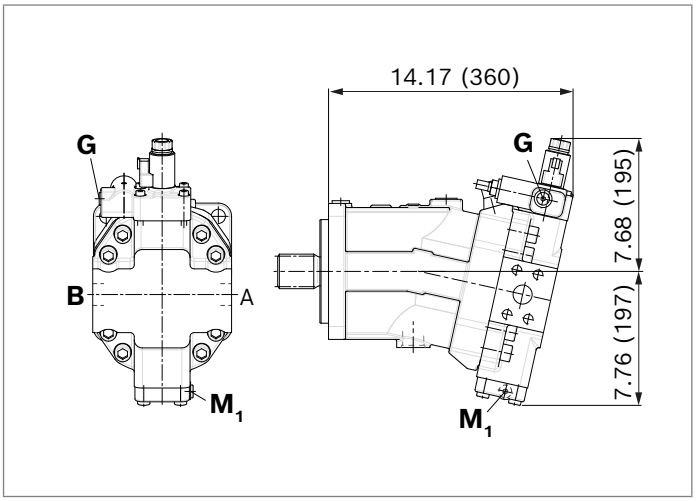
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	1 1/4 in M14 × 2; 0.75 (19) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 1/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

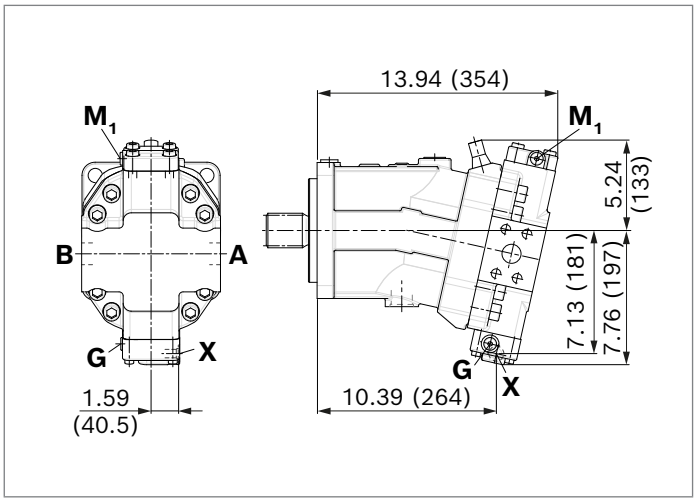
▼ **EP1, EP2** – Proportional electric control, positive control



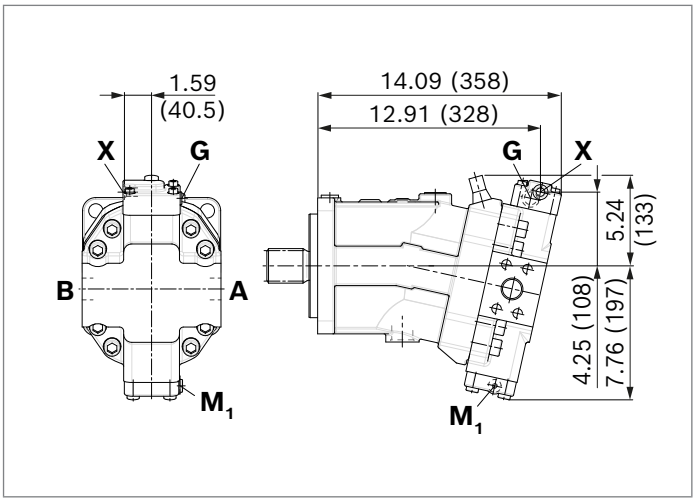
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



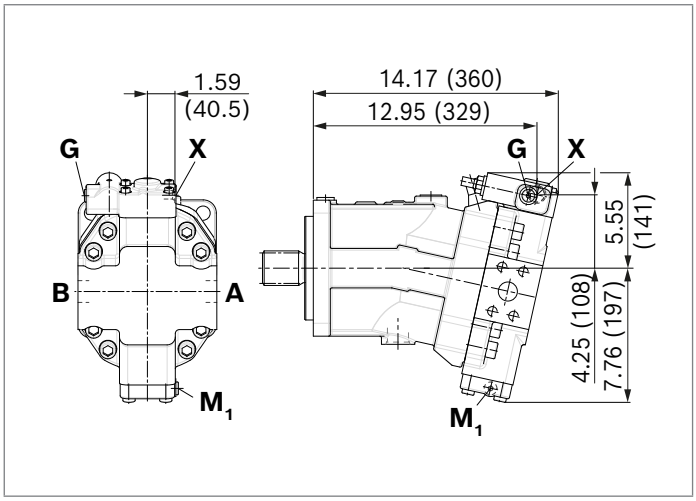
▼ **HP1, HP2** – Proportional hydraulic control, positive control



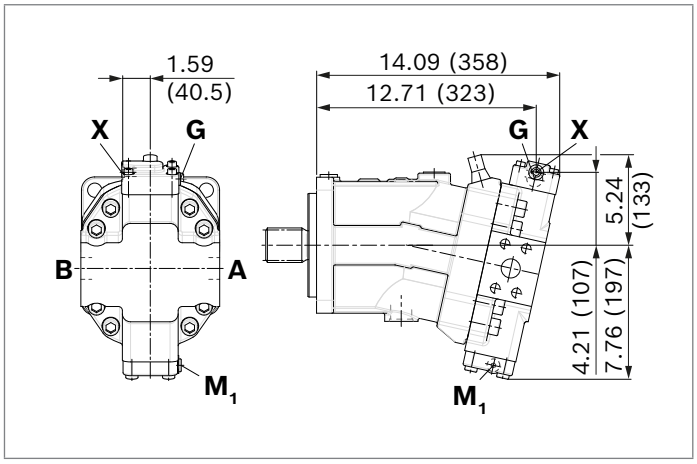
▼ **HP5, HP6** – Proportional hydraulic control, negative control



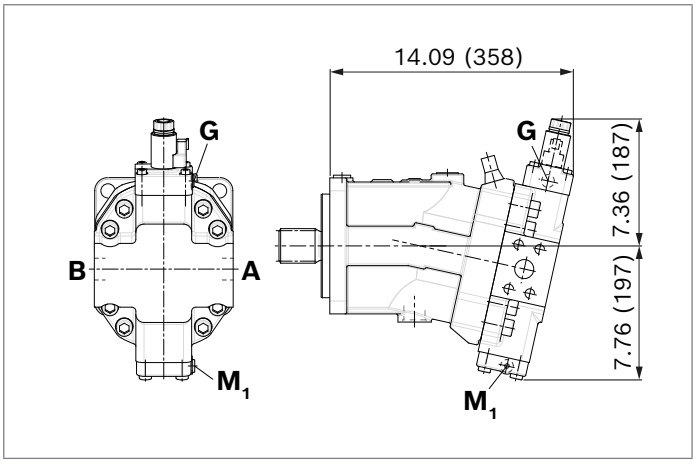
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



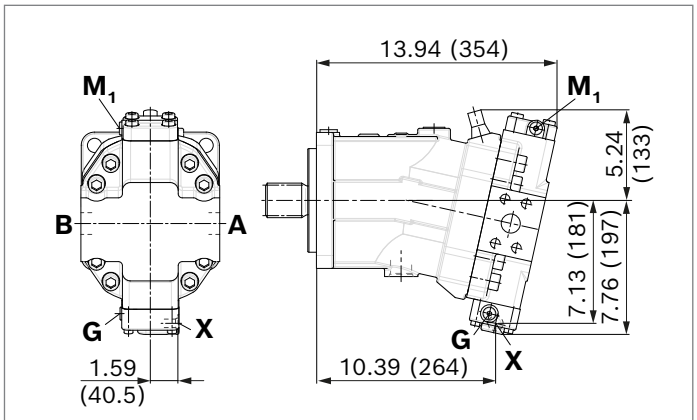
▼ **HZ5** – Two-point hydraulic control, negative control



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

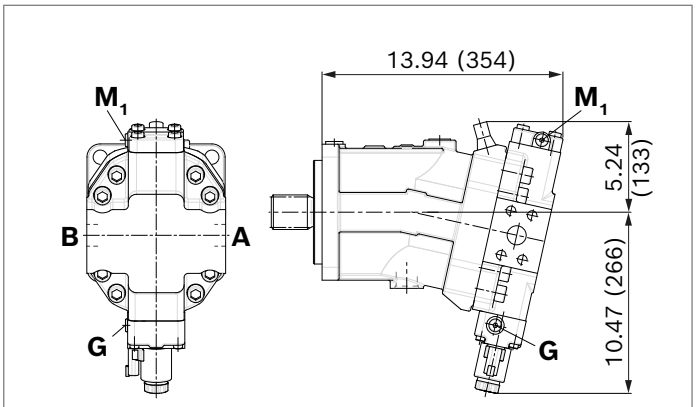


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

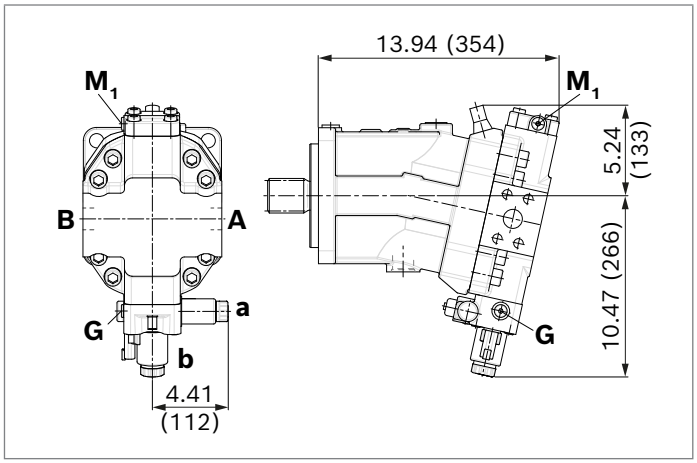


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

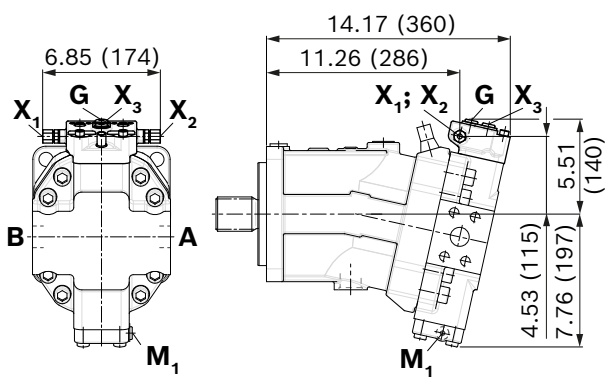
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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

