# Variable plug-in motor A6VE series 65



- High pressure motor for integration in mechanical gearbox
- Sizes 28 to 200
- Nominal pressure 400 bar (sizes 28 to 200)
- Maximum pressure 450 bar (size 28)
- Maximum pressure 530 bar (sizes 55 to 200)
- Open and closed circuits

**Features**

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

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## Type code

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A6V** | **E** | | | | | **0** | **0** | | | **/** | **65** | **M** | **W** | **V** | **0** | | | | | | **–** | |

**Axial piston unit**

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

**Operating mode**

| | | |
|---|---|---|
| 02 | Plug-in motor | **E** |

**Size (NG)**

| | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|
| 03 | Geometric displacement, see technical data on page 9 | | | | | | | |

**Control device**

| | | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 04 | Proportional control hydraulic | Positive control | $\Delta p_{St}$ = 10 bar | ● | ● | ● | ● | ● | ● | **HP1** |
| | | | $\Delta p_{St}$ = 25 bar | ● | ● | ● | ● | ● | ● | **HP2** |
| | | Negative control | $\Delta p_{St}$ = 10 bar | ● | ● | ● | ● | ● | ● | **HP5** |
| | | | $\Delta p_{St}$ = 25 bar | ● | ● | ● | ● | ● | ● | **HP6** |
| | 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** |
| | | | | – | ● | ● | ● | ●[1] | – | **HZ7** |
| | 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 | $\Delta p$ ≤ approx. 10 bar | ● | ● | ● | ● | ● | ● | **HA1** |
| | | With pressure increase | $\Delta p$ = 100 bar | ● | ● | ● | ● | ● | ● | **HA2** |
| | | With minimum pressure increase | $\Delta p$ ≤ approx. 10 bar | – | – | ● | ● | ● | – | **HA3**[1)2)] |
| | speed related, negative control $p_{St}$ / $p_{HD}$ = 5/100 | Hydr. travel direction valve | | ● | ● | ● | ● | ● | ● | **DA0** |

**Pressure control/override**

| | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|
| 05 | Without pressure control/override | ● | ● | ● | ● | ● | ● | **00** |
| | Pressure control fixed setting, only for HP5, HP6, EP5 and EP6 | ● | ● | ● | ● | ● | ● | **D1** |
| | Override of the HA1, HA2, and HA3 controls, hydraulically remote controlled, proportional | ● | ● | ● | ● | ● | ● | **T3** |

**Connector for solenoids**[3)] (see page "Connector for solenoids" on page 28)

| | | 028 to 200 | |
|---|---|---|---|
| 06 | Without connector (without solenoid, only for hydraulic control) | ● | **0** |
| | DEUTSCH - molded connector, 2-pin, without suppressor diode | ● | **P** |

**Additional function 1**

| | | 028 to 200 | |
|---|---|---|---|
| 07 | Without additional function | ● | **0** |

**Additional function 2**

| | | 028 to 200 | |
|---|---|---|---|
| 08 | Without additional function | ● | **0** |

● = Available ○ = On request – = Not available

1) Only possible in combination with port plate 6 (integrated counterbalance valve)
2) HA3 only in combination with T3
3) Connectors for other electric components may deviate

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A6V** | **E** | | | | | **0** | **0** | | | **/** | **65** | **M** | **W** | **V** | **0** | | | | | | **–** | |

**Stroking time damping** (for selection, see control)

| | | | 028 to 200 | |
|---|---|---|---|---|
| 09 | Without damping (standard with HP and EP) | | ● | **0** |
| | Damping | HP, EP, HP5,6D. and EP5,6D., HZ, EZ, HA with counterbalance valve BVD/BVE/BVI | ● | **1** |
| | | One-sided in inlet to large stroking chamber (HA) | ● | **4** |

**Setting range for displacement**[4)]

| | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | $V_{g\,max}$ setting screw | $V_{g\,min}$ setting screw | | | | | | | |
| | Without setting screw[5)] | Short (0-adjustable) | ● | ● | ● | ● | ● | ● | **A** |
| | | Moderate | ● | ● | ● | ● | ● | ● | **B** |
| | | Long | ● | ● | ● | ● | ● | ● | **C** |
| | | Extra long | – | – | – | ● | ● | ● | **D** |
| | Short | Short (0-adjustable) | ● | ● | ● | ● | ● | ● | **E** |
| | | Moderate | ● | ● | ● | ● | ● | ● | **F** |
| | | Long | ● | ● | ● | ● | ● | ● | **G** |
| | | Extra long | – | – | – | ● | ● | ● | **H** |
| | Medium | Short (0-adjustable) | ● | ● | ● | ● | ● | ● | **J** |
| | | Moderate | ● | ● | ● | ● | ● | ● | **K** |
| | | Long | ● | ● | ● | ● | ● | ● | **L** |
| | | Extra long | – | – | – | ● | ● | ● | **M** |

**Series**

| | | 028 to 200 | |
|---|---|---|---|
| 11 | Series 6, index 5 | ● | **65** |

**Version of port and fastening threads**

| | | 028 | 055 to 200 | |
|---|---|---|---|---|
| 12 | Metric ports based on ISO 6149 with O-ring seal, metric fastening threads according to DIN 13 | – | ● | **M** |
| | Metric ports based on DIN 3852 with profile sealing ring, metric fastening thread according to DIN 13 | ● | – | **N** |

**Direction of rotation**

| | | 028 to 200 | |
|---|---|---|---|
| 13 | Viewed on drive shaft, bidirectional | ● | **W** |

**Sealing material**

| | | 028 to 200 | |
|---|---|---|---|
| 14 | FKM (fluorocarbon rubber) | ● | **V** |

**Drive shaft bearing**

| | | 028 to 200 | |
|---|---|---|---|
| 15 | Standard bearing | ● | **0** |

**Mounting flange**

| | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|
| 16 | ISO 3019-2 | 135-2 | ● | – | – | – | – | – | **I2** |
| | | 160-2 | – | ● | – | – | – | – | **P2** |
| | | 190-2 | – | – | ● | ○ | – | – | **Y2** |
| | | 200-2 | – | – | – | ● | ● | – | **S2** |
| | | 260-4 | – | – | – | – | – | ● | **Z4** |

● = Available ○ = On request – = Not available

4) The settings for the setting screws can be found in the table (page 44 and 45).

5) For NG28 with short threaded pin, not adjustable

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A6V** | **E** | | | | | **0** | **0** | | | **/** | **65** | **M** | **W** | **V** | **0** | | | | | | **–** | |

| **Drive shaft** | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | Splined shaft DIN 5480 | W25×1.25×18×9g | ● | – | – | – | – | – | **Z5** |
| | | W30×2×14×9g | ● | ● | – | – | – | – | **Z6** |
| | | W35×2×16×9g | – | ● | ● | – | – | – | **Z8** |
| | | W40×2×18×9g | – | – | ● | ● | – | – | **Z9** |
| | | W45×2×21×9g | – | – | – | ● | ● | – | **A1** |
| | | W50×2×24×9g | – | – | – | – | ● | ● | **A2** |

| **Working port** | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|
| 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 rear, with lateral measuring ports | | – | – | ○ | ● | ● | ○ | **4** |
| | SAE working ports **A** and **B**, at bottom, with integrated counterbalance valve BVI[6] | | – | ● | ● | ● | ● | – | **6** |
| | Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (pilot operated)[7] | BVD20 | – | ● | ● | ● | – | – | **7** |
| | | BVD25 | – | – | – | ● | ● | – | **8** |
| | | BVE25 | – | – | – | ● | – | – | **8** |
| | Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (direct operated)[7] | BVD25 | – | – | – | – | – | ● | **5** |
| | | BVE25 | – | – | – | – | ● | ● | **5** |
| | | BVD32, BVE32 | – | – | – | – | – | ● | **9** |

| **Valve** (see pages 29 to 42) | | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|---|
| 19 | Without valve | | ● | ● | ● | ● | ● | ● | **0** |
| | With BVD/BVE counterbalance valves mounted[8] | | – | ● | ● | ● | ● | ● | **W** |
| | With integrated brake release valve (only with port plate 6) | For external piping | – | ● | ● | ● | ● | – | **Y** |
| | | For internal ducting | – | ● | ● | ● | ● | – | **Z** |
| | With flushing and boost-pressure valve mounted, flushing on both sides<br>Flushing flow at:<br>$\Delta p = p_{ND} - p_G = 25$ bar and $\nu = 10$ mm²/s<br>($p_{ND}$ = low pressure, $p_G$ = case pressure)<br>Only possible with port plates 1, 2 and 4 | **Flushing flow $q_v$ [l/min]** | | | | | | | |
| | | 3.5 | ● | ● | ● | ● | – | – | **A** |
| | | 5 | ● | ● | ● | ● | – | – | **B** |
| | | 8 | ● | ● | ● | ● | ● | ● | **C** |
| | | 10 | ● | ● | ● | ● | ● | ● | **D** |
| | | 14 | – | ● | ● | ● | – | – | **F** |
| | | 15 | – | – | – | – | ● | ● | **G** |
| | | 16 | – | ● | ● | ● | – | – | **H** |
| | | 18 | – | – | – | ●[9] | ● | ● | **I** |
| | | 21 | – | – | – | ●[9] | ● | ● | **J** |
| | | 27 | – | – | – | ●[9] | ● | ● | **K** |
| | | 31 | – | – | – | ●[9] | ● | ● | **L** |
| | | 37 | – | – | – | – | ● | ● | **M** |

● = Available ○ = On request – = Not available

6) Only for HA3, HZ7, EZ5/6, HP5/6 or EP5/6, each with negative control. HZ5, EZ5/6, HP5/6 and EP5/6 are only available for NG160. Supplement specification for integrated counterbalance valve BVI, see separate type code on page 35. Note the restrictions described on page 36.

7) Only possible in combination with HP, EP and HA control. Note the restrictions described on page 31

8) Type code of counterbalance valve according to data sheet 95522 (BVD), 95526 (BVE BR53), 95528 (BVE/BVD BR52), specify separately Note the restrictions described on pages 31 and 35.

9) Not for EZ7, EZ8 and HZ7

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

**Speed sensor** (see page 43)

| | | 028 | 055 | 080 | 107 | 160 | 200 | |
|---|---|---|---|---|---|---|---|---|
| | Without speed sensor | ● | ● | ● | ● | ● | ● | **0** |
| | Prepared for sensor DSA/20 and DST | ● | ● | ● | ● | ● | ● | **W** |
| | Speed sensor DSA/20 mounted[10)] | ● | ● | ● | ● | ● | ● | **C** |
| | Speed sensor DST mounted[11)] | ● | ● | ● | ● | ● | ● | **E** |

**Standard/special version**

| | | 028 to 200 | |
|---|---|---|---|
| 21 | Standard version | ● | **0** |
| | Standard version with installation variants, e.g. **T** ports open and closed contrary to standard | ● | **Y** |
| | Special version | ● | **S** |

● = Available o = On request – = Not available

**Notice**

- Note the project planning notes on page 48.
- 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.

10) Specify type code of the sensor acc. to data sheet 95126 (DSA/20) separately and observe the requirements for the electronics.

11) Specify type code of the sensor acc. to data sheet 95131 (DST) separately and observe the requirements for the electronics.

## Hydraulic fluid

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

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

**Selection of hydraulic fluid**

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

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

Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (vopt; see selection diagram)

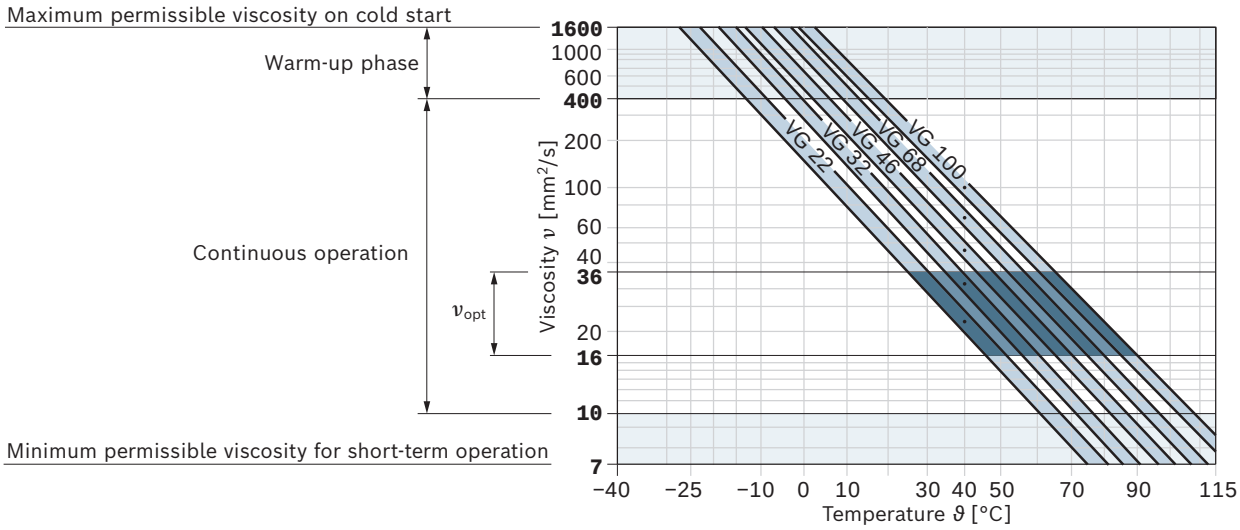
**Notice**
The axial piston unit is not suitable for operation with HFA hydraulic fluids.

**Viscosity and temperature of hydraulic fluids**

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

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

▼ **Selection diagram**




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

2) Special version, please contact us

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

**Filtration of the hydraulic fluid**

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

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

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

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

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

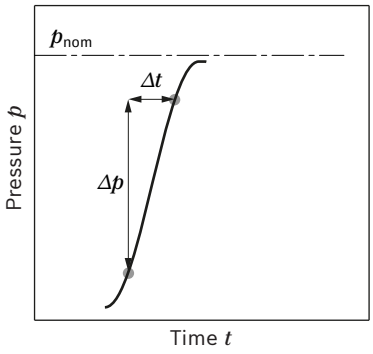
## Flow direction

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

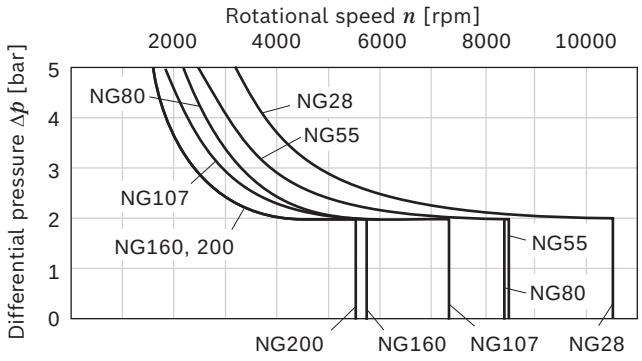
## Working pressure range

| Pressure at working port A or B | | Definition |
|---|---|---|
| Nominal pressure $p_{nom}$ | 400 bar | The nominal pressure corresponds to the maximum design pressure. |
| Maximum pressure $p_{max}$ | 450 bar | The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.<br>Within the total operating period of 300 h, a maximum pressure of 450 bar to 530 bar is permissible for a limited period of 50 h for sizes 55 to 200. |
| Maximum single operating period | 10 s | |
| Total operating period | 300 h | |
| Swivel angle | 100% | |
| Maximum pressure $p_{max}$ NG55 to 200 | 530 bar | |
| Maximum single operating period | 10 s | |
| Total operating period | 50 h | |
| Minimum pressure (high-pressure side) | 25 bar | Minimum pressure on the low-pressure side (**A** or **B**) required to prevent damage to the axial piston unit. |
| Minimum pressure – operation as a pump (inlet) | See diagram (next page) | To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit. |
| Summation pressure $p_{Su}$ (pressure **A** + pressure **B**) | 700 bar | The summation pressure is the sum of the pressures at the ports for the working lines (**A** and **B**) |
| Rate of pressure change $R_{A\,max}$ | | Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range. |
| with integrated pressure relief valve | 9000 bar/s | |
| without pressure relief valve | 16000 bar/s | |
| **Case pressure at port T** | | |
| Continuous differential pressure $\Delta p_{T\,cont}$ | 2 bar | Maximum, averaged differential pressure at the shaft seal (housing pressure to ambient pressure) |
| Maximum differential pressure $\Delta p_{T\,max}$ | See diagram (next page) | Permissible differential pressure at the shaft seal (housing pressure to ambient pressure) |
| Pressure peaks $p_{T\,peak}$ | 10 bar | $t$ < 0.1 s |

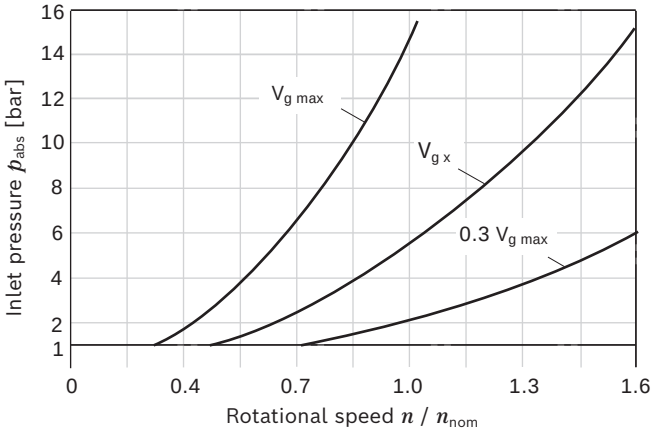
▼ **Rate of pressure change $R_{A\,max}$**




