TS-A6VE

Variable Plug-in Motor
Size: 28 to 160
Nominal Pressure: 400 Bar
Maximum Pressure: 450 Bar
Open & Closed Circuit

Index

Ordering Code

TS-A6V	E					/	63	W		–	V							
01	02	03	04	05	06		07	08	09		10	11	12	13	14	15	16	17

Axial piston unit

01	Bent-axis design, variable	TS-A6V

Operating mode

02	Motor, plug-in version	E

Sizes (NG)

		28	55	80	107	160	
03	Geometric displacement, see table of values on page 7						

Control devices

			28	55	80	107	160	
04	Proportional control hydraulic	Δp = 10 bar	●	●	●	●	●	HD1
		Δp = 25 bar	●	●	●	●	●	HD2
	Two-point control hydraulic		–	–	–	–	–	HZ
			●	–	–	–	●	HZ1
			–	●	●	●	●	HZ3
	Proportional control electric	12 V	●	●	●	●	●	EP1
		24 V	●	●	●	●	●	EP2
	Two-point control electric	12 V	●	–	–	–	●	EZ1
		24 V	●	–	–	–	●	EZ2
		12 V	–	●	●	●	–	EZ3
		24 V	–	●	●	●	–	EZ4
	Automatic control high-pressure related	with minimum pressure increase Δp ≤ 10 bar	●	●	●	●	●	HA1
		with pressure increase Δp = 100 bar	●	●	●	●	●	HA2
		with minimum pressure increase Δp ≤ 10 bar	–	●	●	●	●	HA3

Pressure control (only for HD, EP)

05	Without pressure control (without code)	
	Pressure control, fixed setting	D

Override of controls HA

06	Without override (without code)	
	Hydraulic override, remote control, proportional	T

Series

07	Series 6, index 3	63

Direction of rotation

08	Viewed on drive shaft, bidirectional	W

Setting ranges for displacement[2)]

		28	55	80	107	160	
09	$V_{g\,min}$ = 0 to 0.7 $V_{g\,max}$ (without code)	●	●	●	●	●	

Seals

		28	55	80	107	160	
10	FKM (fluor-caoutchouc)	●	●	●	●	●	V

● = Available – = Not available

Ordering Code

TS-A6V	E					/	63	W		–	V							
01	02	03	04	05	06		07	08	09		10	11	12	13	14	15	16	17

	Drive shafts		**28**	**55**	**80**	**107**	**160**	
11	Splined shaft DIN 5480		●	●	●	●	●	**A**
			●	●	●	●	●	**Z**

	Mounting flanges		**28**	**55**	**80**	**107**	**160**	
12	Similar to ISO 3019-2	2-hole	●	●	●	●	●	**L**
		4-hole	–	–	–	–	–	**M**
	Modified adapter flange	2-hole	–	–	–	●	–	**U**

	Port plates for service lines[3]				**28**	**55**	**80**	**107**	**160**	
13	SAE flange ports A and B at side, opposite		**02**	**0**	●	●	●	●	●	**020**
				7	●	●	●	●	●	**027**
	SAE flange ports A and B at bottom only with integrated counterbalance valve BVI[4]		**22**	**1**	–	●	●	●	●	**221**
				2	–	●	●	●	●	**222**
	Port plate with 1-level pressure-relief valves for mounting a counterbalance valve[5][7]	BVD	**37**	**0**	–	–	–	●	–	**370** **378**
			38	**8**	–	●	●	●	●	**380**

	Valves (see pages 29 to 37)		
14	Without valve		**0**
	Brake release valve integrated (pilot pressure for brake release)	internal ducting	**1**
		external piping	**2**
	Flushing and boost pressure valve mounted		**7**
	Counterbalance valve mounted[6][7]		**8**

	Speed sensor (see page 38)	**28**	**55**	**80**	**107**	**160**	
15	Without speed sensor	●	●	●	●	●	**0**
	Prepared for DSA speed sensor	●	●	●	●	●	**U**
	DSA speed sensor mounted[8]	●	●	●	●	●	**V**

	Connector for solenoids (see page 28)	**28 to 160**	
16	Without connector (without solenoid, only with hydraulic controls)	●	**0**
	(size 250 without code)	–	
	DEUTSCH – molded connector, 2-pin – without suppressor diode	●	**P**
	HIRSCHMANN connector – without suppressor diode (without code)	–	