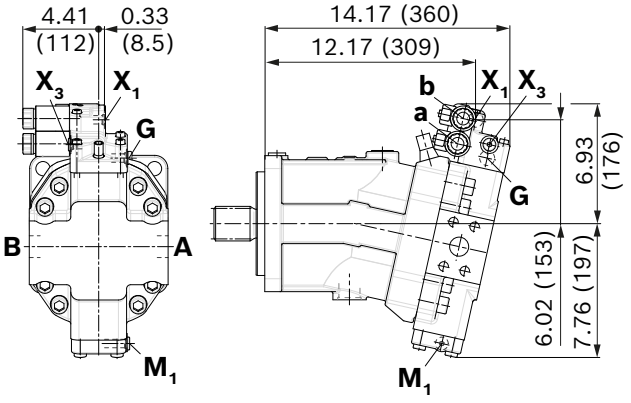


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

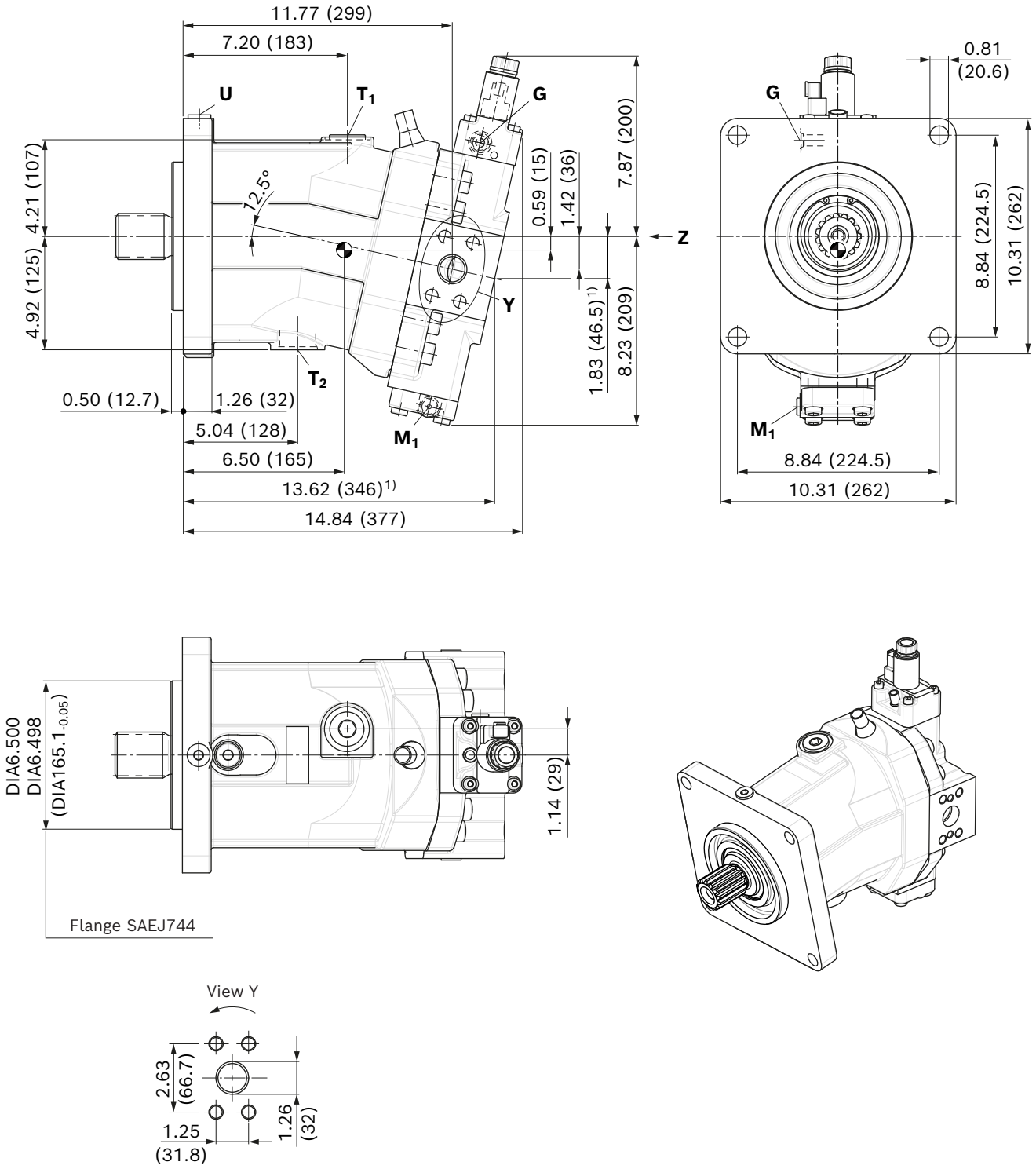
▼ **DA1, DA2** – Automatic speed related control, negative control, with electric travel direction valve and electric $V_{g\,max}$ override



Dimensions, size 215

EP5, EP6 – Proportional electric control, negative control

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

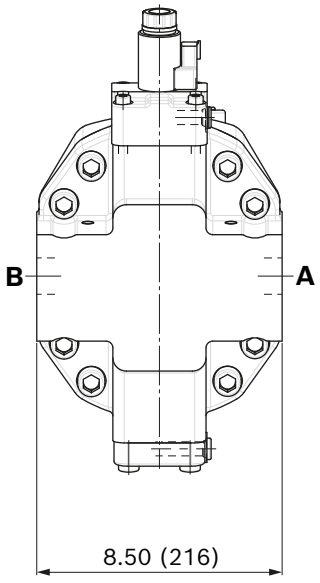


Center of gravity

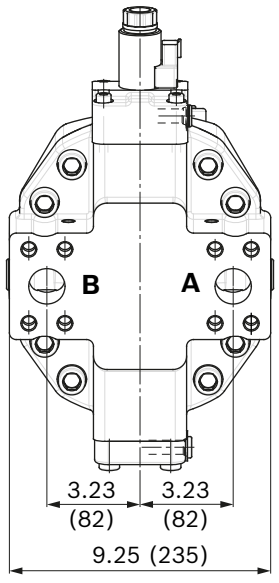
1) Port plate 1 — SAE working ports **A** and **B** at rear

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

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

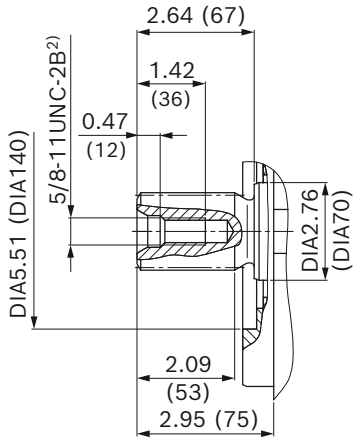


1 SAE working ports **A** and **B** at rear



▼ **SAE J744 splined shaft**

S7 – 2 in 15T 8/16DP[1)]

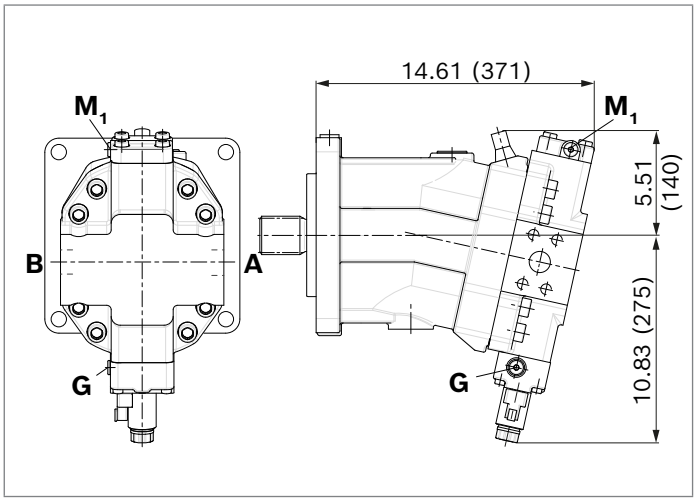


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

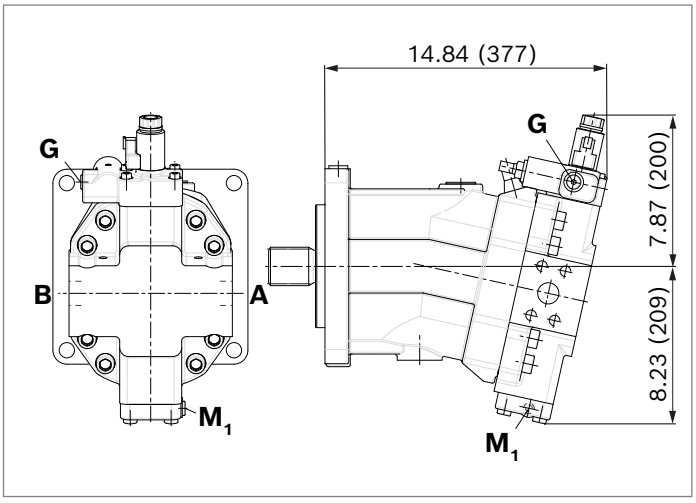
Ports		Standard	Size	p_{max} [psi (bar)][1]	State[5]
A, B	Working port Mounting bolt A/B	SAEJ518[2] DIN 13	1 1/4 in M14 × 2; 0.75 (19) deep	7690 (530)	O
T_1	Drain port	ISO 11926[4]	1 5/16 in -12 UN-2B; 0.79 (20) deep	45 (3)	X[3]
T_2	Drain port	ISO 11926[4]	1 5/8 in -12 UN-2B; 0.79 (20) deep	45 (3)	O[3]
G	Synchronous control	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (530)	X
U	Bearing flushing	ISO 11926[4]	7/8 in -14 UNF-2B; 0.67 (17) deep	45 (3)	X
X	Pilot signal (HP, HZ, HA1T/HA2T)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100)	O
X	Pilot signal (HA1, HA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Pilot signal (DA0)	SO 8434-1	SDSC-L8×M12-F	580 (40)	O
X_1	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	O
X_3	Pilot signal (DA1, DA2)	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	580 (40)	X
M_1	Measuring stroking chamber	ISO 11926[4]	9/16 in -18 UNF-2B; 0.51 (13) deep	7690 (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 78).
4) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to ISO 11926-2.
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

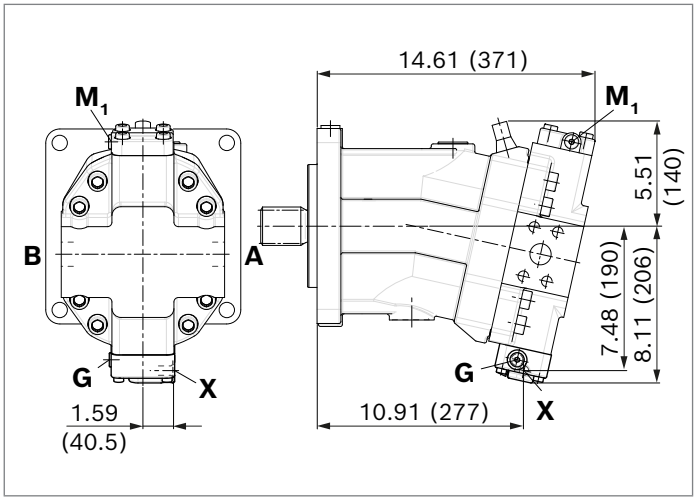
▼ **EP1, EP2** – Proportional electric control, positive control