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

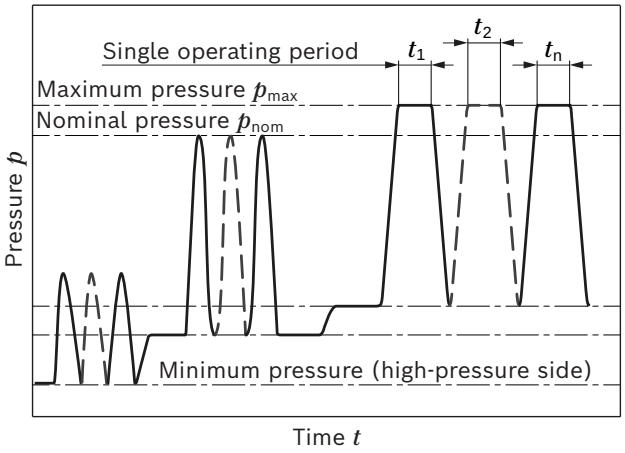



▼ **Minimum pressure – operation as a pump (inlet)**




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

▼ **Pressure definition**




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

**Notice**

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

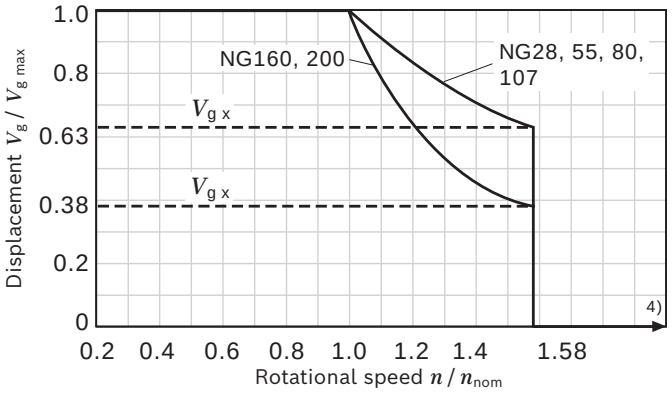
**Effect of case pressure on beginning of control**

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

# Technical data

| Size | | NG | | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|---|---|---|
| Displacement geometric, per revolution | | $V_{g\,max}$ | $cm^3$ | 28.1 | 54.8 | 80 | 107 | 160 | 200 |
| | | $V_{g\,min}$ | $cm^3$ | 0 | 0 | 0 | 0 | 0 | 0 |
| | | $V_{g\,x}$ | $cm^3$ | 18 | 35 | 51 | 68 | 61 | 76 |
| Maximum rotational speed[1] (complying with the maximum permissible inlet flow) | At $V_{g\,max}$ | $n_{nom}$ | rpm | 5550 | 4450 | 3900 | 3550 | 3100 | 2900 |
| | At $V_g < V_{g\,x}$ (see diagram) | $n_{max}$ | rpm | 8750 | 7000 | 6150 | 5600 | 4900 | 4600 |
| | At $V_{g\,0}$ | $n_{max}$ | rpm | 10450 | 8350 | 7350 | 6300 | 5500 | 5100 |
| Inlet flow[2] | At $n_{nom}$ and $V_{g\,max}$ | $q_{v\,max}$ | l/min | 156 | 244 | 312 | 380 | 496 | 580 |
| Torque[3] | At $V_{g\,max}$ and $\Delta p$ = 400 bar | $M$ | Nm | 179 | 349 | 509 | 681 | 1019 | 1273 |
| Rotary stiffness | $V_{g\,max}$ to $V_g/2$ | $c_{min}$ | kNm/rad | 6 | 10 | 16 | 21 | 35 | 44 |
| | $V_g/2$ to 0 (interpolated) | $c_{min}$ | kNm/rad | 18 | 32 | 48 | 65 | 105 | 130 |
| Moment of inertia of the rotary group | | $J_{TW}$ | $kgm^2$ | 0.0014 | 0.0042 | 0.008 | 0.0127 | 0.0253 | 0.0353 |
| Case volume | | $V$ | l | 0.5 | 0.75 | 1.2 | 1.5 | 2.4 | 3.0 |
| Weight approx. | Port plate 1, 2 and 4 | $m$ | kg | approx. 19 | 28 | 36 | 46 | 62 | 78 |
| | Port plate 6 | $m$ | kg | – | 37 | 45 | 52 | 70 | – |

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




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

**Key**

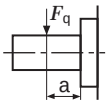
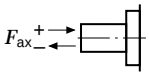
$V_g$ Displacement per revolution [$cm^3$]
$\Delta p$ Differential pressure [bar]
$n$ Rotational speed [rpm]
$\eta_v$ Volumetric efficiency
$\eta_{hm}$ Hydraulic-mechanical efficiency
$\eta_t$ Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

**Notice**

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

1) The values are applicable:
   – for the optimum viscosity range from $v_{opt}$ = 36 to 16 $mm^2/s$
   – with hydraulic fluid based on mineral oils
2) Note inlet flow limitation due to counterbalance valve (page 31).
3) Torque without radial force, with radial force see page 10.
4) Values in this range on request

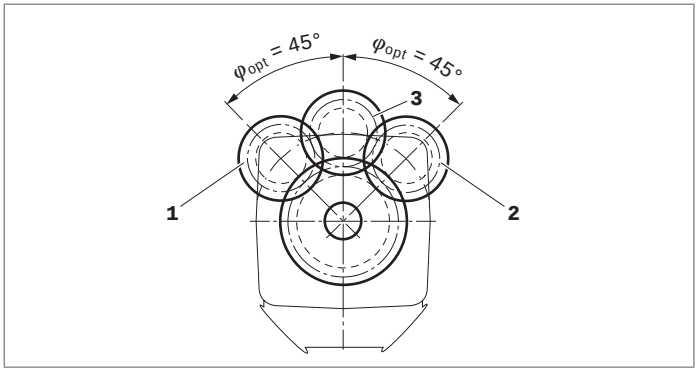
### Permissible radial and axial loading on the drive shafts

| Size | NG | | 28 | 28 | 55 | 55 | 80 | 80 | 107 | 107 | 160 | 160 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drive shaft | | | W25 | W30 | W30 | W35 | W35 | W40 | W40 | W45 | W45 | W50 | W50 |
| Maximum radial force[1)] at distance a (from shaft collar)  | $F_{q\,max}$ | N | 4838 | 6436 | 7581 | 8069 | 10867 | 10283 | 13758 | 12215 | 18278 | 16435 | 20532 |
| | a | mm | 14.0 | 17.5 | 17.5 | 20.0 | 20.0 | 22.5 | 22.5 | 25.0 | 25.0 | 27.5 | 27.5 |
| Maximum torque at $F_{q\,max}$ | $T_{q\,max}$ | Nm | 179 | 179 | 281 | 349 | 470 | 509 | 681 | 681 | 1019 | 1019 | 1273 |
| Maximum differential pressure at $V_{gmax}$ and $F_{q\,max}$ | $\Delta p_{q\,max}$ | bar | 400 | 400 | 322 | 400 | 369 | 400 | 400 | 400 | 400 | 400 | 400 |
| Maximum axial force at standstill or depressurized operation  | $+F_{ax\,max}$ | N | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | $-F_{ax\,max}$ | N | 315 | 315 | 500 | 500 | 710 | 710 | 900 | 900 | 1120 | 1120 | 1250 |
| Permissible axial force per bar working pressure | $+F_{ax\,perm/bar}$ | N/bar | 4.6 | 4.6 | 7.5 | 7.5 | 9.6 | 9.6 | 11.3 | 11.3 | 15.1 | 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 bearing service life. Recommended position of mating gear is dependent on the direction of rotation. Examples:

▼ **Gear output drive**




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

**Notice**

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

## HP – Proportional control, hydraulic

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

**HP1, HP2 positive control**

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

**HP5, HP6 negative control**

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

**Please note**

- Maximum permissible pilot pressure: $p_{St}$ = 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28) or 530 bar (sizes 55 to 200) can occur.
- Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 10 bar.
- The beginning of control and the HP characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 8) and thus a parallel shift of the characteristic curve.
- A leakage flow of maximum 0.3 l/min can occur at port **X** due to internal leakage (working pressure > pilot pressure). The external control is to be suitably configured to avoid an independent build-up of pilot pressure.

**Stroking time damping**

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

**Standard**

HP without damping.

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

**Option**

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

▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.45 | 0.45 | 0.55 | 0.55 | 0.65 |

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

**HP1 positive control**

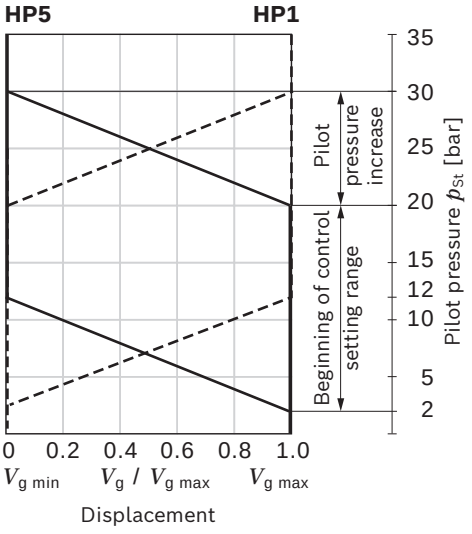
A pilot pressure increase of 10 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

**HP5 negative control**

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

- Beginning of control, setting range 2 to 20 bar
- Standard setting: beginning of control at 3 bar (end of control at 13 bar)

▼ **Characteristic curve**



### HP2, HP6 – pilot pressure increase $\Delta p_{St}$ = 25 bar

**HP2 positive control**

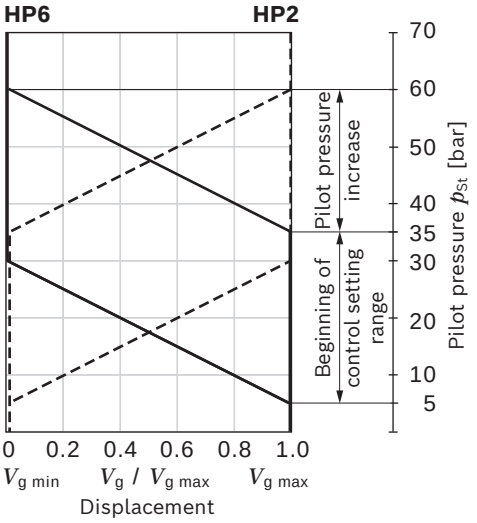
A pilot pressure increase of 25 bar at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

**HP6 negative control**

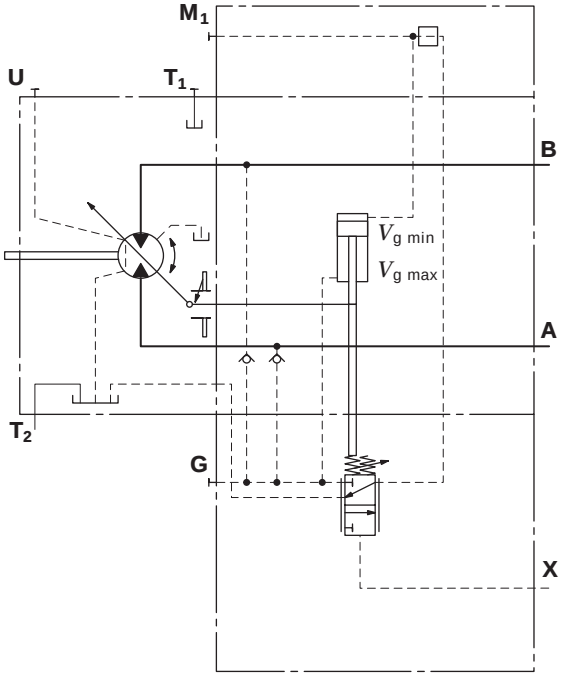
A pilot pressure increase of 25 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

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

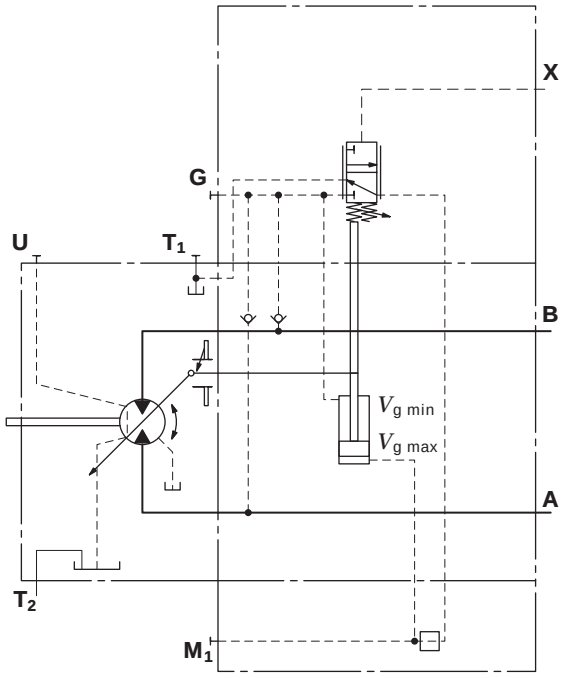
▼ **Characteristic curve**




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




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



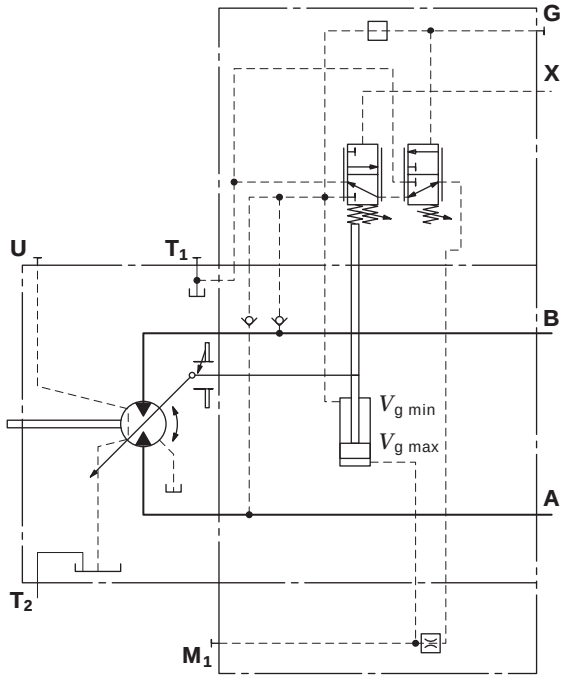
**HP5D1, HP6D1 pressure control, fixed setting**

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 provides more torque, while the pressure remains constant.

Setting range of the pressure control valve 80 to 400 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.

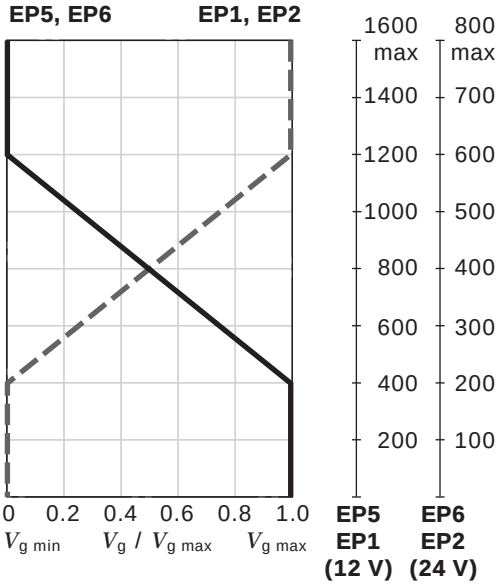
**EP1, EP2 positive control**

- 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**




**Please note**

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
- Please note that at port **G** up to 450 bar (size 28) or 530 bar (sizes 55 to 200) can occur.

**Stroking time damping**

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

**Standard**

EP without damping.

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

**Option**

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

▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.45 | 0.45 | 0.55 | 0.55 | 0.65 |

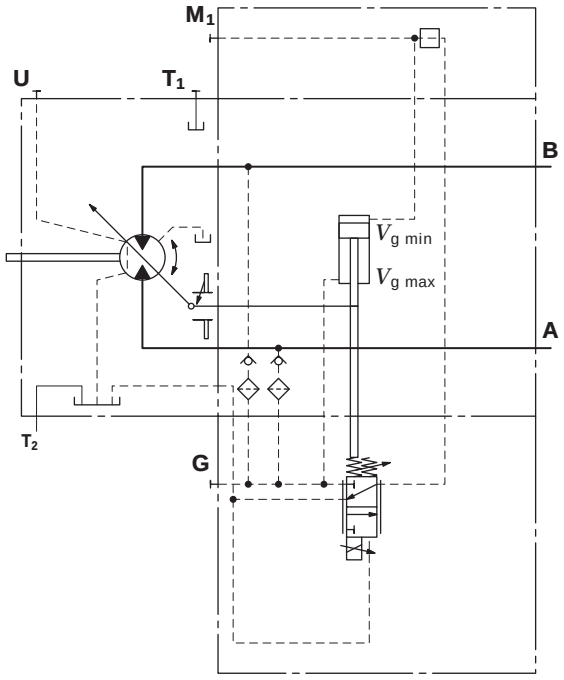
| Technical data, solenoid | EP1, EP5 | EP2, EP6 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Control current | | |
| Start of control | 400 mA | 200 mA |
| End of control | 1200 mA | 600 mA |
| Current limit | 1.54 A | 0.77 A |
| Nominal resistance (at 20 °C) | 5.5 Ω | 22.7 Ω |
| Dither | | |
| Frequency | 100 Hz | 100 Hz |
| Minimum oscillation range[1)] | 240 mA | 120 mA |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 28 | | |

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

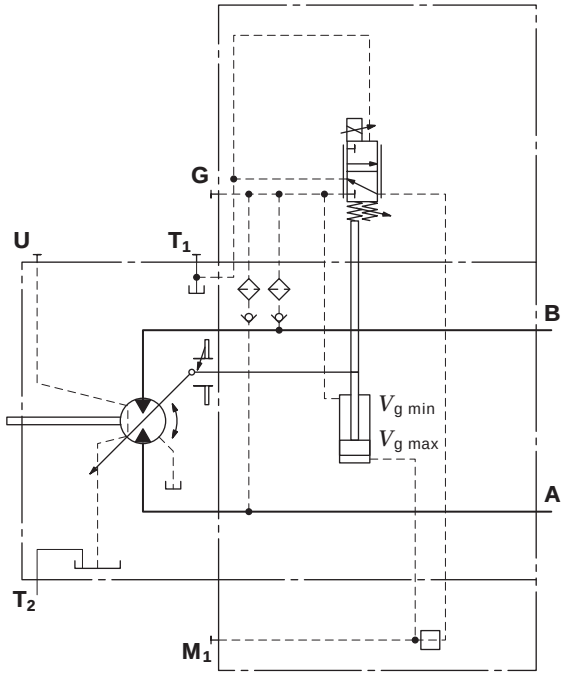
Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics.