	Beginning of control		**28**	**55**	**80**	**107**	**160**	
17	Port plate 02, 37, 38	at $V_{g\,min}$ (standard for HA)	●	●	●	●	●	**A**
		at $V_{g\,max}$ (standard for HD, HZ, EP, EZ, DA)	●	●	●	●	●	**B**
	Port plate 22	at $V_{g\,min}$ (standard for HA3)	–	●	●	●	●	**B**
		at $V_{g\,max}$ (standard for HZ3)	–	●	●	●	●	**B**

● = Available – = Not available

Technical Data

Operating pressure range

(operating with mineral oil)

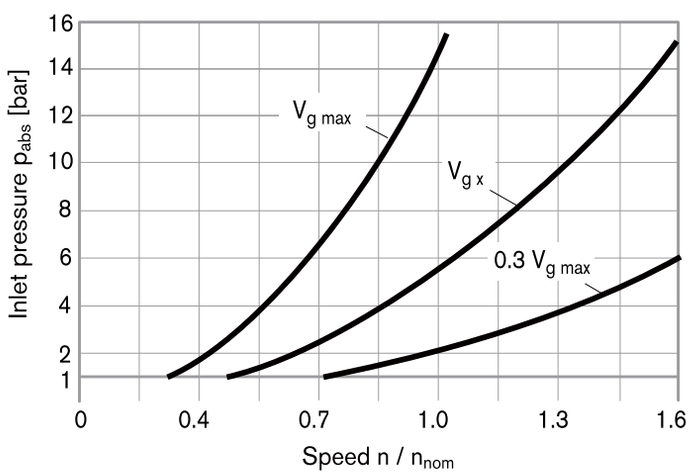
Pressure at service line port A or B

Sizes 28 to 160

Nominal pressure p_{nom} _____ 400 bar absolute

Maximum pressure p_{max} _____ 450 bar absolute
Single operating period _____ 10 s
Total operating period _____ 300 h

Minimum pressure – pump mode (inlet)
To prevent damage to the axial piston motor in pump operation mode (change of high-pressure side with unchanged direction of rotation, e. g. when braking), a minimum pressure must be guaranteed at the service line port (inlet). This minimum pressure is dependent on the speed and displacement of the axial piston unit (see characteristic curve below).



For sizes 28 to 160

This diagram is valid only for the optimum viscosity range from $\nu_{opt} = 36$ to 16 mm²/s.
Please contact us if the above conditions cannot be satisfied.

Definition

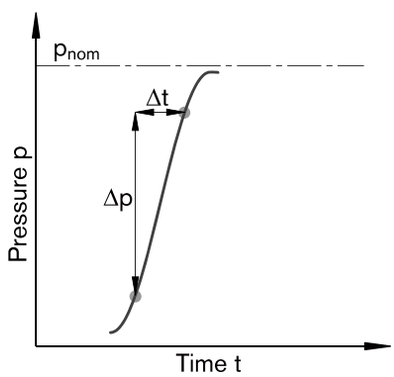
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

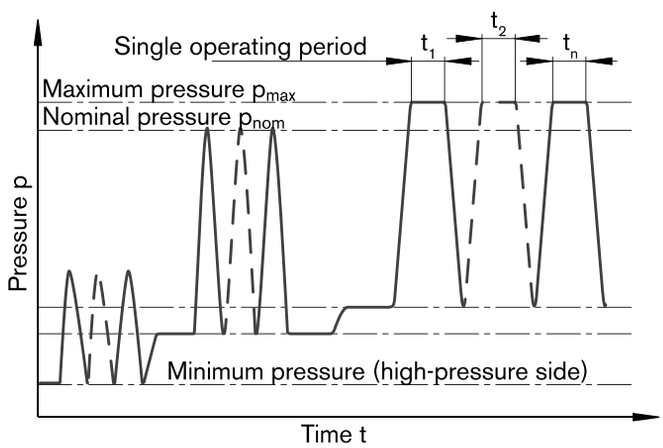
Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Summation pressure p_{Su}
The summation pressure is the sum of the pressures at both service line ports (A and B).

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.