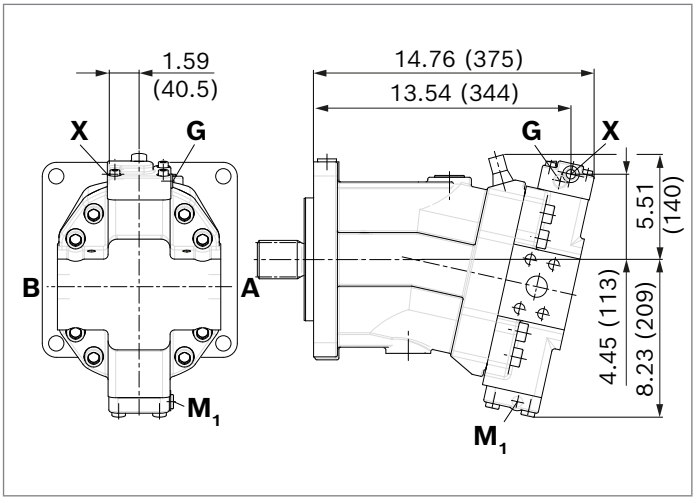
▼ **EP5D1, EP6D1** – Proportional electric control, negative control, with pressure control fixed setting



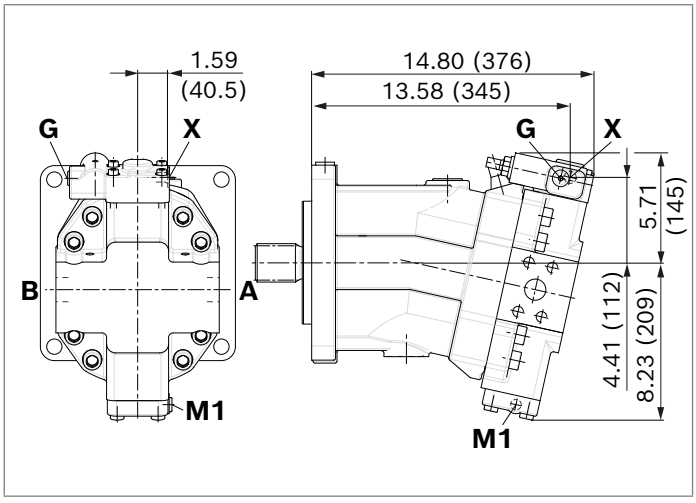
▼ **HP1, HP2** – Proportional hydraulic control, positive control



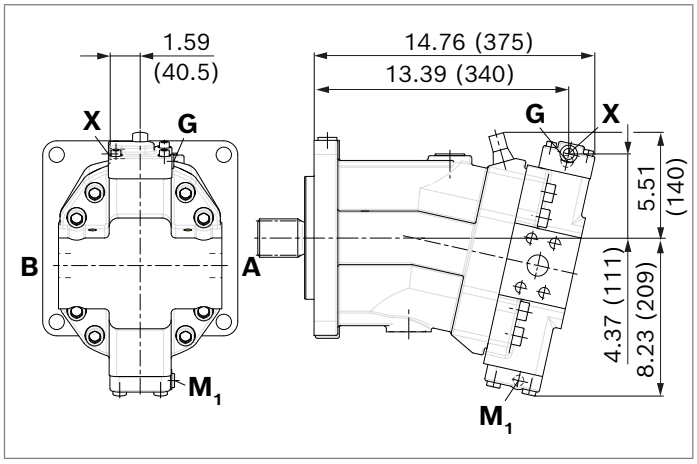
▼ **HP5, HP6** – Proportional hydraulic control, negative control



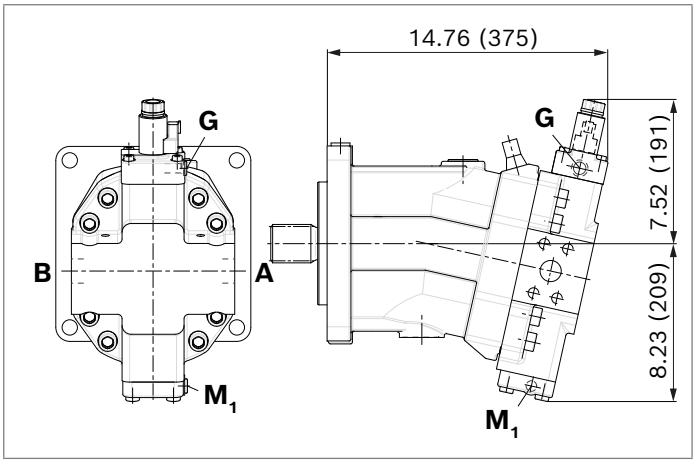
▼ **HP5D1, HP6D1** – Proportional hydraulic control, negative control, with pressure control fixed setting



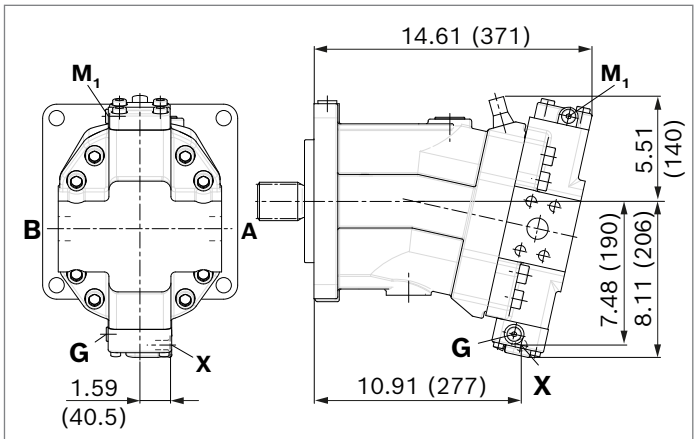
▼ **HZ5** – Two-point hydraulic control, negative control



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

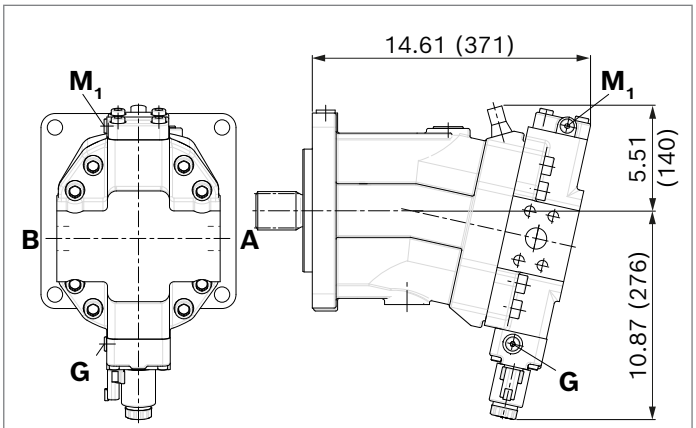


▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

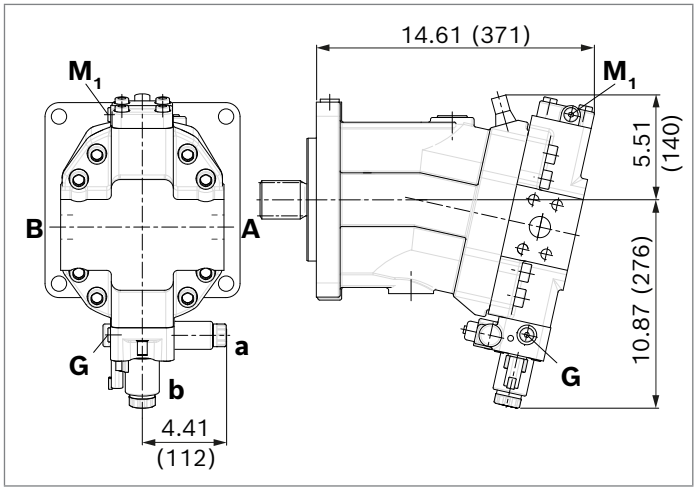


HA1 and HA2, **X** plugged
HA1T and HA2T, **X** open

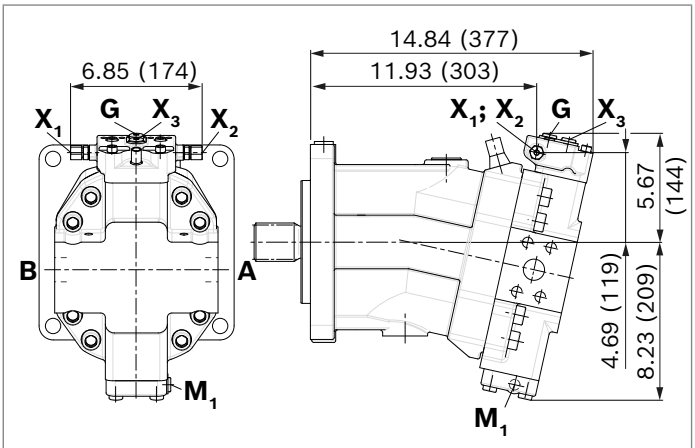
▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point



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

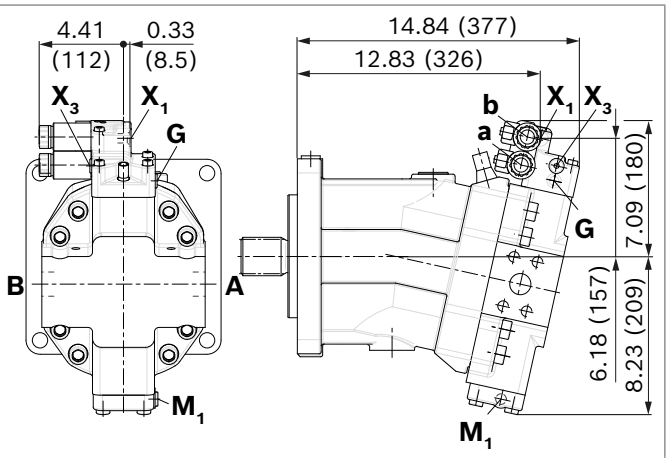


▼ **DA0** – Automatic speed related control, negative control, with hydraulic travel direction valve



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

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



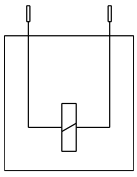
Connector for solenoids

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.
- The procedure is defined in the instruction manual.

Neutral position switch

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

Technical data

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

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

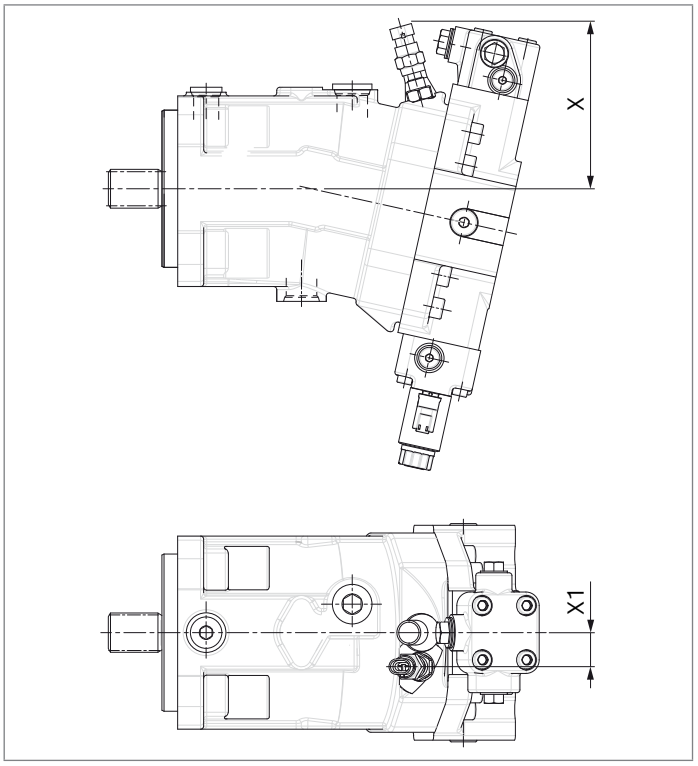
▼ **Mating connector**

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

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

▼ **Dimensions**

Version “N” with neutral position switch mounted



Size	Adjustable angle		X [inch (mm)]		X1 [inch (mm)]
	min.	max.	at min angle	at max angle	
85	0°	2°	5.69 (144.7)	5.56 (141.4)	1.10 (28.0)
115	0°	4°	5.83 (148.1)	5.53 (140.4)	1.18 (30.0)
150	0°	1°	6.03 (153.1)	5.94 (150.9)	1.18 (30.0)
170	0°	0°		6.03 (153.1)	1.18 (30.0)
215	0°	0°		6.23 (159.1)	1.18 (30.0)

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

Flushing and boost-pressure valve

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

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

- Fixed setting 230 psi (16 bar)

Switching pressure of flushing spool Δp

- Size 60 to 115 (small flushing valve) 115±15 psi (8±1 bar)
- Size 115 to 215 (medium and large flushing valve) 254±22.5 psi (17.5±1.5 bar)

Flushing flow q_v

Orifices can be used to adjust the flushing flows as required. The following parameters are based on:
Δp_{ND} = p_{ND} – p_G = 365 psi (25 bar)and ν = 10 cSt
(p_{ND} = low pressure, p_G = case pressure)

Notices

- Port S_a only for sizes 150 to 215
- For a flushing flow of 9.2 gpm (35 l /min) it is recommended that port S_a be connected in order to prevent an increase in case pressure. An increased case pressure reduces the flushing flow.