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

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




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



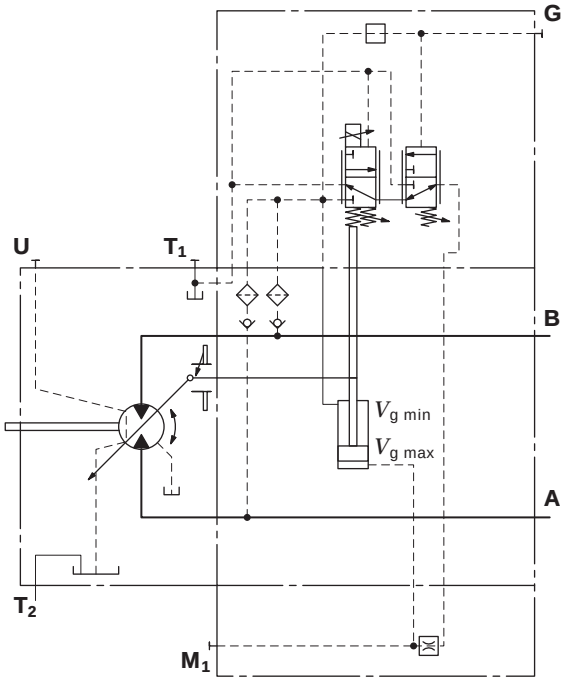

**EP5D1, EP6D1 Pressure control, fixed setting**

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 provides more torque, while the pressure remains constant.

Setting range of the pressure control valve 80 to 400 bar

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



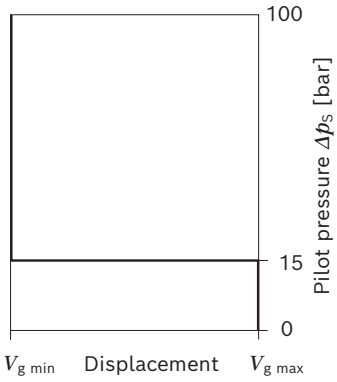
## HZ – Two-point control, hydraulic

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

**HZ5, HZ7 negative control**

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

▼ **Characteristic curve HZ5, HZ7**




**Please note**

- Maximum permissible pilot pressure: 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28) or 530 bar (sizes 55 to 200) can occur.
- A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir.

**Stroking time damping**

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

**Standard for sizes 28, 160 and 200**

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

**Standard for size 160 with BVI**

**HZ7** with throttle pin on both sides 0.30, symmetrical

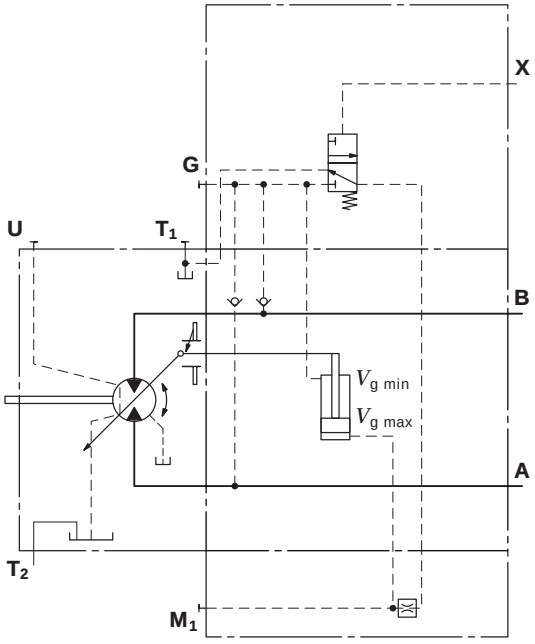
**Standard for sizes 55 to 107**

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

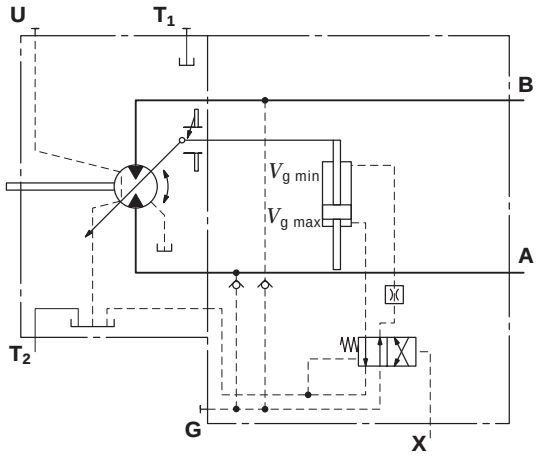
▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.30 | 0.30 | 0.30 | 0.55 | 0.65 |

▼ **Circuit diagram HZ5 (negative control), sizes 28, 160 and 200**



▼ **Circuit diagram HZ7 (negative control)**
**sizes 55 to 107**



## EZ – Two-point control, electric

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

**Please note**
The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve.
For lower pressures, please contact us.
Please note that at port **G** up to 450 bar (size 28) or 530 bar (sizes 55 to 200) can occur.

**Stroking time damping**
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
**Standard for sizes 28, 160 and 200**
EZ5, EZ6 with throttle pin on both sides, symmetrical (see table)
**Standard for sizes 55 to 107**
**EZ7, EZ8** (synchronous piston) with throttle pin on both sides, symmetrical (see table)

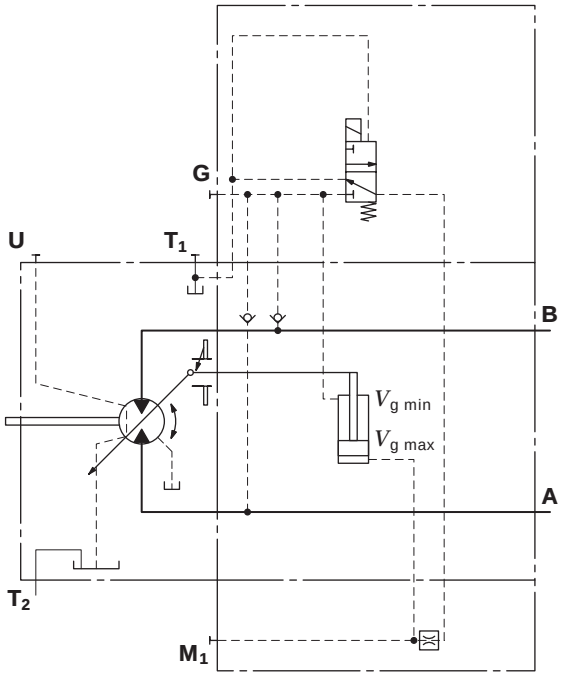
▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.30 | 0.30 | 0.30 | 0.55 | 0.65 |

### Sizes 28, 160 and 200

| 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 28 | | |

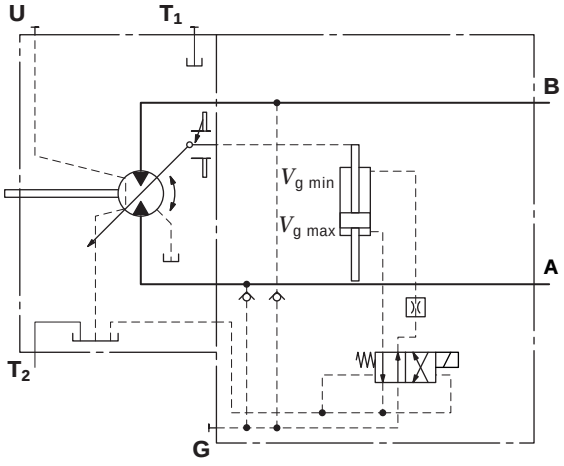
▼ **Circuit diagram EZ5, EZ6 (negative control), sizes 28, 160 and 200**




### Sizes 55 to 107

| 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 28 | | |

▼ **Circuit diagram EZ7, EZ8 (negative control), sizes 55 to 107**



## HA – Automatic control, high-pressure related

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

### HA1, HA2, HA3 positive control

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

### Please note

- For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g\,min}$ (standard for HA).
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28) or 530 bar (sizes 55 to 200) can occur.
- The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in case pressure causes an increase in the beginning of control (see page 8) and thus a parallel shift of the characteristic curve.
- A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir. Only for HA.T control.

### Stroking time damping

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

**Standard for sizes 28 to 200**

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

▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.45 | 0.45 | 0.55 | 0.55 | 0.65 |

**Standard for sizes 55 to 200**

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

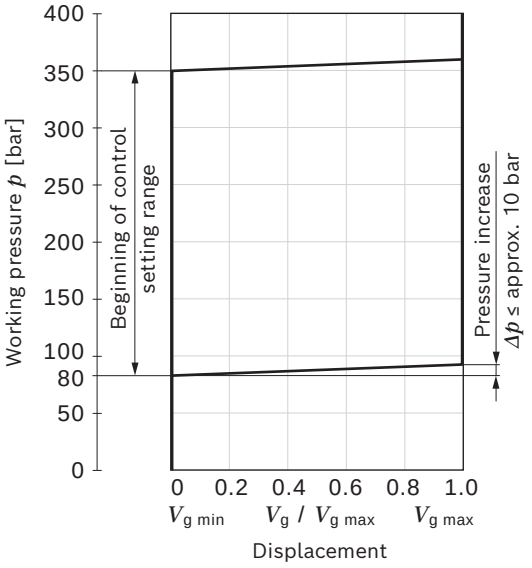
▼ **Throttle screw**

| Size | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|
| Diameter [mm] | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |

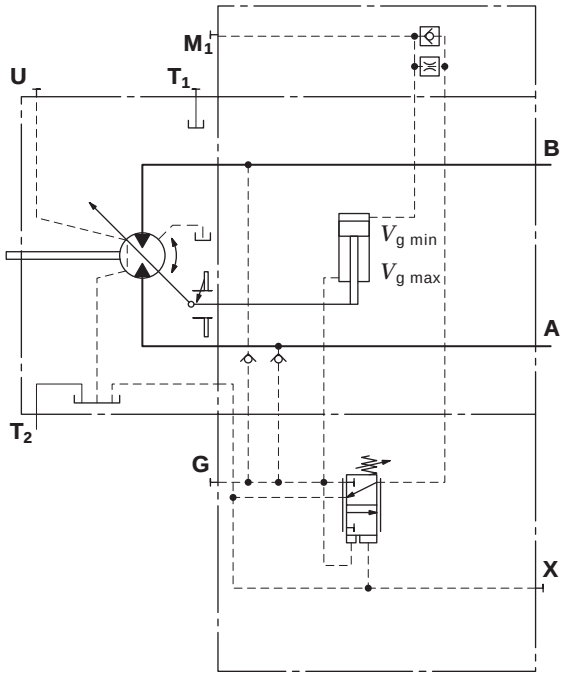
### HA1, HA3 with minimum pressure increase, positive control

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

▼ **Characteristic curve HA1, HA3**



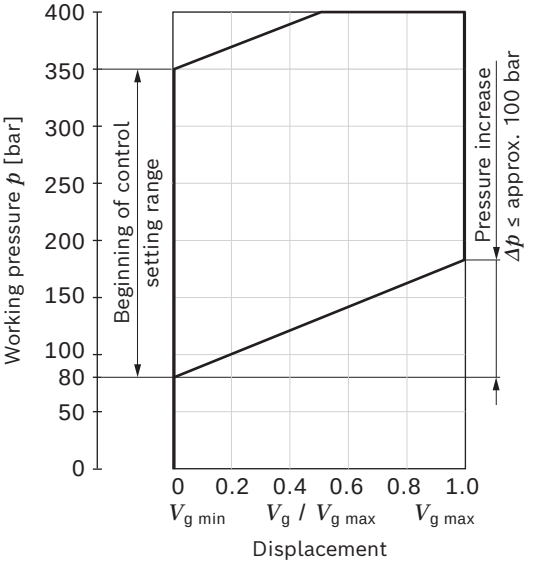

▼ **Circuit diagram HA1**



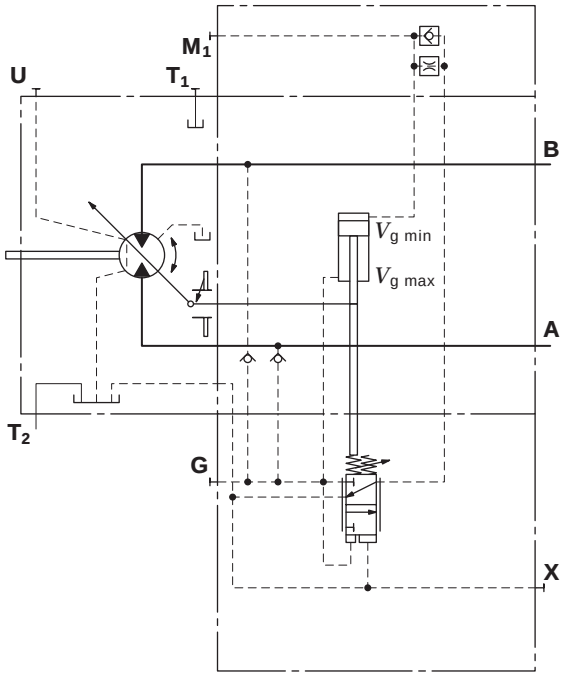

### HA2 with pressure increase, positive control

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

▼ **Characteristic curve HA2**




▼ **Circuit diagram HA2**



### HA.T3 override, hydraulic, remote controlled, proportional

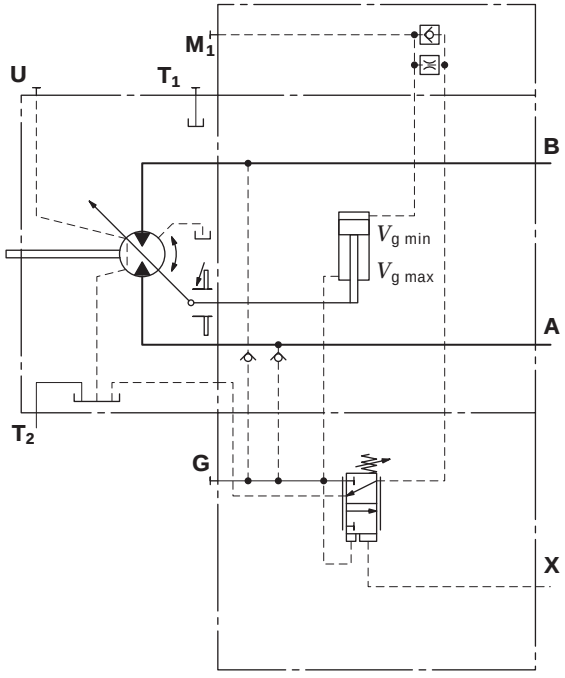
With the HA.T3 control, the beginning of control can be influenced by applying a pilot pressure to port **X**.
For each 1 bar of pilot pressure increase, the beginning of control is reduced by 17 bar.

| Beginning of control setting | 300 bar | 300 bar |
|---|---|---|
| Pilot pressure at port **X** | 0 bar | 10 bar |
| Beginning of control at | 300 bar | 130 bar |

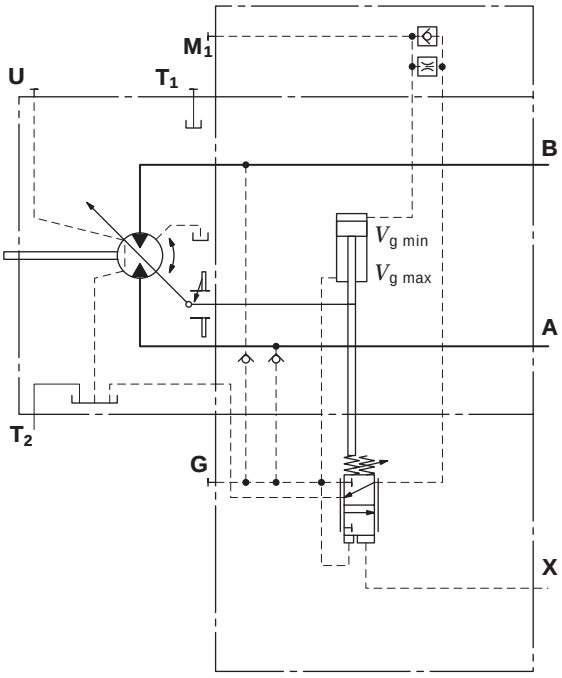
**Please note**

Maximum permissible pilot pressure 100 bar.

▼ **Circuit diagram HA1T3**




▼ **Circuit diagram HA2T3**




▼ **Circuit diagram HA3T3**

With integrated counterbalance valve BVI, see page 38

## DA – Automatic control, speed related

The variable motor A6VE with automatic speed related control, type DA, is designed for use in hydrostatic travel drives in combination with the variable pump A4VG with DA control.
A drivespeed 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.

**Please note**
The beginning of control and the DA characteristic curve are influenced by case pressure. An increase in case pressure causes a decrease in the beginning of control (see page 8) and thus a parallel shift of the characteristic curve.

**Stroking time damping**
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
**Standard for sizes 28 to 200**
DA with throttle pin on one side, throttle from $V_{g\,min}$ to $V_{g\,max}$ (see table).

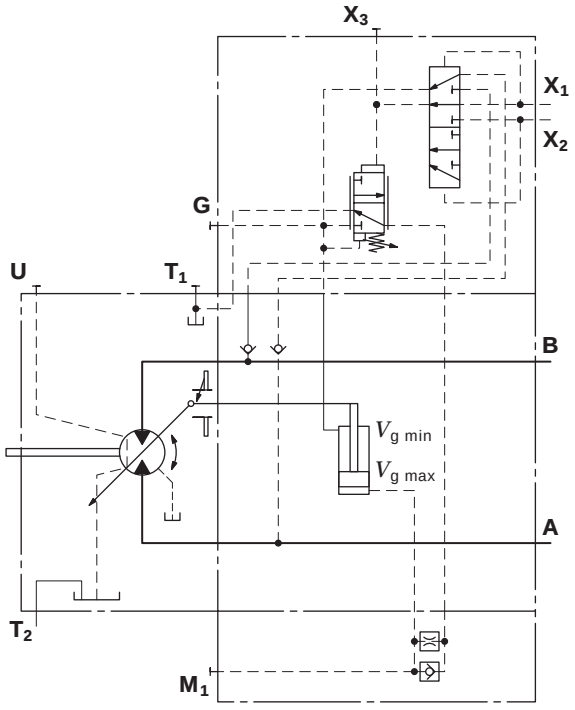
▼ **Throttle pin overview**

| Size | 28 | 55 | 80 | 107 | 140 | 160 | 200 |
|---|---|---|---|---|---|---|---|
| Groove size [mm] | 0.30 | 0.45 | 0.45 | 0.55 | 0.55 | 0.55 | 0.65 |

**DA0 Hydraulic travel direction valve, negative control**
Depending on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressure ports **X**$_1$ or **X**$_2$.

| Direction of rotation | Working pressure in | Pilot pressure in |
|---|---|---|
| Clockwise | **A** | **X**$_1$ |
| Counter-clockwise | **B** | **X**$_2$ |

▼ **Circuit diagram DA0**

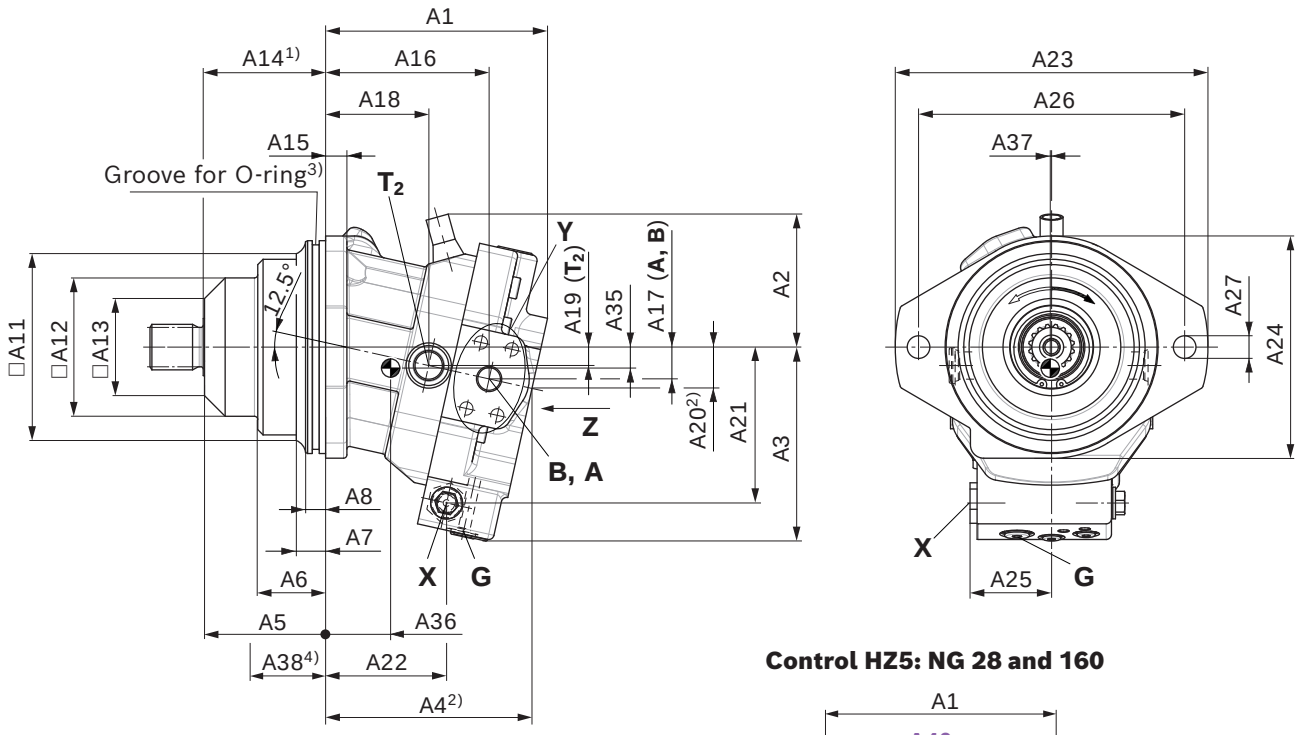


## Dimensions, sizes 28 to 160

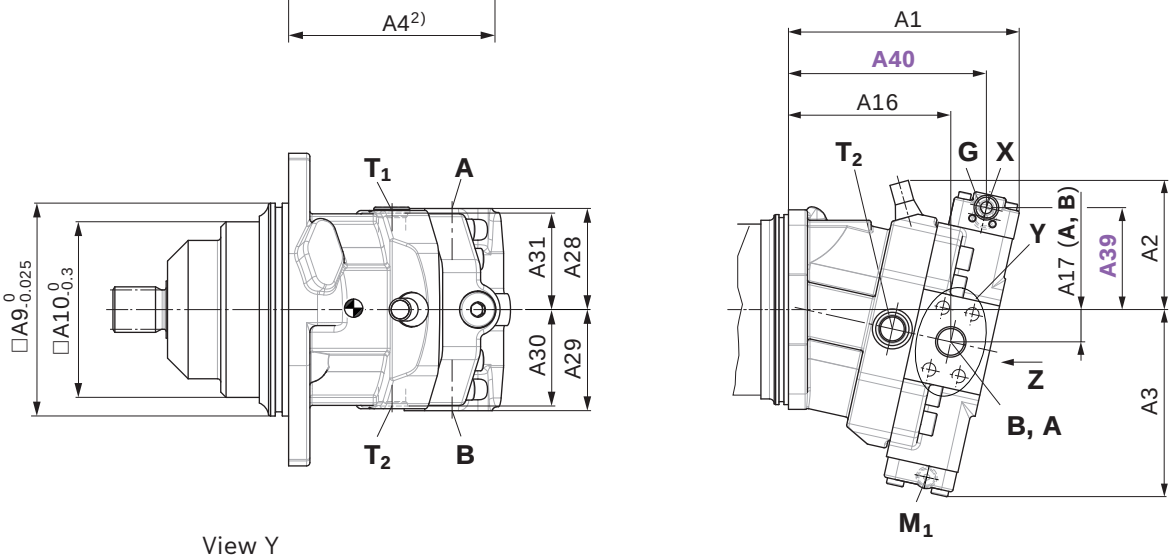
### HZ5 and HZ7 – Two-point control, hydraulic

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

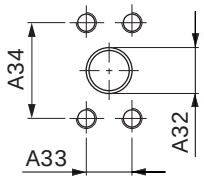
**Control HZ7: NG 55 to 107**




**Control HZ5: NG 28 and 160**




View Y




Center of gravity

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

**Notice**

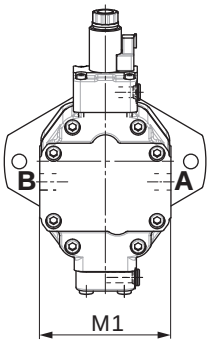
Dimensions of the control devices, see data sheet 91607.

| NG | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | ØA9 | ØA10 | ØA11 | ØA12 | ØA13 | A14 | A15 | A16 | A17 | A18 | A19 | A20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28[2)] | 150 | 105 | 136 | 124 | 88 | 54 | – | 15 | 135 | 110 | 135 | 86 | 64 | 89 | 14 | 91 | 20 | 47 | 10 | 27 |
| 55[1)] | 167 | 100 | 146 | 153 | 91 | 51 | 22 | 15 | 160 | 132 | 140.5 | 104 | 73 | 92 | 16 | 123 | 24 | 77 | 14 | 30 |
| 80[1)] | 176 | 114 | 161 | 164 | 109.5 | 65 | 30 | 15 | 190 | 143 | 151 | 116 | 88 | 110.5 | 18 | 130 | 28 | 78 | 16 | 35 |
| 107[1)] | 187 | 121 | 172 | 175 | 121.8 | 73 | 35 | 15 | 200 | 160 | 168 | 132 | 90 | 122.8 | 18 | 137 | 30 | 82 | 17 | 38 |
| 160[2)] | 243 | 133 | 197 | 212 | 122 | 67 | 29 | 15 | 200 | 180 | 188 | 146 | 100 | 123 | 20 | 171 | 34 | 109 | 20 | 43 |

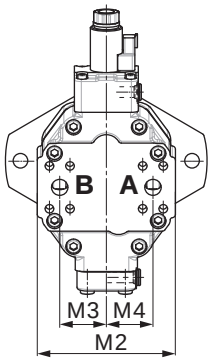
| NG | A21 | A22 | A23 | A24 | A25 | A26 | A27 | A28 | A29 | A30 | A31 | A32 | A33 | A34 | A35 | A36 | A37 | A38 | A39 | A40 | O-ring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28[2)] | 87 | 120 | 188 | 142 | 35.5 | 160 | 13.5 | 66 | 66 | 62.5 | 62.5 | 19 | 23.8 | 50.8 | 2.54 | 109.6 | 0.69 | 64 | 87 | 120 | 126 × 4 |
| 55[1)] | 117 | 91 | 235 | 167 | 57 | 200 | 17 | 76 | 76 | 73 | 73 | 19 | 23.8 | 50.8 | 15.8 | 48.8 | 1 | 60 | – | – | 150 × 4 |
| 80[1)] | 132 | 93 | 260 | 198 | 57 | 224 | 21 | 82 | 82 | 78.5 | 78.5 | 25 | 27.8 | 57.2 | 15.9 | 44.2 | 0.6 | 78.5 | – | – | 182 × 4 |
| 107[1)] | 143 | 99 | 286 | 210 | 61 | 250 | 21 | 90 | 90 | 86.5 | 86.5 | 25 | 27.8 | 57.2 | 15.2 | 42.9 | 0.5 | 83 | – | – | 192 × 4 |
| 160[2)] | – | – | 286 | 210 | 40.5 | 250 | 21 | 102 | 102 | 98.5 | 98.5 | 32 | 31.8 | 66.7 | 14.3 | 69.9 | 0.5 | 83 | 107 | 208 | 192 × 4 |

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

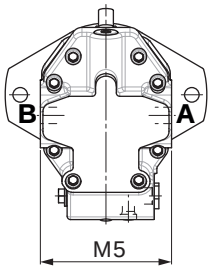
**2** SAE working ports **A** and **B** at side, opposite



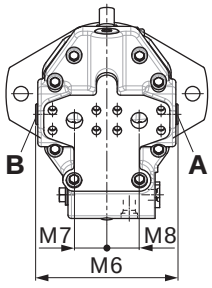

**1** SAE working ports **A** and **B** at rear



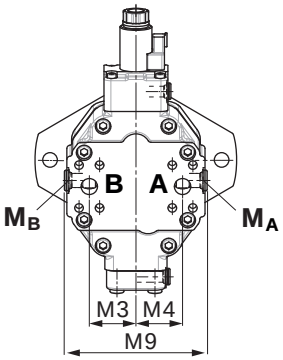

**2** SAE working ports **A** and **B** at side, opposite, only HZ7, EZ7/8 (NG55 to 107)




**1** SAE working ports **A** and **B** at rear, only HZ7, EZ7/8 (NG55 to 107)



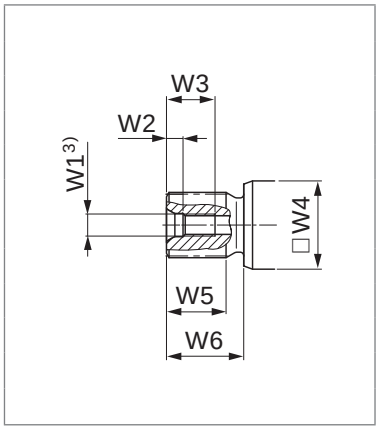

**4** SAE working ports **A** and **B** at rear, with lateral measuring ports




| NG | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 | M9 |
|---|---|---|---|---|---|---|---|---|---|
| 28 | 132 | 146 | 45 | 45 | – | – | – | – | – |
| 55 | 152 | 165 | 54 | 54 | 152 | 165 | 37.5 | 37.5 | – |
| 80 | 164 | 177 | 54 | 54 | 164 | 177 | 42 | 42 | 178 |
| 107 | 180 | 193 | 65 | 65 | 180 | 193 | 42 | 42 | 194 |
| 160 | 204 | 226 | 76 | 76 | – | – | – | – | 226 |

1) HZ7 control
2) HZ5 control

▼ **Drive shaft**




| NG | Splined shaft DIN 5480 | W1 | W2 | W3 | ØW4 | W5 | W6 |
|---|---|---|---|---|---|---|---|
| 28 | **Z5 –** W25×1.25×18×9g | M8 × 1.25 | 6 | 19 | 35 | 43 | 35 |
| 28 | **Z6 –** W30×2×14×9g | M10 × 1.5 | 7.5 | 22 | 35 | 27 | 35 |
| 55 | **Z6 –** W30×2×14×9g | M12 × 1.75 | 9.5 | 28 | 45 | 27 | 35 |
| 55 | **Z8 –** W35×2×16×9g | M12 × 1.75 | 9.5 | 28 | 45 | 32 | 40 |
| 80 | **Z8 –** W35×2×16×9g | M12 × 1.75 | 9.5 | 28 | 50 | 32 | 40 |
| 80 | **Z9 –** W40×2×18×9g | M16 × 2 | 12 | 36 | 50 | 37 | 45 |
| 107 | **Z9 –** W40×2×18×9g | M12 × 1.75 | 9.5 | 28 | 60 | 37 | 45 |
| 107 | **A1 –** W45×2×21×9g | M16 × 2 | 12 | 36 | 60 | 42 | 50 |
| 160 | **A1 –** W45×2×21×9g | M16 × 2 | 12 | 36 | 70 | 42 | 50 |
| 160 | **A2 –** W50×2×21×9g | M16 × 2 | 12 | 36 | 70 | 44 | 55 |
| 200 | **A2 –** W50×2×21×9g | M16 × 2 | 12 | 36 | 70 | 44 | 55 |

| NG | Working port SAE J518[4] A, B | | Drain port ISO 6149[5] $T_1$, $T_2$ | Synchronous control ISO 6149[5] G | Pilot pressure port ISO 6149[5] X (HA1, HA2) | Pilot pressure port ISO 6149[5] X (HP, HZ, HA1T/2T) |
|---|---|---|---|---|---|---|
| 28[6] | 3/4 in | M10 × 1.5; 17 deep | M18 × 1.5; 12 deep | M14 × 1.5; 12 deep | M14 × 1.5; 12 deep | M14 × 1.5; 12 deep |
| 55 | 3/4 in | M10 × 1.5; 17 deep | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep |
| 80 | 1 in | M12 × 1.75; 17 deep | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep |
| 107 | 1 in | M12 × 1.75; 17 deep | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep |
| 160 | 1 1/4 in | M14 × 2; 19 deep | M27 × 2; 19 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep |
| 200 | 1 1/4 in | M14 × 2; 19 deep | M33 × 2; 19 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep | M14 × 1.5; 11.5 deep |
| State[11] | O | | X/O ($T_2$)[10] | X | X | O |
| $p_{max}$ [bar][7] | 450[8]/530[9] | | 3 | 450[8]/530[9] | 3 | 100 |

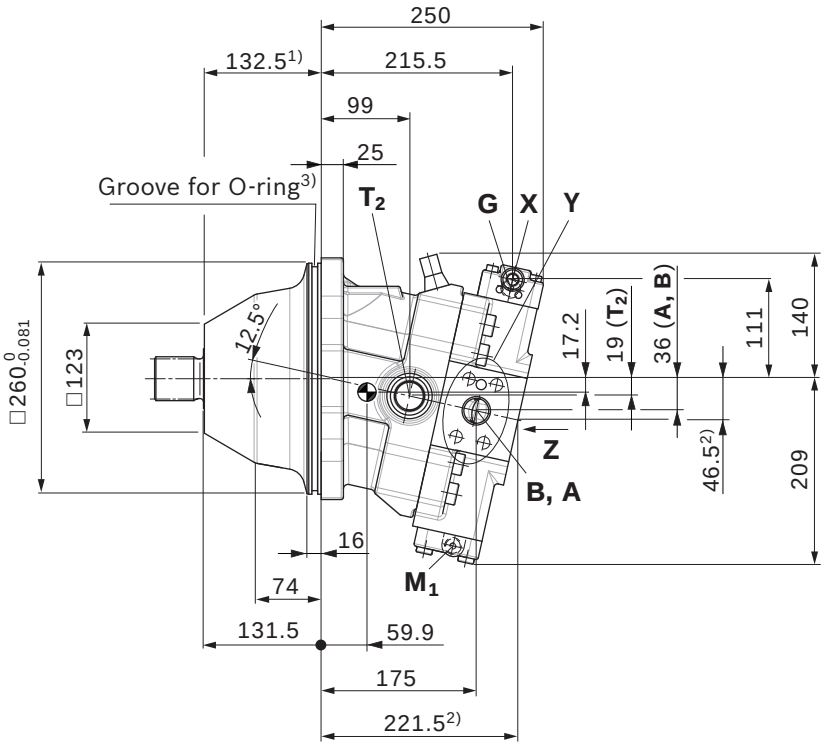
| NG | Pilot pressure port ISO 8434-1 $X_1$, $X_2$ (DA0) | Measuring port, control pressure ISO 6149[5] $M_1$ | Measuring port, pressure A, B ISO 6149[5] $M_A$ / $M_B$ |
|---|---|---|---|
| 28[6] | 8B-ST | M14 × 1.5; 12 deep | – |
| 55 | SDSC-L8×M12-F | M14 × 1.5; 11.5 deep | – |
| 80 | SDSC-L8×M12-F | M14 × 1.5; 11.5 deep | M18 × 1.5; 14.5 deep |
| 107 | SDSC-L8×M12-F | M14 × 1.5; 11.5 deep | M18 × 1.5; 14.5 deep |
| 160 | SDSC-L8×M12-F | M14 × 1.5; 11.5 deep | M22 × 1.5; 15.5 deep |
| 200 | SDSC-L8×M12-F | M14 × 1.5; 11.5 deep | M22 × 1.5; 15.5 deep |
| State[11] | O | X | X |
| $p_{max}$ [bar][7] | 40 | 450[8]/530[9] | 450[8]/530[9] |

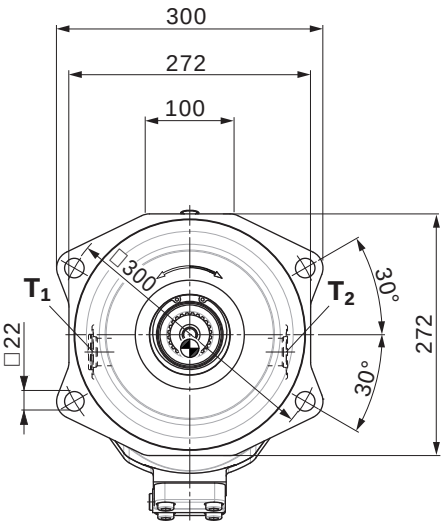
3) Center bore according to DIN 332 (thread according to DIN 13)
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The countersink may be deeper than specified in the standard. Ports designed for straight stud ends according to EN ISO 6149-2. Only sizes 55 to 200
6) The countersink may be deeper than specified in the standard. Ports designed for stud ends according to DIN 3852. For the ports **X**$_1$ and **X**$_2$, DIN 2353-CL applies. Only size 28
7) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
8) Only size 28
9) Only sizes 55 to 160
10) Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 32).
11) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