Small flushing valve for sizes 60 to 115

Material number of orifice	DIA [inch] (Ø [mm])	q_v [gpm (l/min)]	Code
R909651766	0.047 (1.2)	0.9 (3.5)	A
R909419695	0.055 (1.4)	1.3 (5)	B
R909419696	0.071 (1.8)	2.1 (8)	C
R909419697	0.079 (2.0)	2.6 (10)	D
R909444361	0.094 (2.4)	3.7 (14)	F

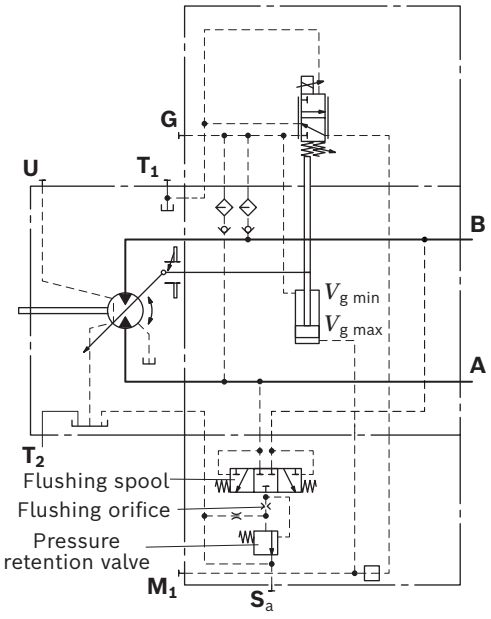
Medium flushingvalve for size 115

Material number of orifice	DIA [inch] (Ø [mm])	q_v [gpm (l/min)]	Code
R909431310	0.11 (2.8)	4.8 (18)	I
R909435172	0.14 (3.5)	7.1 (27)	K
R909449967	0.19 (5.0)	8.2 (31)	L

Large flushing valve

Material number of orifice	DIA [inch] (Ø [mm])	q_v [gpm (l/min)]	Code
R909449998	0.071 (1.8)	2.1 (8)	C
R909431308	0.079 (2.0)	2.6 (10)	D
R909431309	0.10 (2.5)	3.9 (15)	G
R909431310	0.11 (2.8)	4.8 (18)	I
R902138235	0.12 (3.1)	5.5 (21)	J
R909435172	0.14 (3.5)	7.1 (27)	K
R909436622	0.16 (4.0)	8.2 (31)	L
R909449967	0.20 (5.0)	9.7 (37)	M

▼ **Circuit diagram EP**



BVD and BVE counterbalance valve

Function

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

Notice

- BVD available for sizes 60 to 215 and BVE available for sizes 115 to 215.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
- Order example: A6VM085HA1T30004A/71CWV0C2S 97W0-0 + BVD20F27S/41B–V03K16D0400S12
- For safety reasons, controls with beginning of control at $V_{g\ min}$ (e.g. HA) are not permissible for lifting winch drives!
- Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- The counterbalance valve does not replace the mechanical service brake and holding brake.
- Observe the detailed notes on the counterbalance valve in the data sheets 95522 (BVD), 95525 (BVE) and 95528 (BVD/BVE32)!
- For the design of the brake release valve, we must know the following data for the mechanical holding brake:
  - the cracking pressure
  - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 305 psi (21 bar))
  - the required closing time for a warm device (oil viscosity approx. 69.6 SUS (15 mm2/s))

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

Motor	Without valve		Limited values when using pressure relief valves and BVD/BVE							
			DBV[1]				BVD[2]/BVE[3]			
NG	p_{nom}/p_{max} [psi (bar)]	$q_{V\ max}$ [gpm (l/min)]	NG	p_{nom}/p_{max} [psi (bar)]	q_V [gpm (l/min)]	Code	NG	p_{nom}/p_{max} [psi (bar)]	q_V [gpm (l/min)]	Code
60	450/530 (6523/7687)	73 (276)	22	5100/6100 (350/420)	63 (240)	7	20 (BVD)	5100/6100 (350/420)	58 (220)	7W
85		88 (332)								
115		108 (410)	32		106 (400)					
115		108 (410)				8	25 (BVD/BVE)		85 (320)	8W
150		131 (494)					25 (BVD)			
170		141 (533)								
150		131 (494)	–	4351/ 6672 (300/460)	145 (550)	5	25 (BVE)	5100/6100 (350/420)	85 (320)	5W
170		141 (533)								
215		166 (628)					25 (BVD/BVE)			
215		166 (628)				9	32 (BVD/BVE)	5100/5802 (350/400)	166 (628)	9W

Mounting the counterbalance valve

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

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

1) Pressure relief valve
2) Counterbalance valve, double-acting
3) Counterbalance valve, one-sided

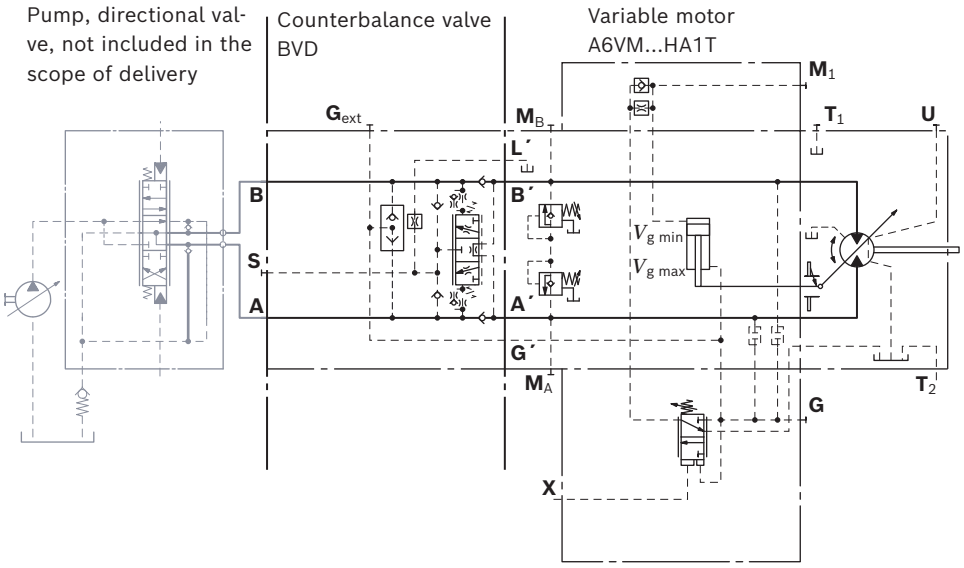
Counterbalance valve for travel drives BVD...F

Application option

- Travel drive for wheeled excavators (BVD and BVE)

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

A6VM085HA1T30004A/71CWV0C2S97W0-0 + BVD20F27S/41B–V03K16D0400S12



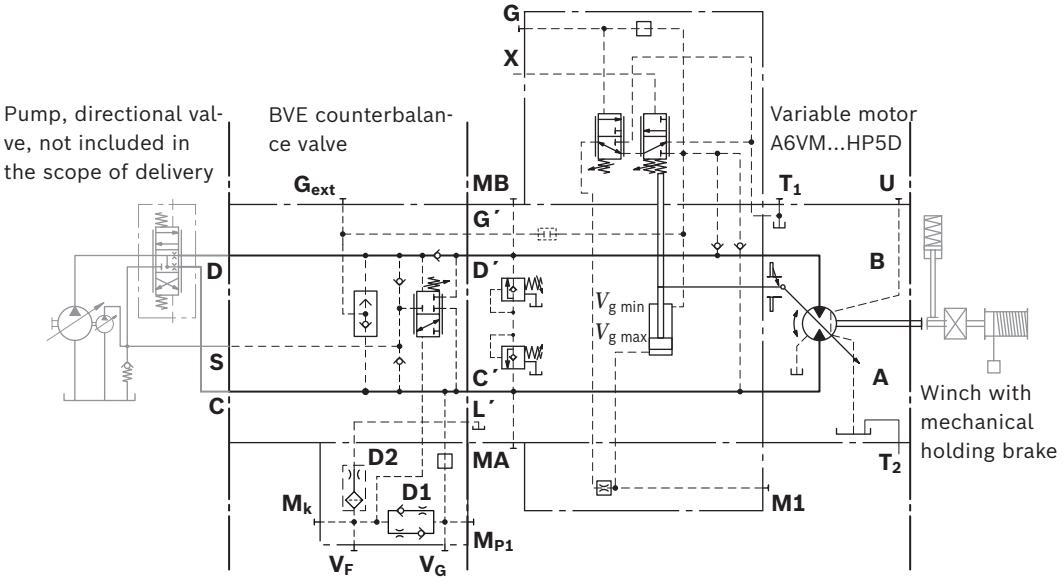
Counterbalance valve for winches and track drive BVD...W and BVE

Application option

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

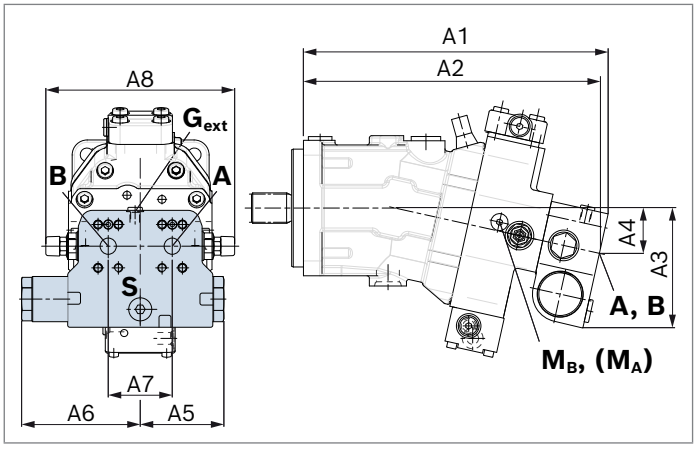
▼ **Example circuit diagram for winch drive in cranes**

A6VM085HA1T30004A/71CWV0C2S97W0-0 + BVE25W38S/51ND-V100K00D4599T30S00-0

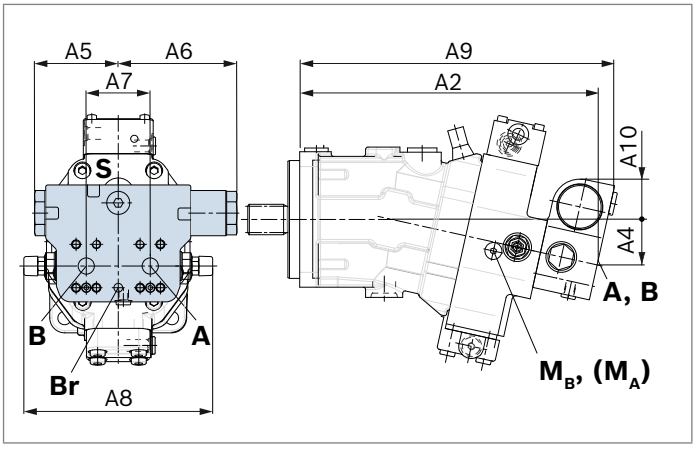


Dimensions

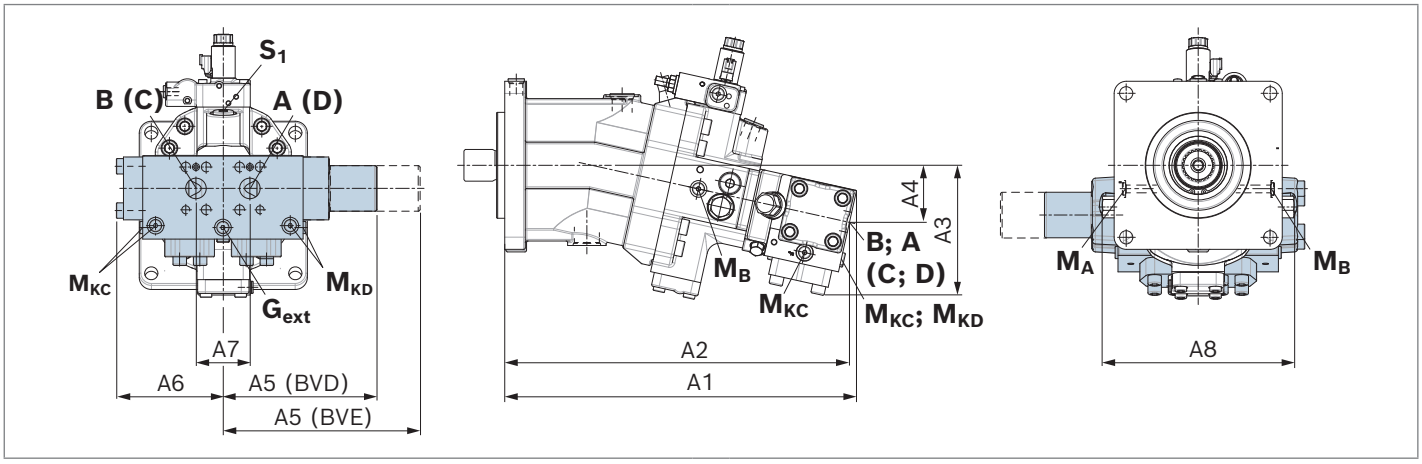
▼ **A6VM...HA, HP1, HP2 or EP1, EP2 with BVD/BVE 20/25**



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



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



A6VM	Counterbalance valve										
NG...plate	Type	Ports	Dimensions								
		A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
60...7	BVD20...17	3/4 in	13.19 (335)	12.83 (326)	5.63 (143)	1.97 (50)	3.86 (98)	5.47 (139)	2.95 (75)	8.74 (222)	13.78 (350)	1.97 (50)
85...7	BVD20...27	1 in	14.33 (364)	13.98 (355)	5.83 (148)	2.17 (55)	3.86 (98)	5.47 (139)	2.95 (75)	8.74 (222)	14.92 (379)	1.81 (46)
115...7	BVD20...28	1 in	15.51 (394)	15.16 (385)	5.98 (152)	2.32 (59)	3.86 (98)	5.47 (139)	3.31 (84)	9.21 (234)	16.10 (409)	1.61 (41)
115...8	BVD25...38	1 1/4 in	16.22 (412)	15.83 (402)	6.50 (165)	2.48 (63)	4.74 (120.5)	6.89 (175)	3.31 (84)	9.37 (238)	16.81 (427)	2.20 (56)
150...8	BVD25...38	1 1/4 in	17.44 (443)	17.01 (433)	6.61 (168)	2.64 (67)	4.74 (120.5)	6.89 (175)	3.31 (84)	9.37 (238)	18.03 (458)	2.09 (53)
170...8	BVD25...38	1 1/4 in	17.68 (449)	17.28 (439)	6.69 (170)	2.68 (68)	4.74 (120.5)	6.89 (175)	3.31 (84)	9.37 (238)	18.27 (464)	2.01 (51)
215...5	BVD25...38	1 1/4 in	18.90 (480)	18.50 (470)	6.93 (176)	2.91 (74)	4.74 (120.5)	6.89 (175)	3.31 (84)	11.77 (299)	19.49 (495)	1.81 (46)
215...9	BVD32...38	1 1/4 in	21.57 (548)	21.14 (537)	7.99 (203)	3.50 (89)	9.45 (240)	6.54 (166)	3.31 (84)	11.77 (299)	–	1.81 (46)
115...8	BVE25...38	1 1/4 in	16.22 (412)	15.83 (402)	6.73 (171)	2.48 (63)	5.39 (137)	8.43 (214)	3.31 (84)	9.37 (238)	16.89 (429)	2.48 (63)
150...8	BVE25...38	1 1/4 in	17.44 (443)	17.01 (433)	6.89 (175)	2.64 (67)	5.39 (137)	8.43 (214)	3.31 (84)	9.37 (238)	17.91 (455)	2.32 (59)
170...8	BVE25...38	1 1/4 in	17.68 (449)	17.28 (439)	6.93 (176)	2.68 (68)	5.39 (137)	8.43 (214)	3.31 (84)	9.37 (238)	18.27 (464)	2.32 (59)
215...5	BVE25...38	1 1/4 in	18.90 (480)	18.50 (470)	7.17 (182)	2.91 (74)	5.39 (137)	8.43 (214)	3.31 (84)	11.77 (299)	18.23 (463)	2.05 (52)
215...9	BVE32...38	1 1/4 in	21.57 (548)	21.14 (537)	7.99 (203)	2.91 (88)	9.45 (240)	6.54 (166)	3.31 (84)	11.77 (299)	–	1.81 (46)

Ports		Version	A6VM plate	Standard	Size[2]	P_{max} [bar][3]	State[5]
A, **B**	Working line			SAE J518	see table above	6100 (420)	O
S, S_1	Boost port	BVD20, BVD32		DIN 3852[4]	M22 × 1.5; 0.55 (14 deep)	435 (30)	X
		BVD25, BVE25		DIN 3852[4]	M27 × 2; 0.6299 (16 deep)	435 (30)	X
B_r	Brake release port, reduced high pressure	L	7	DIN 3852[4]	M12 × 1.5; 0.49 (12.5 deep)	435 (30)	O
			8	DIN 3852[4]	M12 × 1.5; 0.47 (12 deep)	435 (30)	O
G_{ext}	Brake release port, high pressure	S		DIN 3852[4]	M12 × 1.5; 0.49 (12.5 deep)	6100 (420)	X
M_A, M_B	Measuring port, pressure **A**, **B**			ISO 6149[4]	M18 × 1.5; 0.57 (14.5 deep)	6100 (420)	X
M_C	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[4]	M14 × 1.5; 0.47 (12 deep)	6100 (420)	X
M_K	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[4]	M14 × 1.5; 0.47 (12 deep)	5800 (400)	X
M_{KC}	Measuring port, pressure counterbalance spool **C**	BVD32, BVE32		DIN 3852[4]	M14 × 1.5; 0.47 (12 deep)	5800 (400)	X
M_{KD}	Measuring port, pressure counterbalance spool **D**	BVE32, BVE32		DIN 3852[4]	M14 × 1.5; 0.47 (12 deep)	5800 (400)	X
M_{P1}	Measuring port, pressure counterbalance spool	BVE25/53		DIN 3852[4]	M14 × 1.5; 0.47 (12 deep)	6100 (420)	X

1) At the mounting version for the controls HP5, HP6 and EP5, EP6, the cast-in port designations **A** and **B** on the counterbalance valve BVD do not correspond with the port designation of the A6VM motor.
The designation of the ports on the installation drawing of the motor is binding!

2) For information on tightening torques, see the instruction manual.

3) Momentary pressure peaks can occur depending on application. Keep this in mind when selecting measuring devices and fittings.

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

5) O = Needs to be connected (comes plugged)
X = Plugged (in normal operation)

Integrated BVI counterbalance valve

Function

The integrated counterbalance valves for track drives in crawler excavators should reduce the danger of overspeed and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking or driving downhill, the rotational speed of the motor is greater than it should be for the given inlet flow, causing the supply pressure to fall sharply.

If the supply pressure falls below the level specified for the relevant counterbalance valve, the counterbalance valve spool moves into the closed position. The cross-sectional area of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor reaches the specified value for the given inlet flow.

Notice

- BVI available for sizes 150 and 170.
- The counterbalance valve must be ordered additionally. Order example: A6VM150HP6000001A/71MWV0R4A 16Y0-0 + BVI540603002-0
- Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- The counterbalance valve does not replace the mechanical service brake and holding brake.
- For the design of the brake release valve, we require the following data for the mechanical holding brake:
  - the cracking pressure
  - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 505 psi (21 bar))
  - the required closing time for a warm device (oil viscosity approx. 69.6 SUS (15 mm²/s))

Type code

01	02	03	04	05		06
BVI					**–**	

Counterbalance valve

01	Counterbalance valve integrated	**BVI**

Brake piston version		q_v **[gpm (l/min)]**	**Material number**	
02	Volume preselection	≤ 39 (150)	R902038832	**51**
		= 39 – 56 (150 – 210)	R902038936	**52**
		= 56 – 71 (210 – 270)	R902038833	**53**
		= 71 – 87 (270 – 330)	R902038834	**54**
		= 87 – 106 (330 – 400)	R902038835	**55**
		≥ 106 (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**