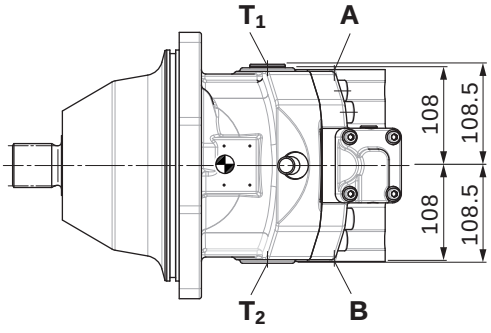
## Dimensions, size 200

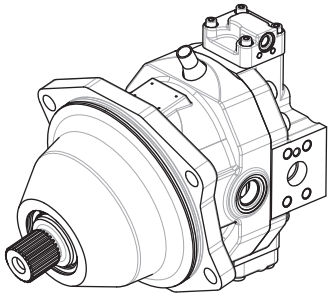
### HZ5 – Two-point control, hydraulic

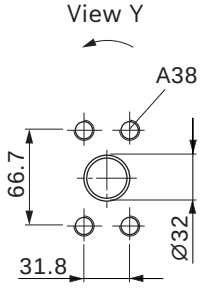
Port plate 2 – SAE working ports **A** and **B** at side, opposite






Center of gravity

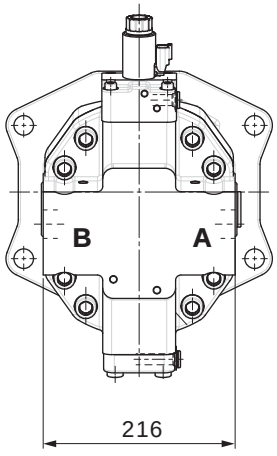
1) To shaft collar
2) Port plate 1 – SAE working ports **A** and **B** at rear
3) The O-ring is not included in the scope of delivery
4) Difference in dimension of mounting flange A6VM to A6VE

**Notice**

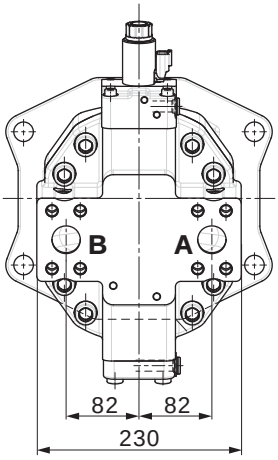
Dimensions of the control devices, see data sheet 91607.

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

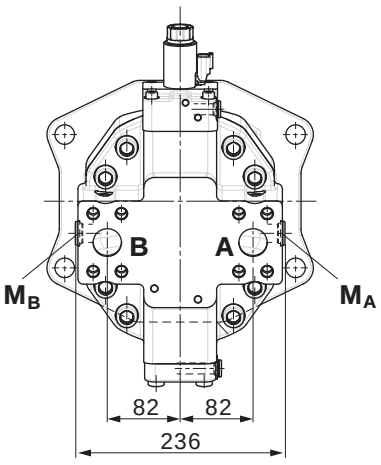
**2** SAE working ports **A** and **B** at side, opposite




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

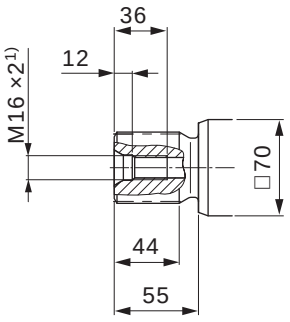



**4** SAE working ports **A** and **B** at rear, with lateral measuring ports




▼ **Splined shaft DIN 5480**

**A2 –** W50×2×24×9g




| Ports | | Standard | Size | $p_{max}$ [bar][2)] | State[6)] |
|---|---|---|---|---|---|
| **A, B** | Working port<br>Fastening thread A/B | SAE J518[3)]<br>DIN 13 | 1 1/4 in<br>M14 × 2; 19 deep | 530 | O |
| **$T_1$** | Drain port | ISO 6149[5)] | M33 × 2; 19 deep | 3 | X[4)] |
| **$T_2$** | Drain port | ISO 6149[5)] | M33 × 2; 19 deep | 3 | O[4)] |
| **G** | Synchronous control | ISO 6149[5)] | M14 × 1.5; 11.5 deep | 530 | X |
| **X** | Pilot pressure port (HP, HZ, HA.T3) | ISO 6149[5)] | M14 × 1.5; 11.5 deep | 100 | O |
| **X** | Pilot pressure port (HA1, HA2) | ISO 6149[5)] | M14 × 1.5; 11.5 deep | 3 | X |
| **$X_1$, $X_2$** | Pilot pressure port (DA0) | ISO 8434-1 | SDSC-L8×M12-F | 40 | O |
| **$M_1$** | Measuring port, control pressure | ISO 6149[5)] | M14 × 1.5; 11.5 deep | 530 | X |
| **$M_A$, $M_B$** | Measuring port, pressure **A**, **B** | ISO 6149[5)] | M22 × 1.5; 15.5 deep | 530 | X |

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
4) Depending on installation position, **$T_1$** or **$T_2$** must be connected (see also installation instructions on page 46).
5) The countersink may be deeper than specified in the standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

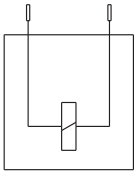
## Connector for solenoids

### DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode
The following type of protection ensues with the installed mating connector:

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

▼ **Switching symbol**



▼ **Mating connector DEUTSCH DT06-2S-EP04**

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

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

**Notice**

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

## Flushing and boost-pressure valve

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

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

- Size 28 to 200, fixed setting 16 bar

**Switching pressure, flushing spool $\Delta p$**

- Size 28 to 107 (small flushing valve) 8 ± 1 bar
- Size 107 to 200 (medium and large flushing valve) 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:
$\Delta p_{ND} = p_{ND} - p_G = 25$ bar and $\nu = 10$ mm²/s
($p_{ND}$ = low pressure, $p_G$ = case pressure)

**Small flushing valve for sizes 28 to 107**

| Material number of orifice | Ø [mm] | $q_v$ [l/min] | Code |
|---|---|---|---|
| R909651766 | 1.2 | 3.5 | A |
| R909419695 | 1.4 | 5 | B |
| R909419696 | 1.8 | 8 | C |
| R909419697 | 2.0 | 10 | D |
| R909444361 | 2.4 | 14 | F |
| R902004465 | 3.0 | 16 | H |

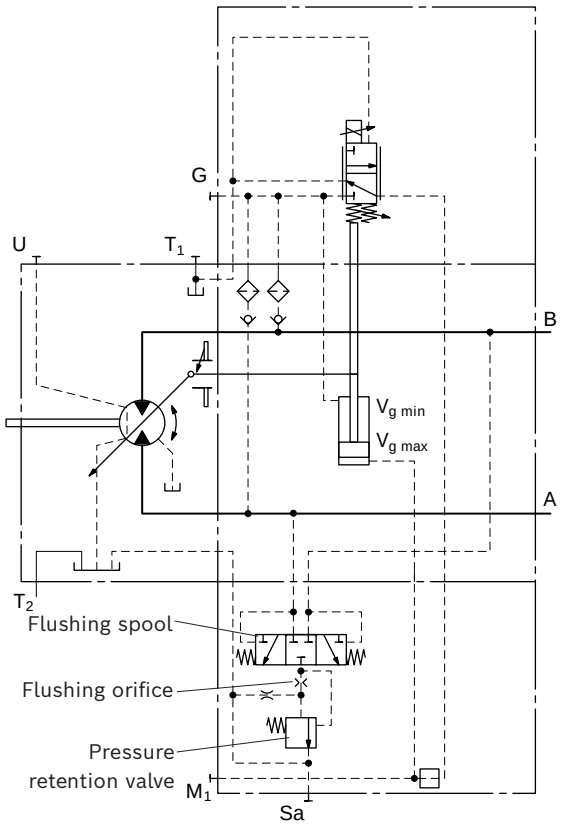
**Medium flushing valve for size 107**

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

**Large flushing valve for sizes 160 to 200**

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

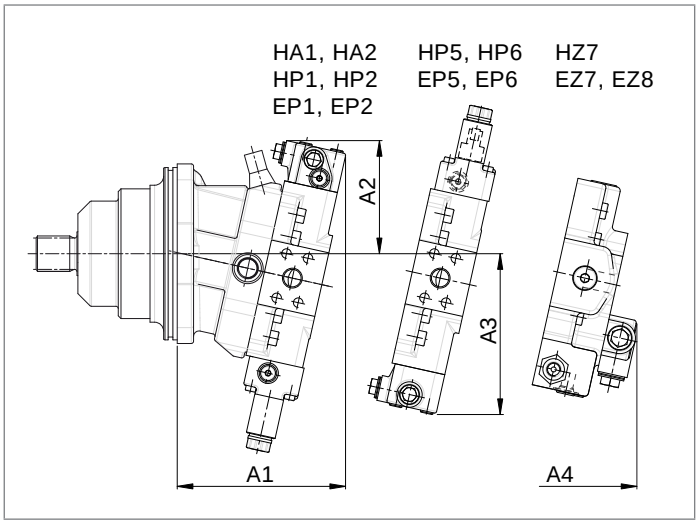
▼ **Circuit diagram EP**




**Notice**

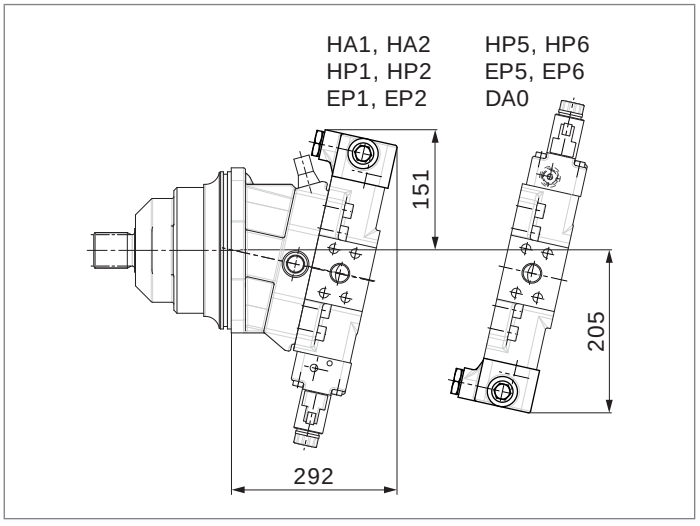
- With size 28, orifices for flushing flows of 3.5 to 10 l/min can be supplied.
- Port **S**a only for sizes 160 to 200
- From a flushing flow of 35 l/min, it is recommended that port **S**a be connected in order to prevent an increase in case pressure. An increased case pressure reduces the flushing flow.

### ▼ Dimensions, sizes 28 to 107 (small flushing valve)

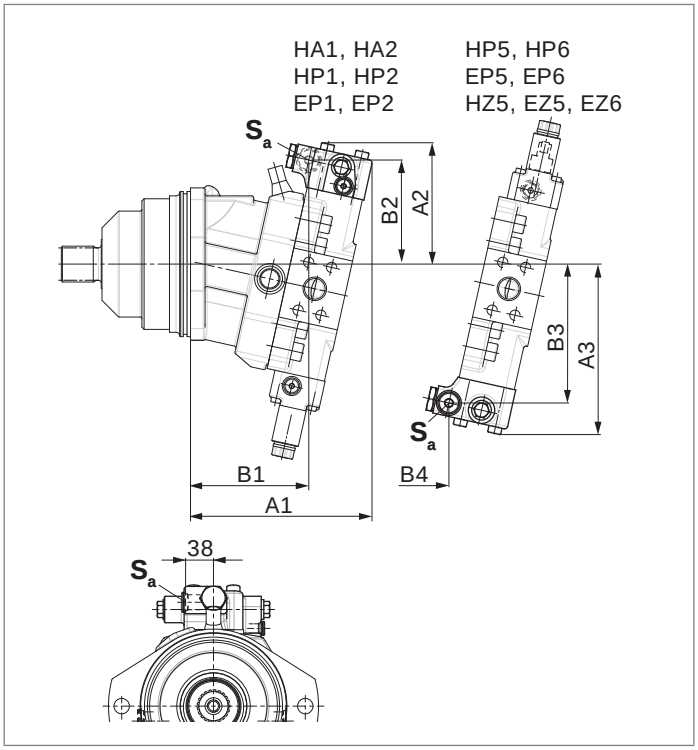



| NG | A1 | A2 | A3 | A4 |
|---|---|---|---|---|
| 28 | 152 | 125 | 161 | – |
| 55 | 183 | 137 | 183 | 176 |
| 80 | 195 | 142 | 194 | 176 |
| 107 | 204 | 143 | 202 | 186 |

### ▼ Dimensions, size 107 (medium flushing valve)




### Dimensions of sizes 160 and 200 (large flushing valve)




| NG | A1 | B1 | A2 | B2 | A3 | B3 | B4 | Sa[1)] |
|---|---|---|---|---|---|---|---|---|
| 160 | 249 | 163 | 165 | 142 | 233 | 190 | 89 | M22 × 1.5; 15.5 deep |
| 200 | 256 | 170 | 172 | 148 | 244 | 201 | 93 | M22 × 1.5; 15.5 deep |

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

## BVD and BVE counterbalance valve

### Function

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

### Notice

- BVD available for sizes 55 to 200 and BVE available for sizes 107 to 200.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
- Order example: A6VE080HA1T30004A/65MWV0Y2Z 97W0-0 + BVD20F27S/41B–V03K16D0400S12
- For safety reasons, controls with beginning of control at $V_{g\ min}$ (e.g. HA) are not permissible for lifting winch drives!
- Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- The counterbalance valve does not replace the mechanical service brake and holding brake.
- Observe detailed information on the counterbalance valve in data sheets 95522 (BVD), 95525 (BVE) and 95528 (BVD/BVE32) !
- For the design of the brake release valve, we require the following data for the mechanical holding brake:
  - the cracking pressure
  - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - the required closing time for a warm device (oil viscosity approx. 15 $mm^2/s$)

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

| Motor NG | Without valve | | Limited values when using pressure relief valves and BVD/BVE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | PRV[1] | | | BVD[2])/BVE[3] | | | |
| | $p_{nom}/p_{max}$ [bar] | $q_{V\ max}$ [l/min] | $p_{nom}/p_{max}$ [bar] | $q_V$ [l/min] | Code | NG | $p_{nom}/p_{max}$ [bar] | $q_V$ [l/min] | Code |
| 55 | 400/530 | 244 | 350/420 | 240 | 7 | 20 (BVD) | 350/420 | 220 | 7W |
| 80 | | 312 | | | | | | | |
| 107 | | 380 | | 400 | | | | | |
| 107 | | 380 | | | 8 | 25 (BVD/BVE) | | 320 | 8W |
| 160 | | 496 | | | | 25 (BVD) | | | |
| 160 | | 496 | 300/420 | 550 | 5 | 25 (BVE) | 350/420 | 320 | 5W |
| 200 | | 580 | | | | 25 (BVD/BVE) | | | |
| 200 | | 580 | | | 9 | 32 (BVD/BVE) | 350/420 | 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

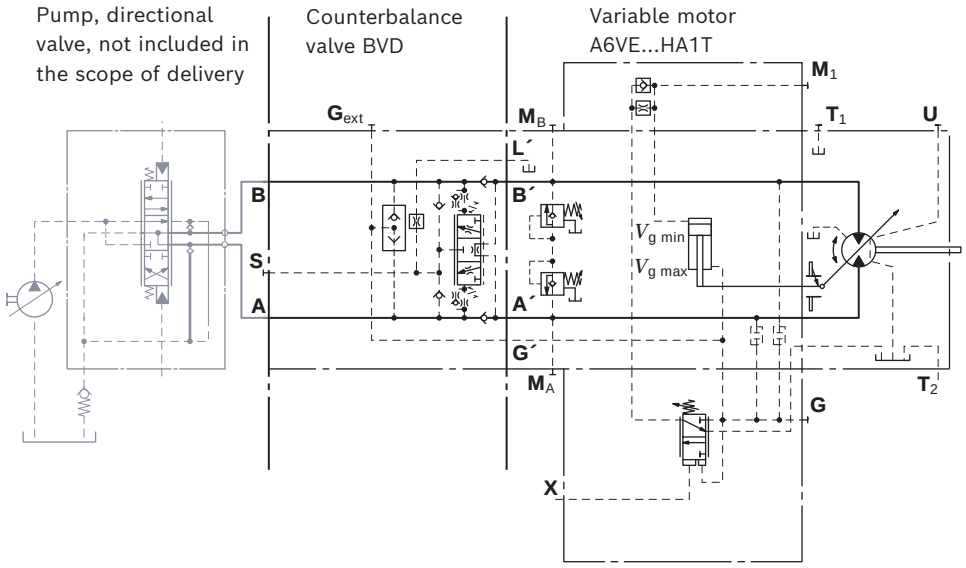
### Counterbalance valve for travel drives BVD...F

Application option

- Travel drive for wheeled excavators (BVD and BVE)