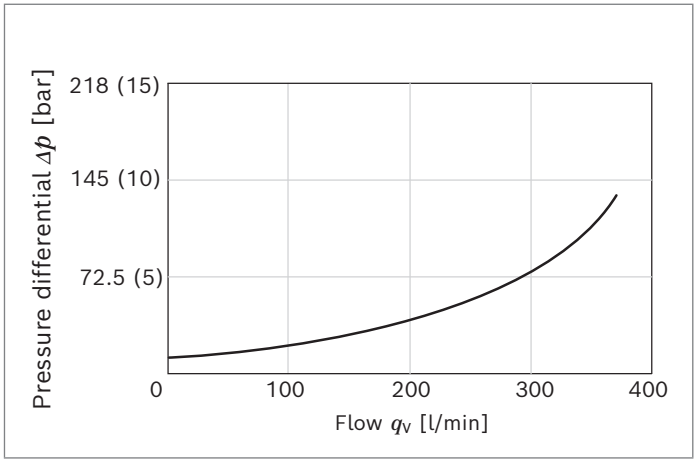
Technical data

Working pressure	Nominal pressure	p	5076 psi (350 bar)
	Maximum pressure	p	6092 psi (420 bar)
Flow, maximum		$q_{v\,max}$	106 gpm (400 l/min)
Counterbalance spool	Start of opening	p	174 psi (12 bar)
	Fully open	p	377 psi (26 bar)
Pressure reducing valve for brake release (fixed setting)	Control pressure	p	$0.33^{+0.06}$ psi (21+4 bar)
	Beginning of control	p	$0.16^{+0.06}$ psi (10^{+4} bar)

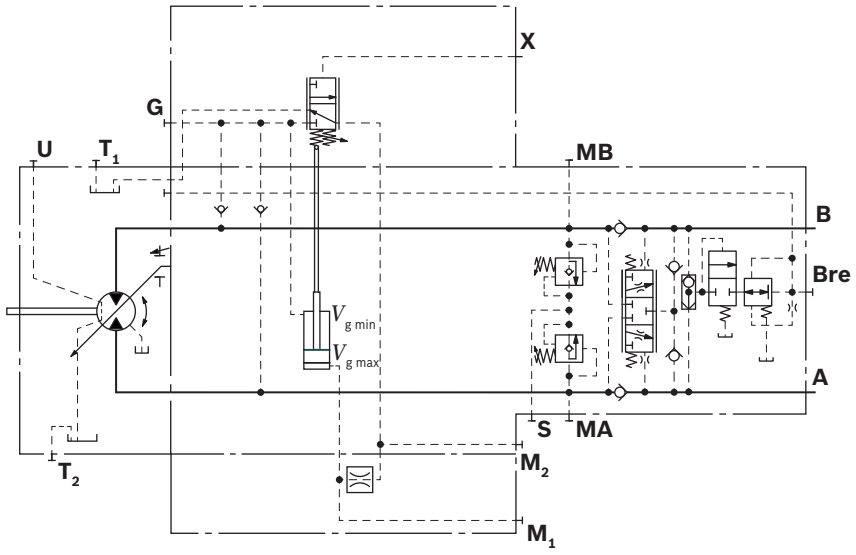
Permissible inlet flow or pressure when using pressure relief valve and BVI

Motor NG	Without restrictions Standard plate (1 + 2)		Limited values Plate with integrated counterbalance valve (6)	
				BVI + PRV
	p_{nom}/p_{max} [psi (bar)]	$q_{V\,max}$ [gpm (l/min)]	p_{nom}/p_{max} [psi (bar)]	q_V [gpm (l/min)]
150	6500/7687 (450/530)	108 (410)	5100/6100 (350/420)	106 (400)
170		141 (533)		

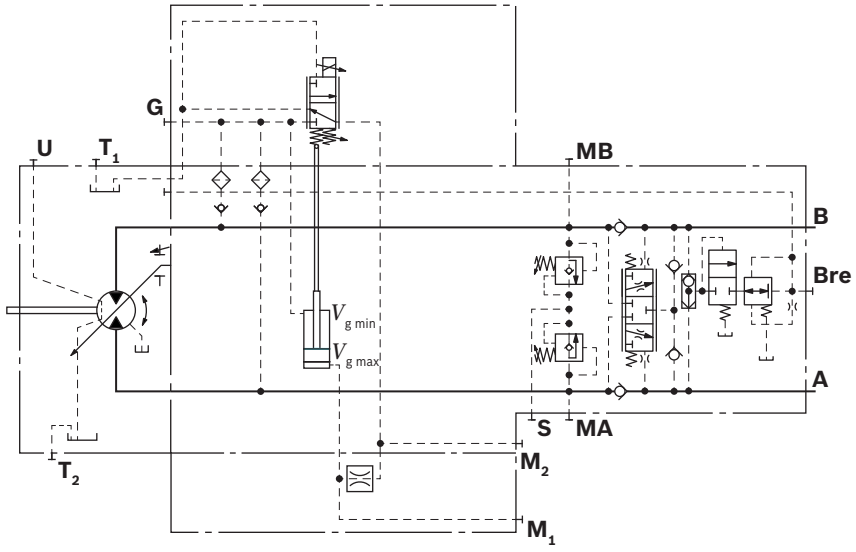
▼ **Boost characteristic**



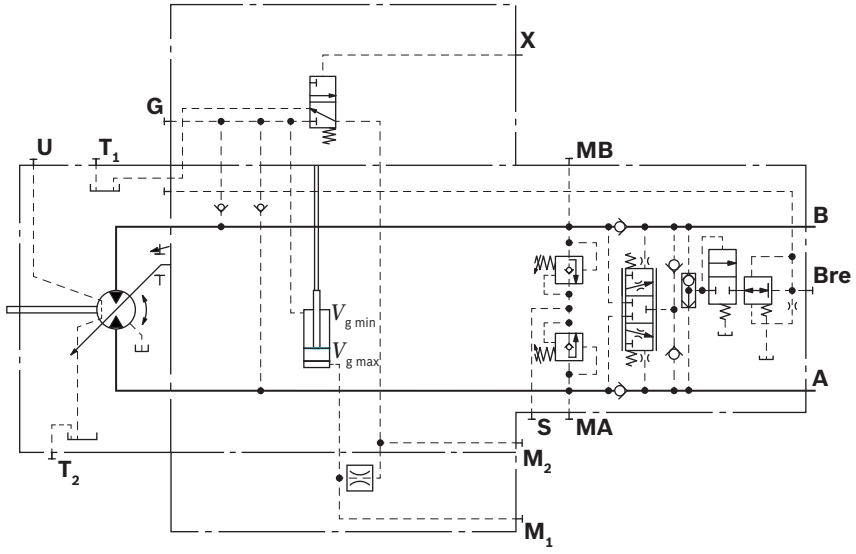
▼ **Circuit diagram HP5**



▼ **Circuit diagram EP5**



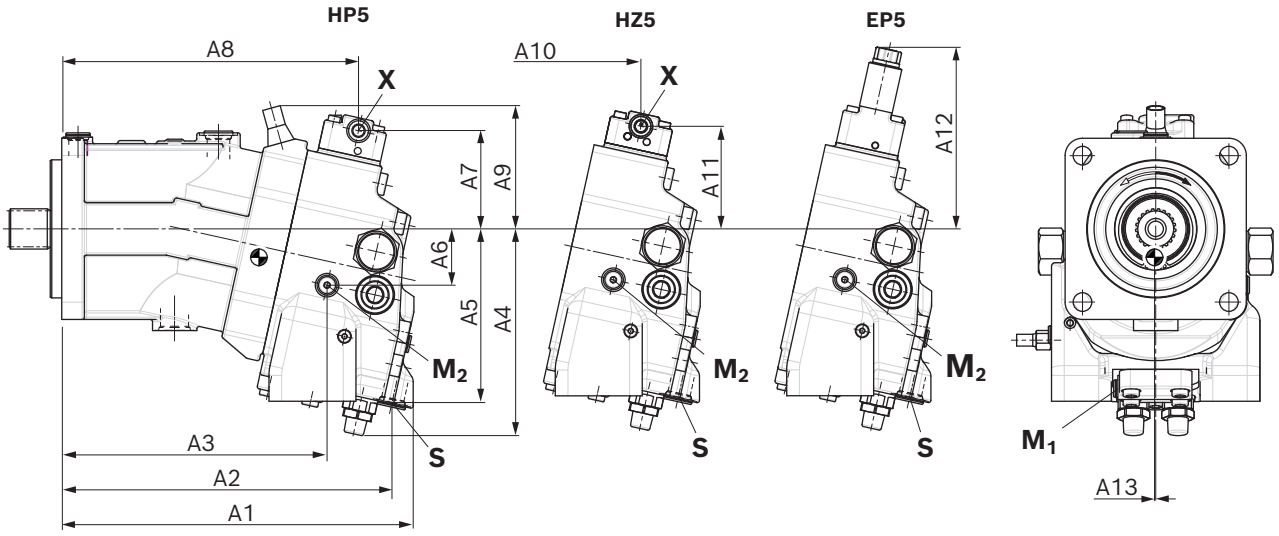
▼ **Circuit diagram HZ5**

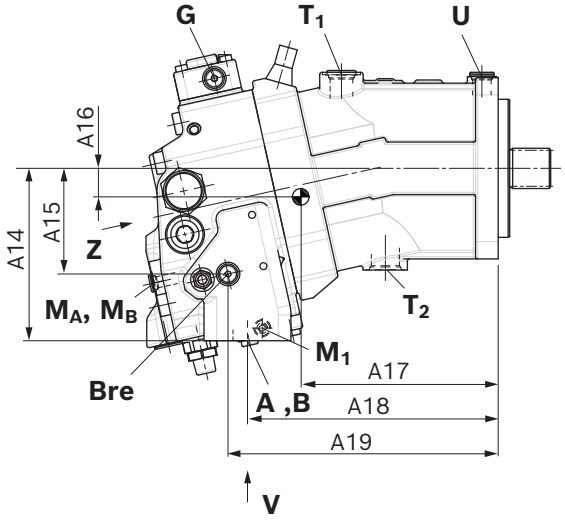


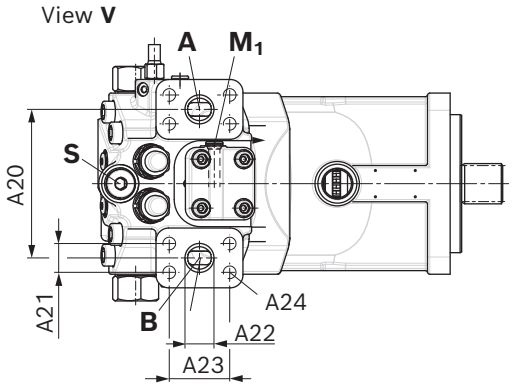
Integrated BVI counterbalance valve dimensions

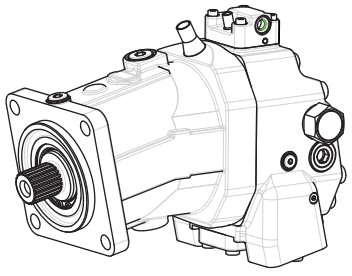
HP5 – Two-point control, hydraulic

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



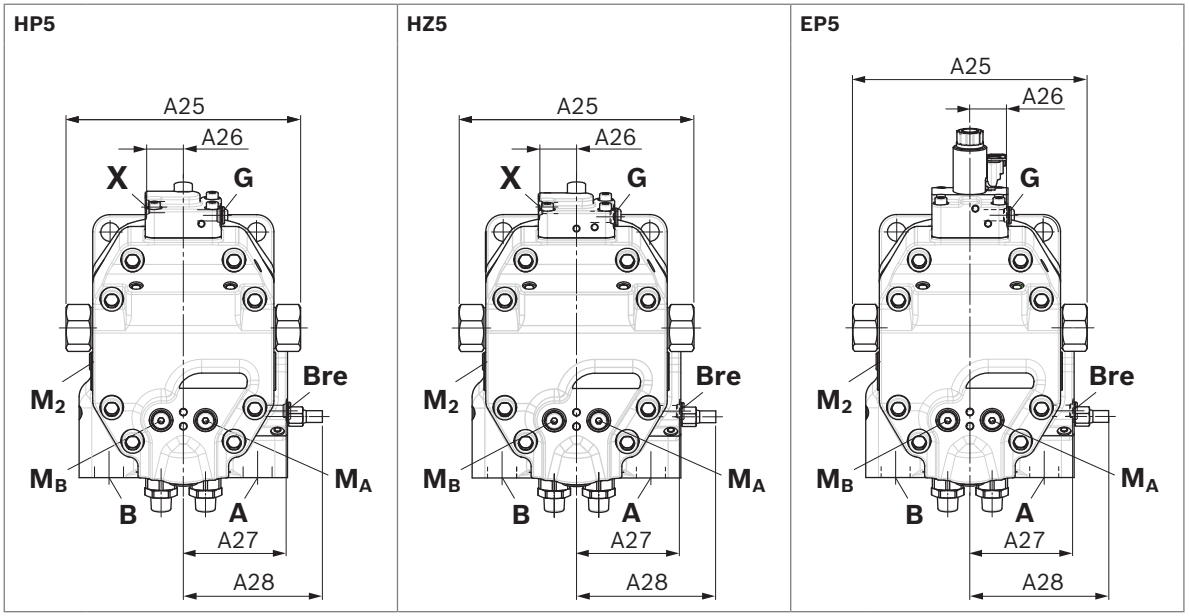






Center of gravity

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



A6VM NG	Port A, B	Dimensions A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
150	1 1/4 in	15.05 (382.3)	14.09 (358)	11.28 (286.5)	8.94 (227)	7.48 (190)	2.40 (61)	4.29 (109)	12.64 (321)	max. 5.28 (134)	12.48 (317)	4.21 (107)	7.72 (196)	0.04 (1.0)
170	1 1/4 in	15.31 (389)	14.35 (354.4)	11.53 (292.8)	8.98 (228)	7.56 (192)	2.44 (62)	4.25 (108)	12.89 (327.5)	max. 5.32 (135)	12.72 (323)	4.21 (107)	7.68 (195)	0.04 (1.0)

A6VM NG	Dimensions A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24 (DIN 13)	A25	A26	A27	A28
150	7.44 (189)	4.53 (115)	0.98 (25)	6.69 (170)	10.63 (270)	11.47 (292)	6.46 (164)	1.24 (31.8)	1.26 (32)	2.63 (66.7)	M14 × 2; 19 deep	10.12 (259)	1.59 (40.5)	4.47 (113.5)	6.06 (154)
170	7.48 (190)	4.61 (117)	1.14 (29)	7.52 (191)	10.87 (276)	11.73 (298)	6.46 (164)	1.24 (31.8)	1.26 (32)	2.63 (66.7)	M14 × 2; 19 deep	10.12 (259)	1.59 (40.5)	4.47 (113.5)	6.06 (154)

Ports	Working line SAE J518[1]	Drain port ISO 6149[2]	Drain port ISO 6149[2]	Bearing flushing port ISO 6149[2]	Pilot pressure port ISO 6149[2]	Boost pressure supply ISO 6149[2]
NG	A, B	T_1	T_2	U	X	S
150	see table above	M27 × 2; 19 deep	M33 × 2; 19 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
170		M27 × 2; 19 deep	M33 × 2; 19 deep	M22 × 1.5; 15.5 deep	M14 × 1.5; 11.5 deep	M27 × 2; 19 deep
p_{max} [psi (bar)][3]	6100 (420)	0.12 (3)	0.12 (3)	0.12 (3)	3.94 (100)	435 (30)
State[5]	O	X[4]	O[4]	X	O	X

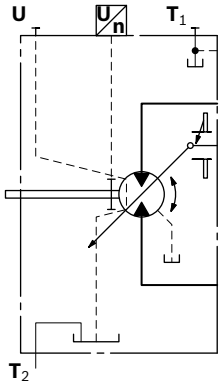
Ports	Measuring port pressure A / pressure B	Control pressure measuring port	Measuring port, stroking chamber	Brake release, external	Synchronous control ISO 6149[2]
NG	M_A, M_B	M_1	M_2	Bre	G
150	M14 × 1.5; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep
170	M14 × 1.5; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep	M14 × 1; 11.5 deep
p_{max} [psi bar)][3]	6100 (420)	6100 (420)	6100 (420)	435 (30)	6100 (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 can be deeper than as 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 39).
5) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

Speed sensor

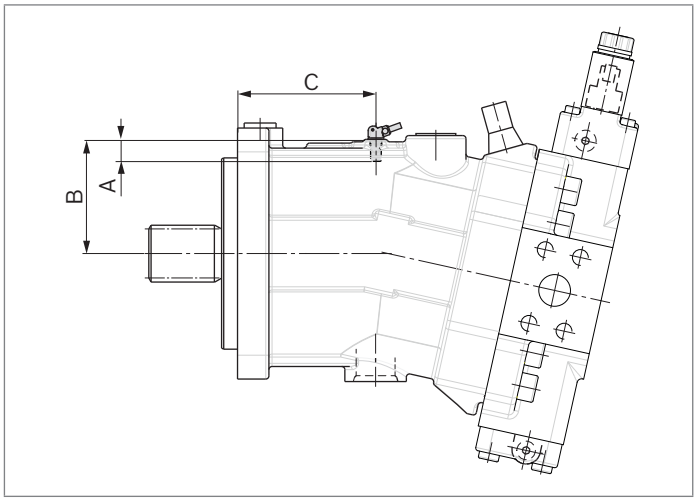
Version A6VM...U (“prepared for speed sensor”, i.e. without sensor) is equipped with a spline on the rotary group.
A signal proportional to motor speed can be generated with the mounted speed sensor DSA. The DSA sensor measures the rotational speed and direction of rotation.
Type code, technical data, dimensions and parameters for the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95133 (DSA).
The sensor is mounted on the port provided for this purpose with a mounting bolt. On deliveries without sensor, the port is plugged with a pressure-resistant cover.
We recommend ordering the A6VM variable motor complete with mounted sensor.

▼ **Circuit diagram EP**



▼ **Dimensions**

Version “V”, with mounted speed sensor



Size		60	85	115	150	170	215
Number of teeth		54	58	67	72	75	80
A	Insertion depth (tolerance -0.0098 (-0.25))	0.72 (18.4)	0.72 (18.4)	0.72 (18.4)	0.72 (18.4)	0.72 (18.4)	0.72 (18.4)
B	Contact surface	2.95 (75)	3.11 (79)	3.46 (88)	3.66 (93)	3.78 (96)	3.98 (101)
C		3.55 (90.2)	3.91 (99.2)	4.30 (109.2)	4.84 (123.4)	4.87 (123.7)	95.2 (127.2)

Setting range for displacement

	60				85				115			
	$V_{g\,max}$ [in³/rev (cm³/rev)]		$V^{g}{}_{min}$ [in³/rev (cm³/rev)]		$V_{g\,max}$ [in³/rev (cm³/rev)]		$V_{g\,min}$ [in³/rev (cm³/rev)]		$V_{g\,max}$ [in³/rev (cm³/rev)]		$V_{g\,min}$ [in³/rev (cm³/rev)]	
	from	to	from	to	from	to	from	to	from	to	from	to
A	3.78 (62.0)	3.78 (62.0)	0.0 (0.0)	0.9 (15.0)	3.35 (85.2)	3.35 (85.2)	0.0 (0.0)	0.55 (9.0)	7.05 (115.6)	7.05 (115.6)	0.0 (0.0)	1.46 (24.0)
	without screw		M10 × 60 R909154690		without screw		M12 × 60 R909083530		without screw		M12 × 70 R909085976	
B	3.78 (62.0)	3.78 (62.0)	> 0.92 (> 15.0)	1.86 (30.5)	3.35 (85.2)	3.35 (85.2)	> 0.55 (> 9.0)	1.71 (28.0)	7.05 (115.6)	7.05 (115.6)	> 1.46 (> 24.0)	2.90 (47.5)
	without screw		M10 × 70 R909153779		without screw		M12 × 70 R909085976		without screw		M12 × 80 R909153075	
C	3.78 (62.0)	3.78 (62.0)	> 1.86 (> 30.5)	2.62 (43.0)	3.35 (85.2)	3.35 (85.2)	> 1.71 (> 28.00)	2.87 (47.0)	7.05 (115.6)	7.05 (115.6)	> 2.90 (> 47.5)	4.33 (71.0)
	without screw		M10 × 80 R909154058		without screw		M12 × 80 R909153075		without screw		M12 × 90 R909154041	
D	x		x		3.35 (85.2)	3.35 (85.2)	> 2.87 (> 47.0)	3.60 (59.0)	7.05 (115.6)	7.05 (115.6)	> 4.33 (> 71.0)	4.88 (80.0)
					without screw		M12 × 90 R909154041		without screw		M12 × 100 R909153975	
E	< 3.78 (< 62.0)	2.90 (47.5)	0.0 (0.0)	0.92 (15.0)	3.35 (85.2)	3.03 (77.0)	0.0 (0.0)	0.55 (9.0)	< 7.05 (< 115.6)	5.71 (93.5)	0.0 (0.0)	1.46 (24.0)
	M10 × 60 R909154690		M10 × 60 R909154690		M12 × 60 R909083530		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976	
F	< 3.78 (< 62.0)	2.90 (47.5)	> 0.92 (> 15.0)	1.86 (30.5)	3.35 (85.2)	3.03 (77.0)	> 0.55 (> 9.0)	1.71 (28.0)	< 7.05 (< 115.6)	5.71 (93.5)	> 1.46 (> 24.0)	2.90 (47.5)
	M10 × 60 R909154690		M10 × 70 R909153779		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075	
G	< 3.78 (< 62.0)	2.90 (47.5)	> 1.86 (> 30.5)	2.62 (43.0)	3.35 (85.2)	3.03 (77.0)	> 1.71 (> 28.00)	2.87 (47.0)	< 7.05 (< 115.6)	5.71 (93.5)	> 2.90 (> 47.5)	4.33 (71.0)
	M10 × 60 R909154690		M10 × 80 R909154058		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 90 R909154041	
H	x		x		3.35 (85.2)	3.03 (77.0)	> 2.87 (> 47.0)	3.60 (59.0)	< 7.05 (< 115.6)	5.71 (93.5)	> 4.33 (> 71.0)	4.88 (80.0)
					M12 × 60 R909083530		M12 × 90 R909154041		M12 × 70 R909085976		M12 × 100 R909153975	
J	< 2.90 (< 47.5)	2.01 (33.0)	0.0 (0.0)	0.92 (15.0)	< 3.03 (< 77.0)	2.28 (58.0)	0.0 (0.0)	0.55 (9.0)	< 5.71 (< 93.5)	4.33 (71.0)	0.0	1.46 (24.0)
	M10 × 70 R909153779		M10 × 60 R909154690		M12 × 70 R909085976		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976	
K	< 2.90 (< 47.5)	2.01 (33.0)	> 0.92 (> 15.0)	1.86 (30.5)	< 3.03 (< 77.0)	2.28 (58.0)	> 0.55 (> 9.0)	1.71 (28.0)	< 5.71 (< 93.5)	4.33 (71.0)	> 1.46 (> 24.0)	2.90 (47.5)
	M10 × 70 R909153779		M10 × 70 R909153779		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075	
L	< 2.90 (< 47.5)	2.01 (33.0)	> 1.86 (>30.5)	2.62 (43.0)	< 3.03 (< 77.0)	2.28 (58.0)	> 1.71 (> 28.00)	2.87 (47.0)	< 5.71 (< 93.5)	4.33 (71.0)	> 2.90 (> 47.5)	4.33 (71.0)
	M10 × 70 R909153779		M10 × 80 R909154058		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041	
M	x		x		< 3.03 (< 77.0)	2.28 (58.0)	> 2.87 (> 47.0)	3.60 (59.0)	< 5.71 (< 93.5)	4.33 (71.0)	> 4.33 (> 71.0)	4.88 (80.0)
					M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975	

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

- $V_{g\,min}$ = ... in³ (cm³), $V_{g\,max}$ = ... in³ (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.