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

A6VE080HA1T30004A/65MWV0Y2Z97W0-0 + BVD20F27S/41B–V03K16D0400S12



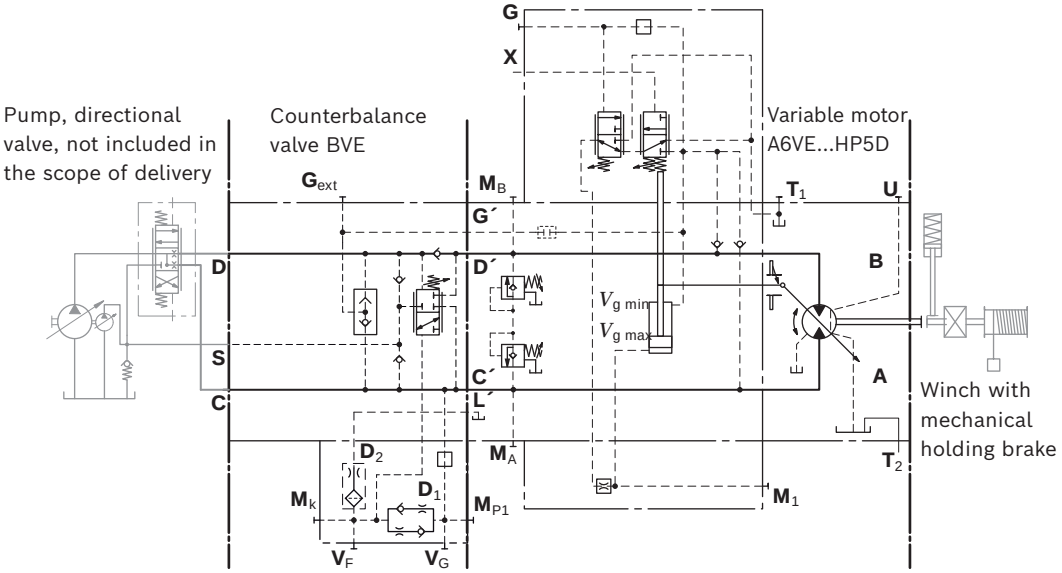

### Counterbalance valve for winches and track drive BVD...W and BVE

Application option

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

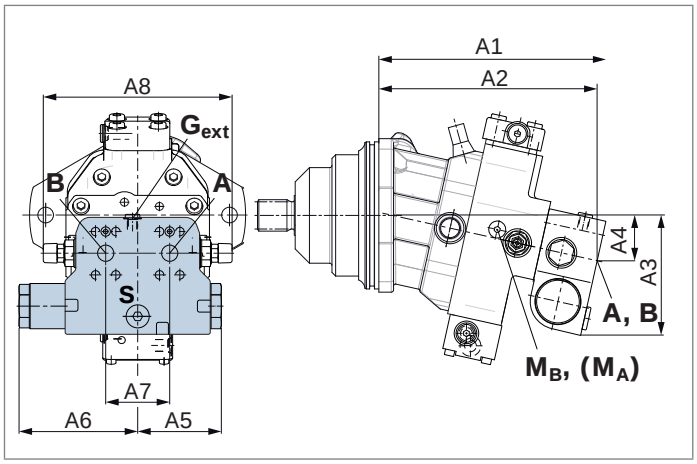
▼ **Example circuit diagram for winch drive in cranes**

A6VE107HP5D10001A/65MWV0Y2Z97W0-0 + BVE25W38S/51ND-V100K00D4598T30S00-0

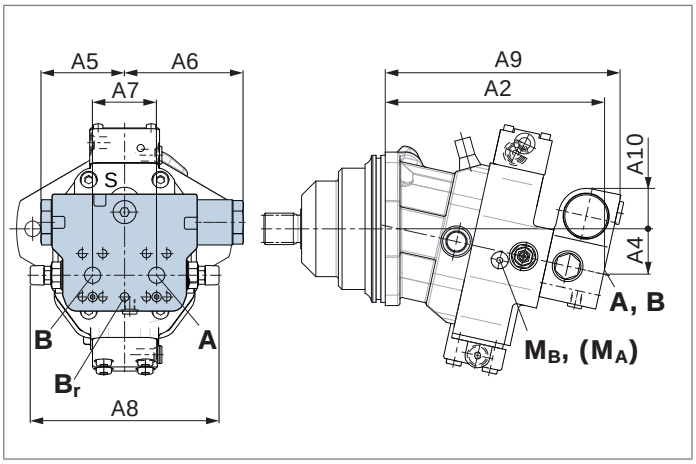


## Dimensions

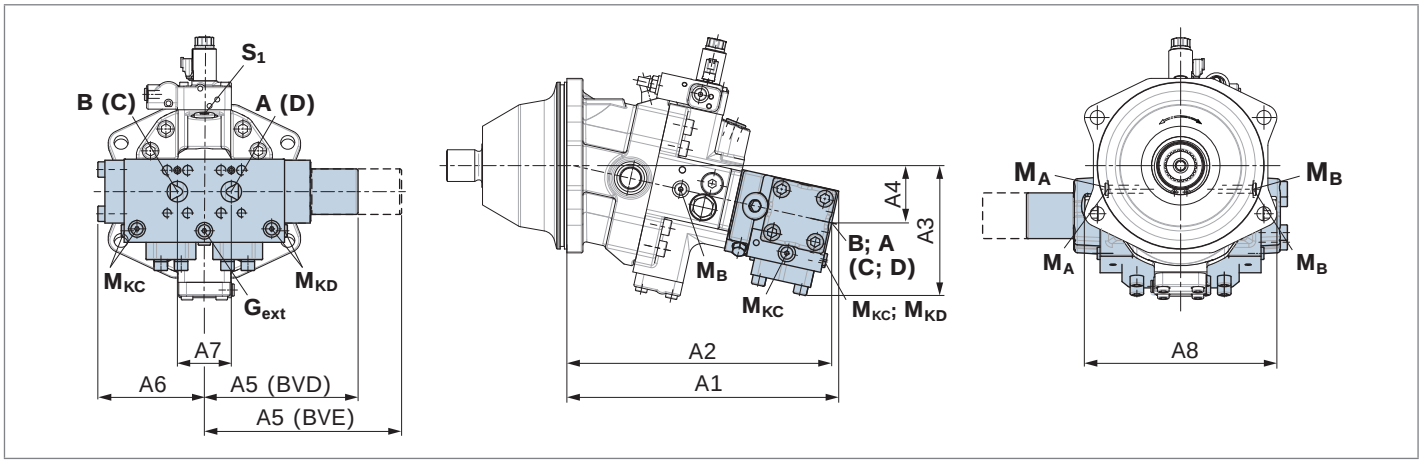
▼ **A6VE...HA, HP1, HP2 or EP1, EP2 with BVD20 or BVD/BVE25**




▼ **A6VE...HP5, HP6 or EP5, EP6[1] with BVD20 or BVD/BVE25**




▼ **A6VE...HA, HP5, HP6 or EP5, EP6 with BVD/BVE 32**




| A6VE | Counterbalance valve | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NG...plate | Type | Ports | Dimensions | | | | | | | | | |
| | | A, B | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 |
| 55...7 | BVD20...17 | 3/4 in | 252 | 243 | 143 | 50 | 98 | 139 | 75 | 222 | 267 | 50 |
| 80...7 | BVD20...27 | 1 in | 261 | 252 | 148 | 55 | 98 | 139 | 75 | 222 | 276 | 46 |
| 107...7 | BVD20...28 | 1 in | 280 | 271 | 152 | 59 | 98 | 139 | 84 | 234 | 295 | 41 |
| 107...8 | BVD25...38 | 1 1/4 in | 298 | 288 | 165 | 63 | 120.5 | 175 | 84 | 238 | 311 | 56 |
| 160...8 | BVD25...38 | 1 1/4 in | 334 | 324 | 170 | 68 | 120.5 | 175 | 84 | 238 | 349 | 51 |
| 200...5 | BVD25...38 | 1 1/4 in | 356 | 346 | 176 | 74 | 120.5 | 175 | 84 | 299 | 370 | 46 |
| 200...9 | BVD32...38 | 1 1/4 in | 423 | 412 | 202 | 89 | 240 | 166 | 84 | 299 | – | 46 |
| 107...8 | BVE25...38 | 1 1/4 in | 298 | 288 | 171 | 63 | 137 | 214 | 84 | 238 | 315 | 63 |
| 160...5 | BVE25...38 | 1 1/4 in | 334 | 325 | 176 | 68 | 137 | 214 | 84 | 238 | 349 | 59 |
| 200...5 | BVE25...38 | 1 1/4 in | 356 | 346 | 182 | 74 | 137 | 214 | 84 | 299 | 370 | 52 |
| 200...9 | BVE32...38 | 1 1/4 in | 423 | 412 | 202 | 89 | 240 | 166 | 84 | 299 | – | 46 |

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 A6VE motor.
The designation of the ports on the installation drawing of the motor is binding!

| Ports | | Version | A6VE plate | Standard | Size | $p_{max}$ [bar][2] | State[4] |
|---|---|---|---|---|---|---|---|
| **A, B** | Working line | | | SAE J518 | See table above | 420 | O |
| **S, $S_1$** | Boost pressure supply | BVD20, BVE25 | | DIN 3852[3] | M22 × 1.5; 14 deep | 30 | X |
| | | BVD25, BVE25 | | DIN 3852[3] | M27 × 2; 16 deep | 30 | X |
| **$B_r$** | Brake release, reduced high pressure | L | 7 | DIN 3852[3] | M12 × 1.5; 12.5 deep | 30 | O |
| | | | 8 | DIN 3852[3] | M12 × 1.5; 12 deep | 30 | O |
| **$G_{ext}$** | Brake release, high pressure | S | | DIN 3852[3] | M12 × 1.5; 12.5 deep | 420 | X |
| **$M_A$, $M_B$** | Pressure measurement **A** and **B** | | | ISO 6149[3] | M18 × 1.5; 14.5 deep | 420 | X |
| **$M_C$** | Measuring port, pressure counterbalance spool | BVE25/53 | | DIN 3852[3] | M14 × 1.5; 12 deep | 350 | X |
| **$M_K$** | Measuring port, pressure counterbalance spool | BVE25/53 | | DIN 3852[3] | M14 × 1.5; 12 deep | 350 | X |
| **$M_{KC}$** | Measuring port, pressure counterbalance spool **C** | BVD32, BVE32 | | DIN 3852[3] | M14 × 1.5; 12 deep | 350 | X |
| **$M_{KD}$** | Measuring port, pressure counterbalance spool **D** | BVD32, BVE32 | | DIN 3852[3] | M14 × 1.5; 12 deep | 350 | X |
| **$M_{P1}$** | Measuring port, pressure counterbalance spool | BVE25/53 | | DIN 3852[3] | M14 × 1.5; 12 deep | 350 | X |

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

## Integrated counterbalance valve BVI

### Function

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

### Notice

- BVI available for sizes 55, 80, 107 and 160.
- The counterbalance valve must be ordered additionally. Order example: A6VE160HP6000001A/65MWV0R4A 16Y0-0 + BVI540603002-0
- Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- The counterbalance valve does not replace the mechanical service brake and holding brake.
- For the design of the brake release valve, we require the following data for the mechanical holding brake:
  - the cracking pressure
  - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - the required closing time for a warm device (oil viscosity approx. 15 $mm^2/s$)

## Type code

| 01 | 02 | 03 | 04 | 05 | | 06 |
|---|---|---|---|---|---|---|
| **BVI** | | | | | **–** | |

**Counterbalance valve**

| | | |
|---|---|---|
| 01 | Counterbalance valve integrated | **BVI** |

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

**Throttle mounting**

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

**Check valve**

| | | |
|---|---|---|
| 04 | Without residual opening | **00** |

**Brake release valve**

| | | | |
|---|---|---|---|
| 05 | With brake release valve (standard HZ, EZ, EP and HP) | Without disable function | **1** |
| | With brake release valve (standard HA) | With disable function | **2** |

**Standard/special version**

| | | |
|---|---|---|
| 06 | Standard version | **0** |
| | Special version | **S** |

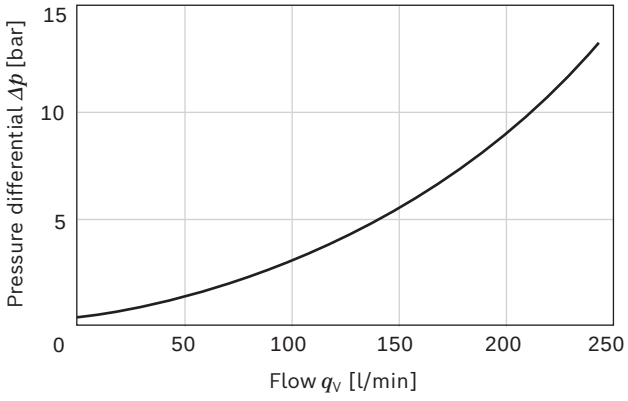
## Technical data

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

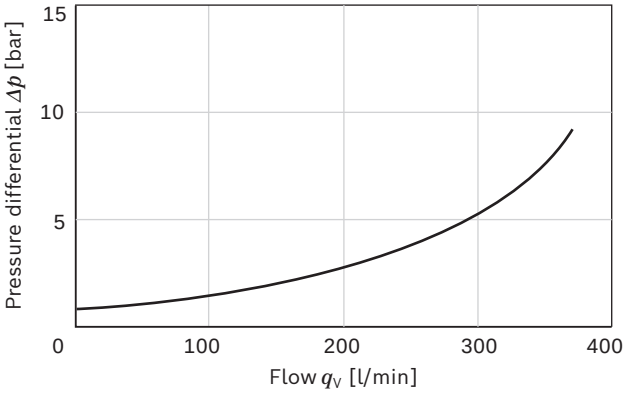
## Permissible inlet flow or pressure when using pressure relief valve and BVI

| Motor NG | Without restrictions Standard plate (1 + 2) | | Restricted values Plate with integrated counterbalance valve (6) | |
|---|---|---|---|---|
| | | | | BVI + PRV |
| | $p_{nom}/p_{max}$ [bar] | $q_{V\,max}$ [l/min] | $p_{nom}/p_{max}$ [bar] | $q_V$ [l/min] |
| 55 | 400/530 | 244 | 350/420 | 240 |
| 80 | | 312 | | |
| 107 | | 380 | | |
| 160 | | 496 | | 400 |

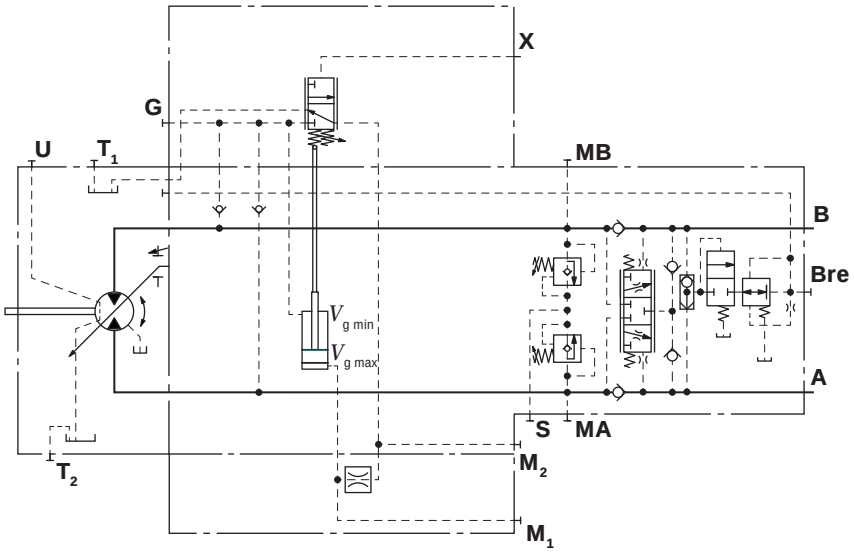
▼ **Boost characteristic NG55, NG80 and NG107**