	150				170				215			
	$V_{g\,max}$ [in³/rev (cm³/rev)]		$V_{g\,min}$ [in³/rev (cm³/rev)]		$V_{g\,max}$ [in³/rev (cm³/rev)]		$V_{g\,min}$ [in³/rev (cm³/rev)]		$V_{g\,max}$ [in³/rev (cm³/rev)]		$V_{g\,min}$ [in³/rev (cm³/rev)]	
	from	to	from	to	from	to	from	to	from	to	from	to
A	9.28 (152.1)	9.28 (152.1)	0.0 (0.0)	2.68 (44.0)	10.48 (171.8)	10.48 (171.8)	0.0 (0.0)	2.14 (35.0)	13.21 (216.5)	13.21 (216.5)	0.0 (0.0)	2.72 (44.5)
	without screw		M12 × 80 R909153075		without screw		M12 x 80 R909153075		without screw		M12 × 80 R909153075	
B	9.28 (152.1)	9.28 (152.1)	> 2.68 (> 44.0)	4.21 (69.0)	10.48 (171.8)	10.48 (171.8)	> 2.14 (> 35.0)	3.87 (63.5)	13.21 (216.5)	13.21 (216.5)	> 2.72 (> 44.5)	4.88 (80.0)
	without screw		M12 × 90 R909154041		without screw		M12 × 90 R909154041		without screw		M12 × 90 R909154041	
C	9.28 (152.1)	9.28 (152.1)	> 4.21 (> 69.0)	6.04 (99.0)	10.48 (171.8)	10.48 (171.8)	> 3.87 (> 63.5)	5.98 (98.0)	13.21 (216.5)	13.21 (216.5)	> 4.88 (> 80.0)	7.02 (115.0)
	without screw		M12 × 100 R909153975		without screw		M12 × 100 R909153975		without screw		M12 × 100 R909153975	
D	9.28 (152.1)	9.28 (152.1)	> 6.04 (> 99.0)	6.04 (106.0)	10.48 (171.8)	10.48 (171.8)	> 5.98 (> 98.0)	9.15 (120.0)	13.21 (216.5)	13.21 (216.5)	> 7.02 (> 115.0)	9.15 (150.0)
	without screw		M12 × 110 R909154212		without screw		M12 × 110 R909154212		without screw		M12 × 110 R909154212	
E	< 9.28 (<152.1)	6.77 (111.0)	0.0 (0.0)	2.68 (44.0)	< 10.48 (< 171.8)	8.48 (139.0)	0.0 (0.0)	2.14 (35.0)	< 13.21 (< 216.5)	10.68 (175.0)	0.0 (0.0)	2.72 (44.5)
	M12 × 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075		M12 x 80 R909153075		M12 × 80 R909153075		M12 × 80 R909153075	
F	< 9.28 (<152.1)	6.77 (111.0)	> 2.68 (> 44.0)	4.21 (69.0)	< 10.48 (< 171.8)	8.48 (139.0)	> 2.14 (> 35.0)	3.87 (63.5)	< 13.21 (< 216.5)	10.68 (175.0)	> 2.72 (> 44.5)	4.88 (80.0)
	M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041	
G	< 9.28 (<152.1)	6.77 (111.0)	> 4.21 (> 69.0)	6.04 (99.0)	< 10.48 (< 171.8)	8.48 (139.0)	> 3.87 (> 63.5)	3.86 (98.0)	< 13.21 (< 216.5)	10.68 (175.0)	> 4.88 (> 80.0)	7.02 (115.0)
	M12 × 80 R909153075		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 100 R909153975	
H	< 9.28 (<152.1)	6.77 (111.0)	> 6.04 (> 99.0)	6.47 (106.0)	< 10.48 (< 171.8)	8.48 (139.0)	> 3.86 (> 98.0)	7.32 (120.0)	< 13.21 (< 216.5)	10.68 (175.0)	> 7.02 (> 115.0)	9.15 (150.0)
	M12 × 80 R909153075		M12 × 110 R909154212		M12 × 80 R909153075		M12 × 110 R909154212		M12 × 80 R909153075		M12 × 110 R909154212	
J	< 6.77 (< 111.0)	5.31 (87.0)	0.0 (0.0)	2.68 (44.0)	< 8.48 (< 139.0)	6.83 (112.0)	0.0 (0.0)	2.14 (35.0)	< 10.68 (< 175.0)	8.60 (141.0)	0.0 (0.0)	2.72 (44.5)
	M12 × 90 R909154041		M12 × 80 R909153075		M12 × 90 R909154041		M10 x 80 R909153075		M12 × 90 R909154041		M12 × 80 R909153075	
K	< 6.77 (< 111.0)	5.31 (87.0)	> 2.68 (> 44.0)	4.21 (69.0)	< 8.48 (< 139.0)	6.83 (112.0)	> 2.14 (> 35.0)	3.87 (63.5)	< 10.68 (< 175.0)	8.60 (141.0)	> 2.72 (> 44.5)	4.88 (80.0)
	M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 90 R909154041	
L	< 6.77 (< 111.0)	5.31 (87.0)	> 4.21 (> 69.0)	6.04 (99.0)	< 8.48 (< 139.0)	6.83 (112.0)	> 3.87 (> 63.5)	5.98 (98.0)	< 10.68 (< 175.0)	8.60 (141.0)	> 4.88 (> 80.0)	7.02 (115.0)
	M12 × 90 R909154041		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 100 R909153975	
M	< 6.77 (< 111.0)	5.31 (87.0)	> 6.04 (> 99.0)	6.47 (106.0)	< 8.48 (< 139.0)	6.83 (112.0)	> 5.98 (> 98.0)	7.32 (120.0)	< 10.68 (< 175.0)	8.60 (141.0)	> 7.02 (> 115.0)	9.15 (150.0)
	M12 × 90 R909154041		M12 × 110 R909154212		M12 × 90 R909154041		M12 × 110 R909154212		M12 × 90 R909154041		M12 × 110 R909154212	

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

- $V_{g\,min}$ = ... in³ (cm³), $V_{g\,max}$ = ... in³ (cm³)

Theoretical, maximum setting:

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

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

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air-bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines. Particularly in the installation position “drive shaft upwards”, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T_1**, **T_2**).

If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operational conditions, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

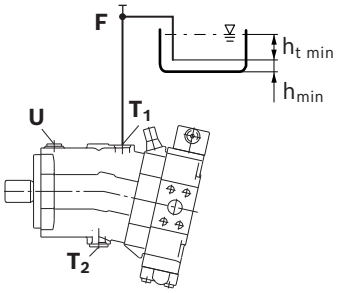
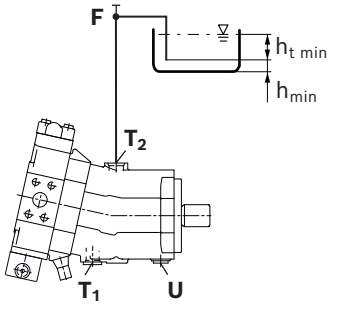
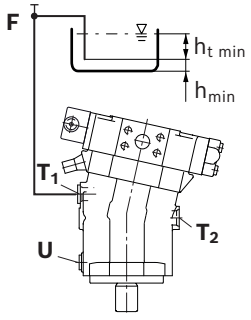
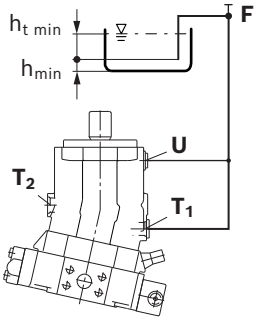
Notice
Effects on the control system are to be expected in certain installation positions. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

Installation position

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

Below-reservoir installation (standard)

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

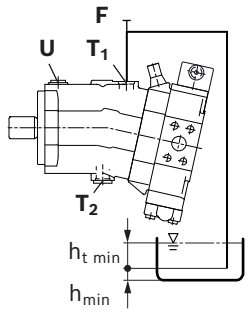
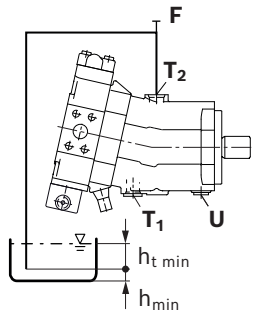
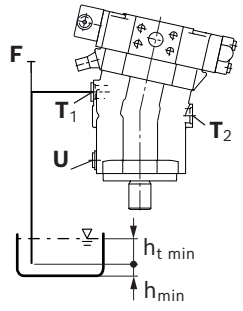
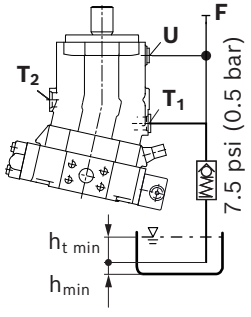
Installation position	Air bleed	Filling
1 		T_1
2 		T_2
3 		T_1
4 	U	T_1

Above-reservoir installation

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

Recommendation for installation position 8 (drive shaft up):

A check valve in the drain line (cracking pressure 7.5 psi (0.5 bar)) can prevent draining of the housing area.

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

Key	
F	Filling/air bleeding
U	Bearing flushing port/air bleeding
T_1, T_2	Drain port
$h_{t\ min}$	Minimum required immersion depth 7.87 in (200 mm)
h_{min}	Minimum required distance to reservoir bottom 3.94 in (100 mm)

Notice

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

Project planning notes

- The motor A6VM is designed to be used in open and closed circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly.If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- For safety reasons, controls with beginning of control at $V_{g\ min}$ (e.g., HA) are not permissible for winch drives, e.g. anchor winches!
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or in the instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure cut-off / Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the 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 9 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- The ports and fastening threads are designed for the permissible pressures p_{max} of the respective ports, see the port tabeles. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The working ports and function ports are only intended to accommodate hydraulic lines.
- Note that series connection of motors and operation under summation pressure have an effect on the efficiency of the units.
- The control behavior of the motor can change slightly due to natural influences such as 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 manufacturer's responsibility to make sure that the load can always be put in a safe mode if needed. Also, he needs to ensure that these measures are properly implemented.
- When using the axial piston motor in winch drives, make certain that the technical limit values are not exceeded under all operating conditions. If the axial piston motor is extremely overloaded (e.g. if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst. The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.

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