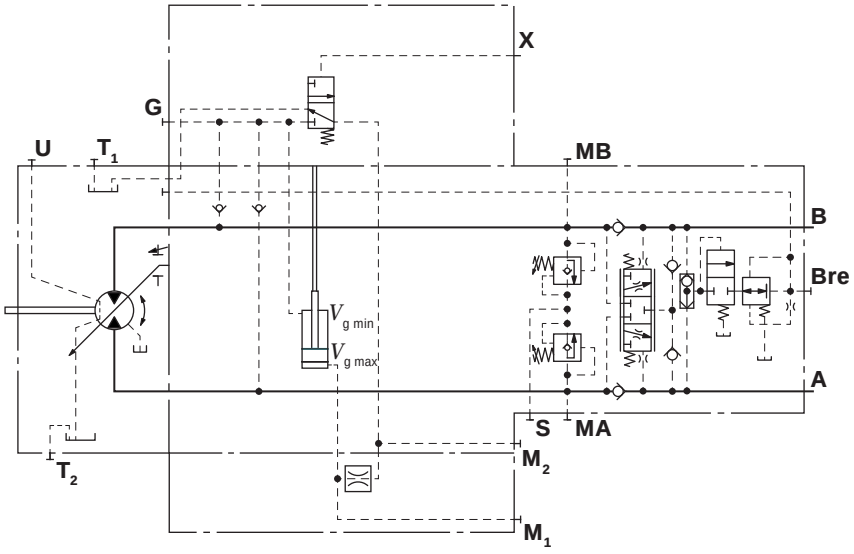

▼ **Boost characteristic NG160**



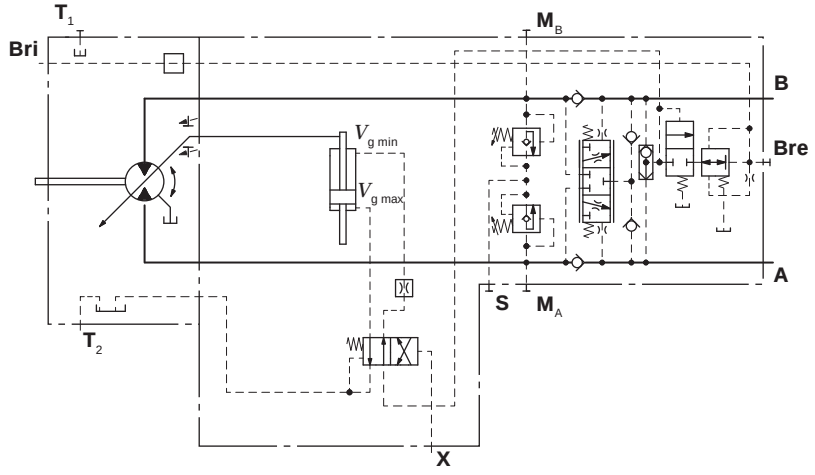
▼ **Circuit diagram HP5/6**



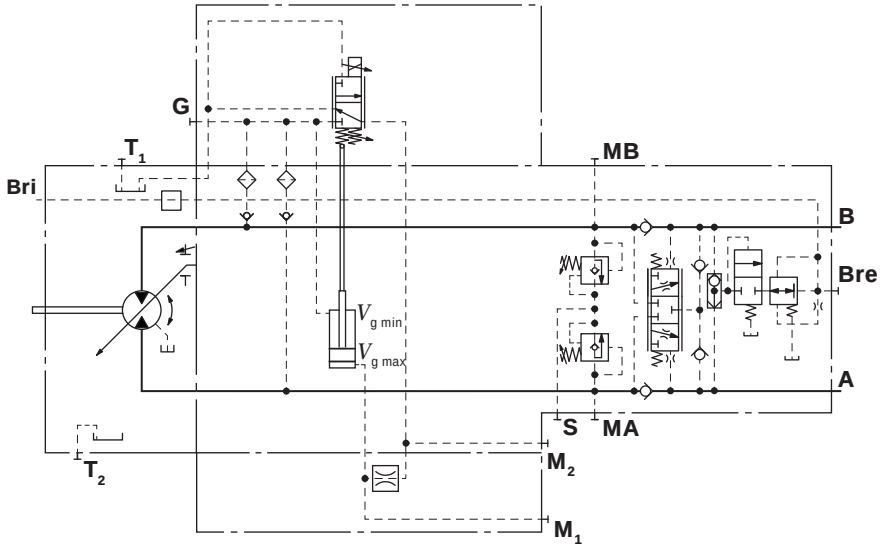

▼ **Circuit diagram HZ5**



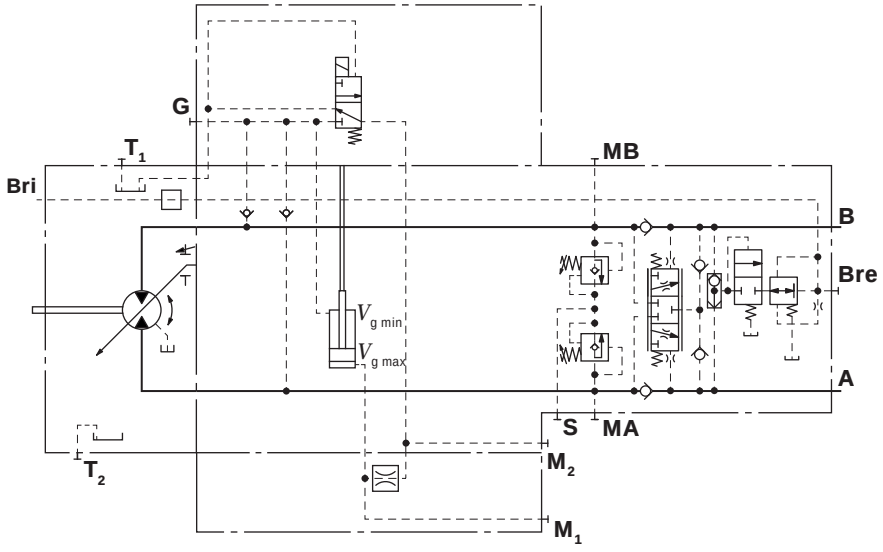

▼ **Circuit diagram HZ7**



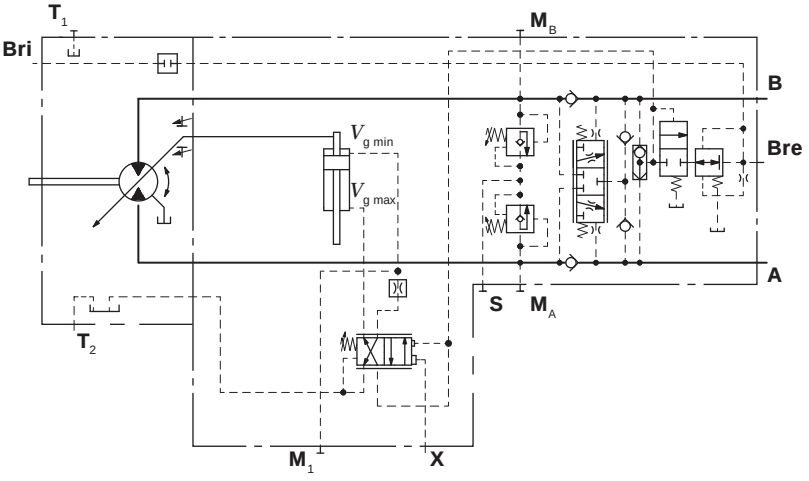
▼ **Circuit diagram EP5/6**




▼ **Circuit diagram EZ5/6**




▼ **Circuit diagram HA3T3**

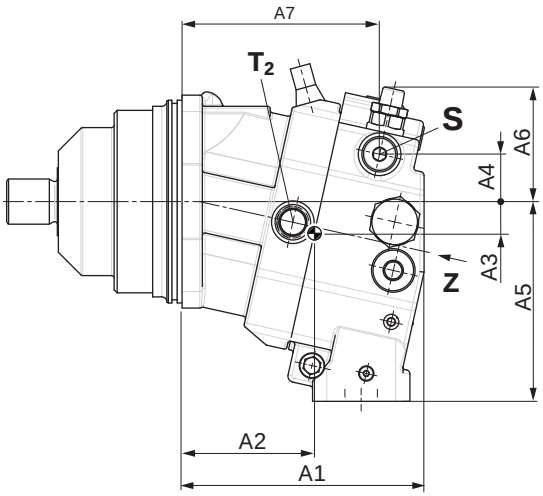


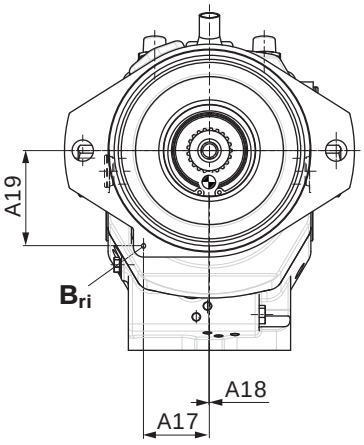
**Integrated counterbalance valve BVI dimensions**

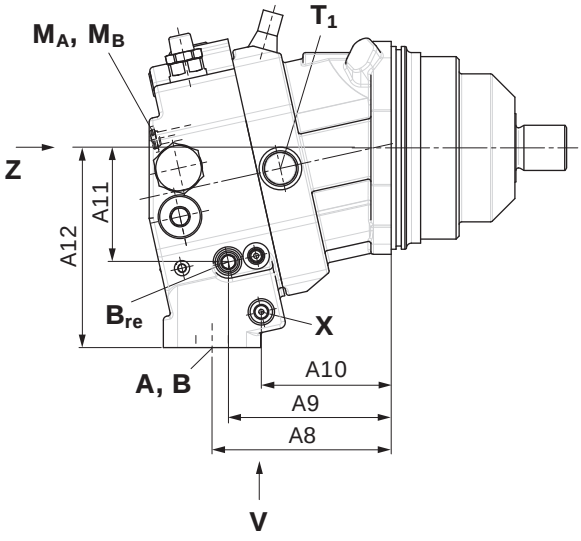
**HZ7 – Two-point control, hydraulic, negative control (NG 55 to 160)**

**HA3 – Automatic high-pressure related control, positive control (only NG 107 and 160)**

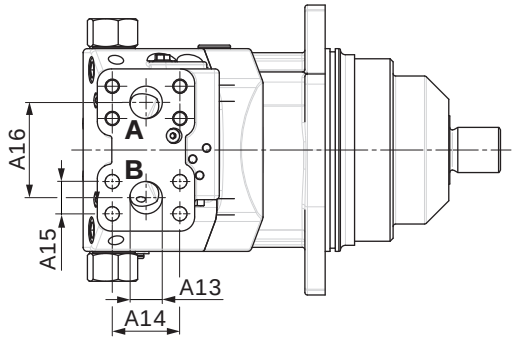
Port plate **6**, with integrated counterbalance valve BVI – SAE working ports **A** and **B** at bottom

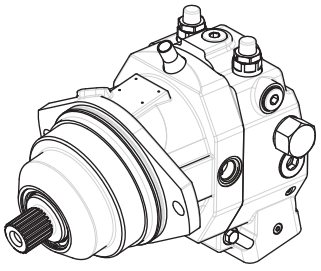


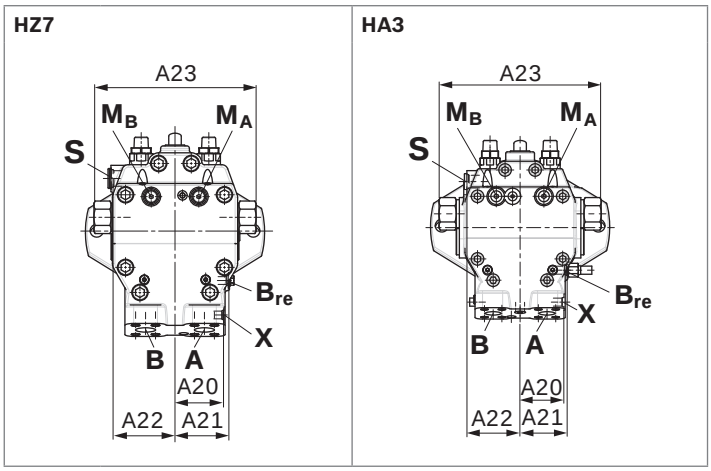

View **V**



Center of gravity

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




| NG | Dimensions | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | ØA13 | A14 | A15 | A16 | A17 | A18 | A19 | A20 | A21 |
| 55 | 192 | 80.6 | 24.5 | 37 | 144 | 102 | 144 | 133 | 119 | 91 | 86 | 117 | 19 | 50.8 | 23.8 | 80 | 51 | 0.4 | 74 | 64 | 67 |
| 80 | 198 | 74.1 | 27.7 | 40 | 162 | 114[1] | 150 | 138 | 123 | 93 | 92 | 132 | 25 | 57.2 | 27.8 | 86 | 53 | 0.4 | 90 | 70 | 70 |
| 107 | 204 | 68 | 24.4 | 40 | 172 | 122[1] | 161 | 144 | 131 | 99 | 98 | 143 | 25 | 57.2 | 27.8 | 86 | 58 | 0.3 | 96 | 70 | 74 |
| 160 | 240 | 94 | 28.8 | 47 | 197 | 136[1] | 195 | 177 | 161 | 128 | 113 | 162 | 32 | 66.7 | 31.8 | 94 | 65 | 0.5 | 94 | 78 | 85 |

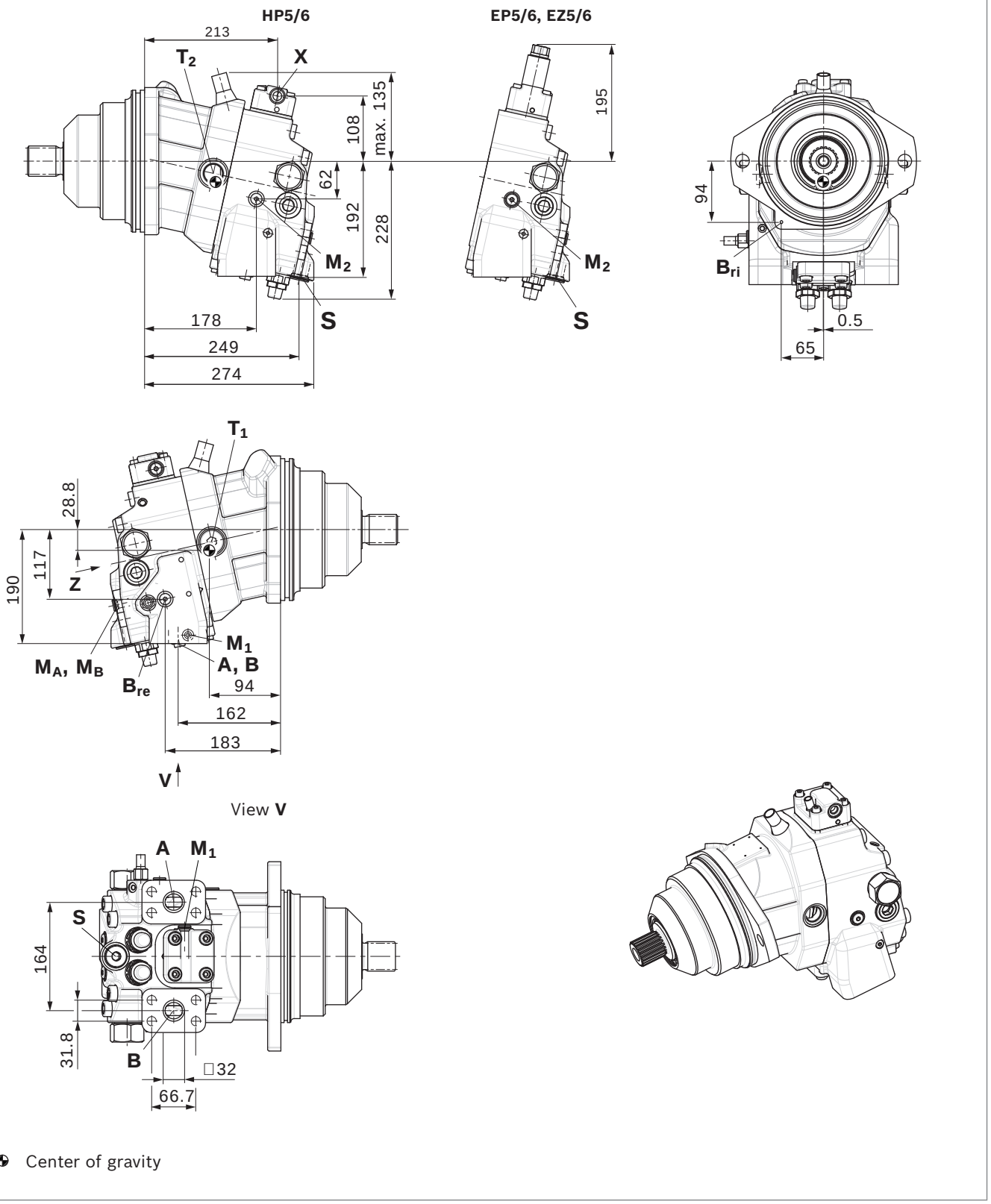
| NG | Dimensions | | Working port SAE J518[2] A, B | Drain port ISO 6149[3] $T_1$, $T_2$ | Pilot pressure port ISO 6149[3] X | Boost port ISO 6149[3] S |
|---|---|---|---|---|---|---|
| | A22 | A23 | | | | |
| 55 | 83 | 259 | 3/4 in | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M22 × 1.5; 15.5 deep |
| 80 | 83 | 259 | 1 in | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M22 × 1.5; 15.5 deep |
| 107 | 85 | 259 | 1 in | M22 × 1.5; 15.5 deep | M14 × 1.5; 11.5 deep | M22 × 1.5; 15.5 deep |
| 160 | 101.5 | 259 | 1 1/4 in | M27 × 2; 19 deep | M14 × 1.5; 11.5 deep | M27 × 2; 19 deep |
| $p_{max}$ **[bar]**[4] | | | 420 | 3 | 100 | 30 |
| **State**[6] | | | O | X/O (**$T_2$**)[5] | O | X |

| Port<br>NG | Measuring port, pressure A, B<br>$M_A$, $M_B$ | Measuring port, control pressure<br>**$M_1$** not with HZ7 | Brake release port external ISO 6149[3]<br>Bre | Brake release port, internal<br>Bri |
|---|---|---|---|---|
| 55 | M14 × 1.5; 11.5 deep | M10 × 1; 10 deep | M14 × 1.5; 11.5 deep | Ø4 |
| 80 | M14 × 1.5; 11.5 deep | M10 × 1; 10 deep | M14 × 1.5; 11.5 deep | Ø4 |
| 107 | M14 × 1.5; 11.5 deep | M10 × 1; 10 deep | M14 × 1.5; 11.5 deep | Ø4 |
| 160 | M14 × 1.5; 11.5 deep | M10 × 1; 10 deep | M14 × 1; 11.5 deep | Ø4 |
| $p_{max}$ **[bar]**[4] | 420 | 420 | 30 | 30 |
| **State**[6] | X | X | O/X[7] | X/O[8] |

1) Referring to tamper-proof cap
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
3) The countersink may be deeper than specified in the standard.
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, **$T_1$** or **$T_2$** must be connected (see also installation instructions on page 46).
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
7) Must be connected for external piping. Is plugged for internal channel routing.
8) Is plugged for external channel routing. Must be connected for internal piping.

**Dimensions integrated counterbalance valve BVI, size 160**
**HP5/6 – Proportional control, hydraulic**
**EP5/6 – Proportional control, electric**
**EZ5/6 – Two-point control, electric**

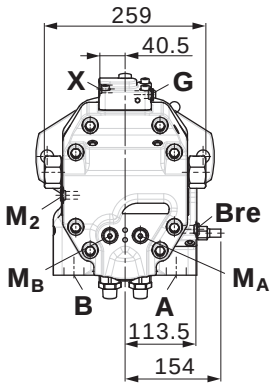
Port plate **6**, with integrated counterbalance valve BVI – SAE working ports **A** and **B** at bottom



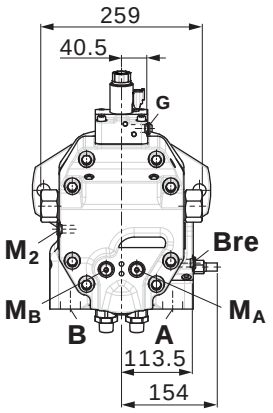

Center of gravity

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

**HP5/6**




**EP5/6, EZ5/6**



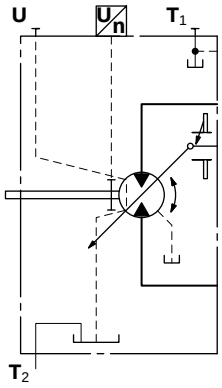

| Ports | | Standard | Size | $p_{max}$ [bar][3] | State[5] |
|---|---|---|---|---|---|
| **A, B** | Working port fastening thread | SAE J518<br>DIN 13[1] | 1 1/4 in<br>M14 × 2; 19 deep | 420 | O |
| **$T_1$, $T_2$** | Drain port | ISO 6149[2] | M27 × 2; 19 deep | 30 | X/O (**$T_2$**)[4] |
| **G** | Synchronous control | ISO 6149[2] | M14 × 1.5; 11.5 deep | 420 | X |
| **X** (HP, HZ) | Pilot pressure port | ISO 6149[2] | M14 × 1.5; 11.5 deep | 100 | O |
| **$M_1$** | Measuring port, control pressure | ISO 6149[2] | M14 × 1.5; 11.5 deep | 420 | X |
| **$M_2$** | Measuring port, control pressure | ISO 6149[2] | M14 × 1.5; 11.5 deep | 420 | X |
| **$M_A$, $M_B$** | Measuring port, pressure **A, B** | ISO 6149[2] | M14 × 1.5; 11.5 deep | 420 | X |
| **Bre** | Brake release port, external | ISO 6149[2] | M14 × 1.5; 11.5 deep | 30 | O/X[6] |
| **Bri** | Brake release port, internal | ISO 6149[2] | Ø4 | 30 | O/X[7] |
| **S** | Boost port | ISO 6149[2] | M27 x 2; 19 deep | 30 | X |

1) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
2) The countersink may be deeper than specified in the standard.
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, **$T_1$** or **$T_2$** must be connected (see also installation instructions on page 46).
5) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
6) Must be connected for external piping. Is plugged for internal channel routing.
7) Is plugged for external channel routing. Must be connected for internal piping.

## Speed sensor

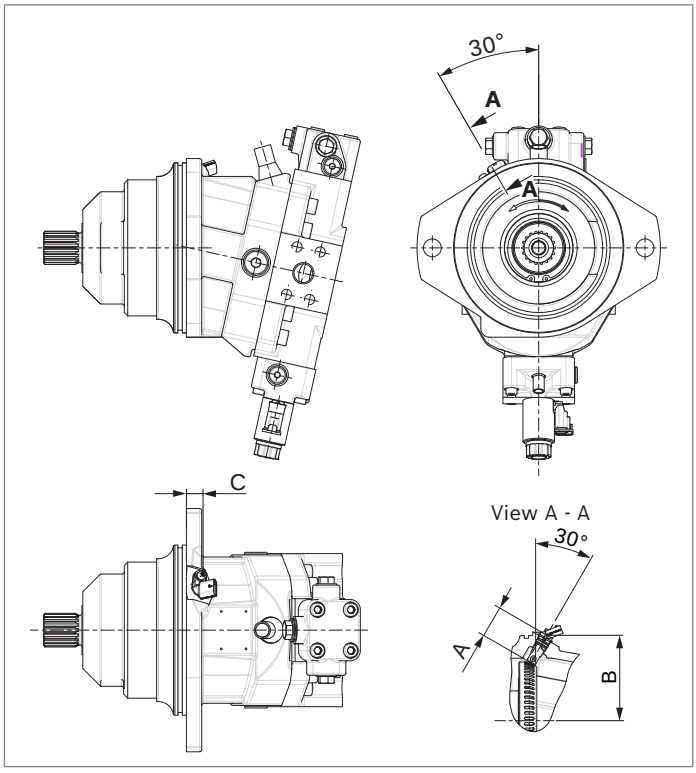
The motor speed can be recorded by the mounted DST or DSA speed sensor. The proportional frequency signal required is generated by splines at the rotary group.
In addition to the rotational speed, the DST or DSA sensor detects the direction of rotation of the motor and the temperature at the installation location.
Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95131 (DST) or 95126 (DSA/20).
The sensor is mounted on the port provided for this purpose with a mounting bolt. On deliveries without sensor, the port is plugged with a pressure-resistant cover. We recommend ordering the A6VE variable motor complete with mounted sensor.

▼ **Circuit diagram EP**




▼ **Dimensions**

Version "E" with mounted DST speed sensor




| Size | | 28 | 55 | 80 | 107 | 160 | 200 |
|---|---|---|---|---|---|---|---|
| Number of teeth | | 40 | 54 | 58 | 67 | 75 | 80 |
| A | Insertion depth (tolerance -0.25) | 32 | 32 | 32 | 32 | 32 | 32 |
| B | Contact surface | 69.3 | 83.8 | 87.3 | 96.3 | 104.3 | 109.2 |
| C | | 14 | 16 | 18 | 18 | 20 | 22.7 |

## Setting range for displacement

| | 28 | | | | 55 | | | | 80 | | | | 107 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | |
| | from | to | from | to | from | to | from | to | from | to | from | to | from | to | from | to |
| **A** | 28.1 | 28.1 | 0.0 | 6.9 | 54.8 | 54.8 | 0.0 | 13.3 | 80.0 | 80.0 | 0.0 | 23.0 | 107.0 | 107.0 | 0.0 | 22.2 |
| | M8 × 40<br>R909086115 | | M8 × 50<br>R909153076 | | Without screw | | M10 × 60<br>R909154690 | | Without screw | | M12 × 70<br>R909085976 | | Without screw | | M12 × 70<br>R909085976 | |
| **B** | 28.1 | 28.1 | > 6.9 | 15.0 | 54.8 | 54.8 | > 13.3 | 27 | 80.0 | 80.0 | 23.0 | 41.0 | 107.0 | 107.0 | > 22.2 | 43.8 |
| | M8 × 40<br>R909086115 | | M8 × 60<br>R909153811 | | Without screw | | M10 × 70<br>R909153779 | | Without screw | | M12 × 80<br>R909153075 | | Without screw | | M12 × 80<br>R909153075 | |
| **C** | 28.1 | 28.1 | > 15.0 | 20.0 | 54.8 | 54.8 | > 27.0 | 38.0 | 80.0 | 80.0 | > 41.0 | 56.0 | 107.0 | 107.0 | > 43.8 | 65.5 |
| | M8 × 40<br>R909086115 | | M8 × 70<br>R909154506 | | Without screw | | M10 × 80<br>R909154058 | | Without screw | | M12 × 90<br>R909154041 | | Without screw | | M12 × 90<br>R909154041 | |
| **D** | x | | x | | x | | x | | x | | x | | 107.0 | 107.0 | > 65.5 | 75.0 |
| | | | | | | | | | | | | | Without screw | | M12 × 100<br>R909153975 | |
| **E** | < 28.1 | 21.6 | 0.0 | 6.9 | < 54.8 | 42.0 | 0.0 | 13.3 | < 80.0 | 58.0 | 0.0 | 23.0 | < 107.0 | 86.0 | 0.0 | 22.2 |
| | M8 × 50<br>R909153076 | | M8 × 50<br>R909153076 | | M10 × 60<br>R909154690 | | M10 × 60<br>R909154690 | | M12 × 70<br>R909085976 | | M12 × 70<br>R909085976 | | M12 × 70<br>R909085976 | | M12 × 70<br>R909085976 | |
| **F** | < 28.1 | 21.6 | > 6.9 | 15.0 | < 54.8 | 42.0 | > 13.3 | 27.0 | < 80.0 | 58.0 | > 23.0 | 41.0 | < 107.0 | 86.0 | > 22.2 | 43.8 |
| | M8 × 50<br>R909153076 | | M8 × 60<br>R909153811 | | M10 × 60<br>R909154690 | | M10 × 70<br>R909153779 | | M12 × 70<br>R909085976 | | M12 × 80<br>R909153075 | | M12 × 70<br>R909085976 | | M12 × 80<br>R909153075 | |
| **G** | < 28.1 | 21.6 | > 15.0 | 20.0 | < 54.8 | 42.0 | > 27.0 | 38.0 | < 80.0 | 58.0 | > 41.0 | 56.0 | < 107.0 | 86.0 | > 43.8 | 65.5 |
| | M8 × 50<br>R909153076 | | M8 × 70<br>R909154506 | | M10 × 60<br>R909154690 | | M10 × 80<br>R909154058 | | M12 × 70<br>R909085976 | | M12 × 90<br>R909154041 | | M12 × 70<br>R909085976 | | M12 × 90<br>R909154041 | |
| **H** | x | | x | | x | | x | | x | | x | | < 107.0 | 86.0 | > 65.5 | 75.0 |
| | | | | | | | | | | | | | M12 × 70<br>R909085976 | | M12 × 100<br>R909153975 | |
| **J** | < 21.6 | 13.8 | 0.0 | 6.9 | < 42.0 | 29.0 | 0.0 | 13.3 | < 58.0 | 41.0 | 0.0 | 23.0 | < 86.0 | 64.0 | 0.0 | 22.2 |
| | M8 × 60<br>R909153811 | | M8 × 50<br>R909153076 | | M10 × 70<br>R909153779 | | M10 × 60<br>R909154690 | | M12 × 80<br>R909153075 | | M12 × 70<br>R909085976 | | M12 × 80<br>R909153075 | | M12 × 70<br>R909085976 | |
| **K** | < 21.6 | 13.8 | > 6.9 | 15.0 | < 42.0 | 29.0 | > 13.3 | 27.0 | < 58.0 | 41.0 | > 23.0 | 41.0 | < 86.0 | 64.0 | > 22.2 | 43.8 |
| | M8 × 60<br>R909153811 | | M8 × 60<br>R909153811 | | M10 × 70<br>R909153779 | | M10 × 70<br>R909153779 | | M12 × 80<br>R909153075 | | M12 × 80<br>R909153075 | | M12 × 80<br>R909153075 | | M12 × 80<br>R909153075 | |
| **L** | < 21.6 | 13.8 | > 15.0 | 20.0 | < 42.0 | 29.0 | > 27.0 | 38.0 | < 58.0 | 41.0 | > 41.0 | 56.0 | < 86.0 | 64.0 | > 43.8 | 65.5 |
| | M8 × 60<br>R909153811 | | M8 × 70<br>R909154506 | | M10 × 70<br>R909153779 | | M10 × 80<br>R909154058 | | M12 × 80<br>R909153075 | | M12 × 90<br>R909154041 | | M12 × 80<br>R909153075 | | M12 × 90<br>R909154041 | |
| **M** | x | | x | | x | | x | | x | | x | | < 86.0 | 64.0 | > 65.5 | 75.0 |
| | | | | | | | | | | | | | M12 × 80<br>R909153075 | | M12 × 100<br>R909153975 | |

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

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

Theoretical, maximum setting:

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

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

| | 160 | | | | 200 | | | |
|---|---|---|---|---|---|---|---|---|
| | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | | $V_{g\,max}$ (cm³/rev) | | $V_{g\,min}$ (cm³/rev) | |
| | from | to | from | to | from | to | from | to |
| **A** | 160.0 | 160.0 | 0.0 | 26.0 | 200.0 | 200.0 | 0.0 | 39.0 |
| | Without screw | | M12 × 80 R909153075 | | Without screw | | M12 × 80 R909153075 | |
| **B** | 160.0 | 160.0 | > 26.0 | 54.0 | 200.0 | 200.0 | > 39.0 | 72.0 |
| | Without screw | | M12 × 90 R909154041 | | Without screw | | M12 × 90 R909154041 | |
| **C** | 160.0 | 160.0 | > 54.0 | 83.0 | 200.0 | 200.0 | > 72.0 | 105.0 |
| | Without screw | | M12 × 100 R909153975 | | Without screw | | M12 × 100 R909153975 | |
| **D** | 160.0 | 160.0 | > 83.0 | 110.0 | 200.0 | 200.0 | > 105.0 | 140.0 |
| | Without screw | | M12 × 110 R909154212 | | Without screw | | M12 × 110 R909154212 | |
| **E** | < 160.0 | 136.0 | 0.0 | 26.0 | < 200.0 | 164.0 | 0.0 | 39.0 |
| | M12 × 80 R909153075 | | M12 × 80 R909153075 | | M12 × 80 R909153075 | | M12 × 80 R909153075 | |
| **F** | < 160.0 | 136.0 | > 26.0 | 54.0 | < 200.0 | 164.0 | > 39.0 | 72.0 |
| | M12 × 80 R909153075 | | M12 × 90 R909154041 | | M12 × 80 R909153075 | | M12 × 90 R909154041 | |
| **G** | < 160.0 | 136.0 | > 54.0 | 83.0 | < 200.0 | 164.0 | > 72.0 | 105.0 |
| | M12 × 80 R909153075 | | M12 × 100 R909153975 | | M12 × 80 R909153075 | | M12 × 100 R909153975 | |
| **H** | < 160.0 | 136.0 | > 83.0 | 110.0 | < 200.0 | 164.0 | > 105.0 | 140.0 |
| | M12 × 80 R909153075 | | M12 × 110 R909154212 | | M12 × 80 R909153075 | | M12 × 110 R909154212 | |
| **J** | < 136.0 | 109.0 | 0.0 | 26.0 | < 164.0 | 130.5 | 0.0 | 39.0 |
| | M12 × 90 R909154041 | | M12 × 80 R909153075 | | M12 × 90 R909154041 | | M12 × 80 R909153075 | |
| **K** | < 136.0 | 109.0 | > 26.0 | 54.0 | < 164.0 | 130.5 | > 39.0 | 72.0 |
| | M12 × 90 R909154041 | | M12 × 90 R909154041 | | M12 × 90 R909154041 | | M12 × 90 R909154041 | |
| **L** | < 136.0 | 109.0 | > 54.0 | 83.0 | < 164.0 | 130.5 | > 72.0 | 105.0 |
| | M12 × 90 R909154041 | | M12 × 100 R909153975 | | M12 × 90 R909154041 | | M12 × 100 R909153975 | |
| **M** | < 136.0 | 109.0 | > 83.0 | 110.0 | < 164.0 | 130.5 | > 105.0 | 140.0 |
| | 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:

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

Theoretical, maximum setting:

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

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

## Installation instructions

### General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation.
This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T**$_1$, **T**$_2$).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts).
Under all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

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

| Key | |
|---|---|
| **F** | Filling/air bleeding |
| **T**$_1$, **T**$_2$ | Drain port |
| $h_{t\ min}$ | Minimum required immersion depth (200 mm) |
| $h_{min}$ | Minimum required distance to reservoir bottom (100 mm) |

### Installation position

See the following examples **1** to **6**.
Further installation positions are available upon request.
Recommended installation position: **1** and **2**

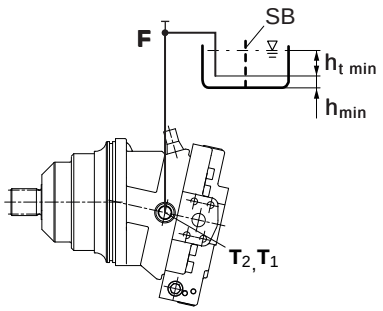
**Notice**
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

## Below-reservoir installation (standard)

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

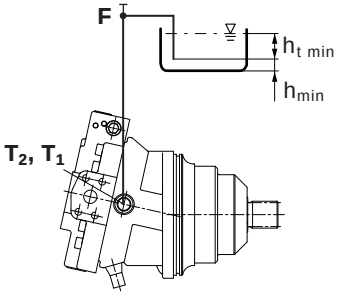
### ▼ Installation position 1

| Air bleeding the housing | Filling |
|---|---|
| – | $T_1$ or $T_2$ (F) |



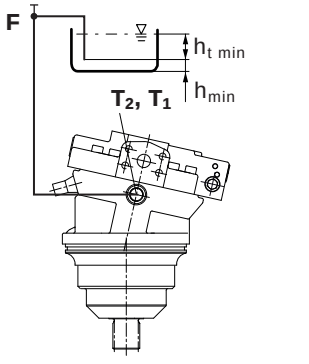

### ▼ Installation position 2

| Air bleeding the housing | Filling |
|---|---|
| – | $T_1$ or $T_2$ (F) |




### ▼ Installation position 3

| Air bleeding the housing | Filling |
|---|---|
| – | $T_1$ or $T_2$ (F) |

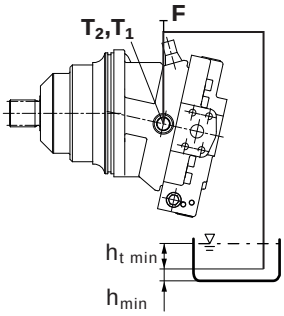



## Above-reservoir installation

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

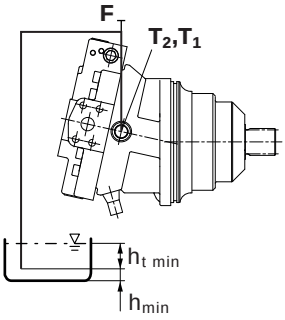
### ▼ Installation position 4

| Air bleeding the housing | Filling |
|---|---|
| $T_1$ or $T_2$ (F) | $T_1$ or $T_2$ (F) |



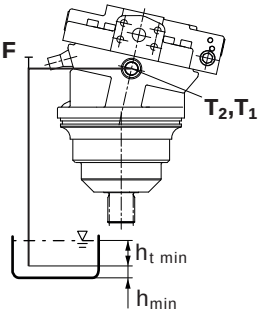

### ▼ Installation position 5

| Air bleeding the housing | Filling |
|---|---|
| $T_1$ or $T_2$ (F) | $T_1$ or $T_2$ (F) |




### ▼ Installation position 6

| Air bleeding the housing | Filling |
|---|---|
| $T_1$ or $T_2$ (F) | $T_1$ or $T_2$ (F) |



## Project planning notes

- The motor A6VE 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 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 preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all configuration variants 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. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference.
  Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. 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.
- 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 excitation of the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times 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 $p_{max}$ permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service ports and function ports are only intended to accommodate hydraulic lines.
- Please note that the series connection of motors and the operation under summation pressure affect the efficiency of the units.
- The control behavior of the motor can change slightly due to natural influences 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 burning 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 an undefined 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. 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 check whether additional measures are required on the machine for the relevant application in order to keep the load in a safe position and ensure they are properly implemented.
- When using the axial piston motor in winch drives, make certain that the technical limit values are not exceeded under all operating conditions. If the axial piston motor is extremely overloaded (e.g. if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst.
  The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.

# Related documentation

### Product-specific documentation

| Document type | Title | Document number |
|---|---|---|
| Manual | Instruction manual Variable Plug-in Motor A6VE Series 65 and 71 | 91616-01-B |
| Data sheet | Technical Data for Torsional Vibration Calculation | 90261 |
| | Storage and preservation of axial piston units | 90312 |

### Documentation for mounted components

| Document type | Title | Document number |
|---|---|---|
| Data sheet | Counterbalance valve BVD, series 41 | 95522 |
| | Counterbalance valve BVE, series 53 | 95526 |
| | Counterbalance valve BVD/BVE, series 52 | 95528 |
| | Speed sensor DSA, series 20 | 95126 |
| | Speed sensor DST | 95131 |

### Documentation for hydraulic fluids

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