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

Technical Data

Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size		NG	28	55	80	107	160
Displacement geometric[1], per revolution	$V_{g\,max}$	cm^3	28.1	54.8	80	107	160
	$V_{g\,min}$	cm^3	0	0	0	0	0
	$V_{g\,x}$	cm^3	18	35	51	68	61
Speed maximum[2] (while adhering to the maximum permissible input flow)							
at $V_{g\,max}$	n_{nom}	rpm	5550	4450	3900	3550	3100
At $V_g < V_{g\,x}$ (see diagram below)	n_{max}	rpm	8750	7000	6150	5600	4900
at $V_{g\,0}$	n_{max}	rpm	10450	8350	7350	6300	5500
Input flow[3]							
at n_{nom} and $V_{g\,max}$	$q_{V\,max}$	L/min	156	244	312	380	496
Torque[4]							
At $V_{g\,max}$ and $\Delta p = 400$ bar	T	Nm	179	349	509	681	1019
At $V_{g\,max}$ and $\Delta p = 350$ bar	T	Nm	157	305	446	596	891
Rotary stiffness							
$V_{g\,max}$ to $V_{g/2}$	c_{min}	KNm/rad	6	10	16	21	35
$V_{g/2}$ to 0 (interpolated)	c_{max}	KNm/rad	18	32	48	65	105
Moment of inertia for rotary group	J_{GR}	kgm^2	0.0014	0.0042	0.008	0.0127	0.0253
Maximum angular acceleration	α	rad/s^2	47000	31500	24000	19000	11000
Case volume	V	L	0.5	0.75	1.2	1.5	2.4
Mass (approx.)							
Port plate 02, 37, 38	m	kg	16	26	34	47	64
Port plate 22	m	kg	–	35	43	53	72

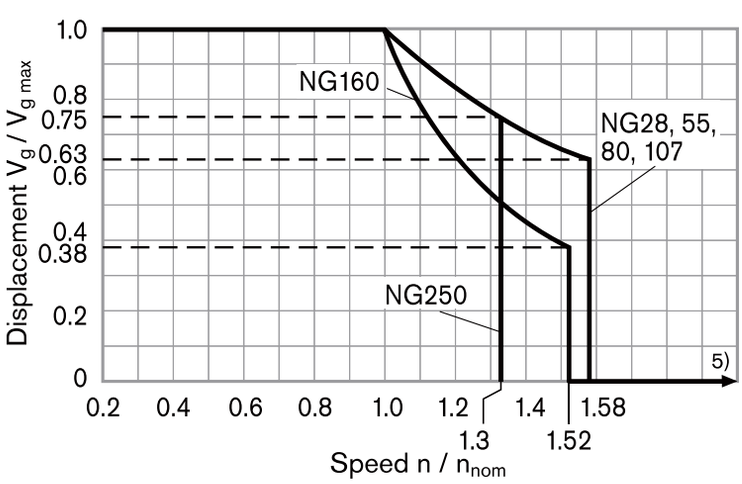
1) The minimum and maximum displacement are infinitely adjustable, see ordering code,

2) The values are valid:
- for the optimum viscosity range from $\nu_{opt} = 36$ to 16 mm^2/s
- with hydraulic fluid based on mineral oils

3) Restriction of input flow with counterbalance valve,

4) Torque without radial force, with radial force

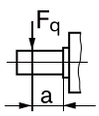
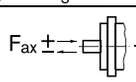
Permissible displacement in relation to speed



5) Values in this range on request

Technical data

Permissible radial and axial forces of the drive shafts

Size	NG		28	55	80	107	160
Drive shaft	ø	mm	30	30	40	40	50
Maximum radial force[1] at distance a (from shaft collar) 	$F_{q\ max}$	N	4838	7581	10283	13758	16435
	a	mm	17.5	17.5	22.5	22.5	27.5
with permissible torque	T_{max}	Nm	179	281	509	681	1019
≙ Permissible pressure Δp at $V_{g\ max}$	$p_{nom\ perm.}$	bar	400	322	400	400	400
Maximum axial force[2] 	$+F_{ax\ max}$	N	315	500	710	900	1120
	$-F_{ax\ max}$	N	0	0	0	0	0
Permissible axial force per bar operating pressure	$F_{ax\ perm./bar}$	N/bar	4.6	7.5	9.6	11.3	15.1

1) With intermittent operation.
2) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.

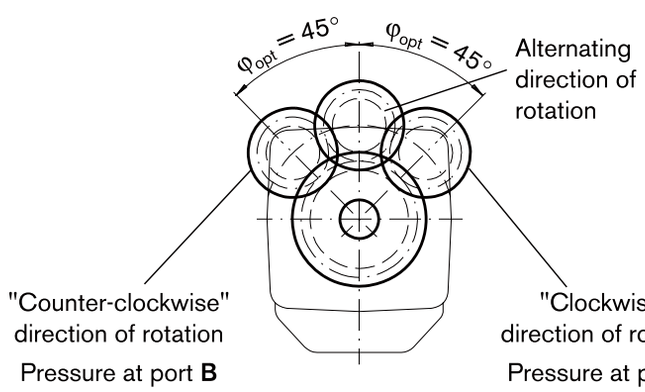
Note
Influence of the direction of the permissible axial force:

$+F_{ax\ max}$ = Increase in service life of bearings
$-F_{ax\ max}$ = Reduction in service life of bearings (avoid)

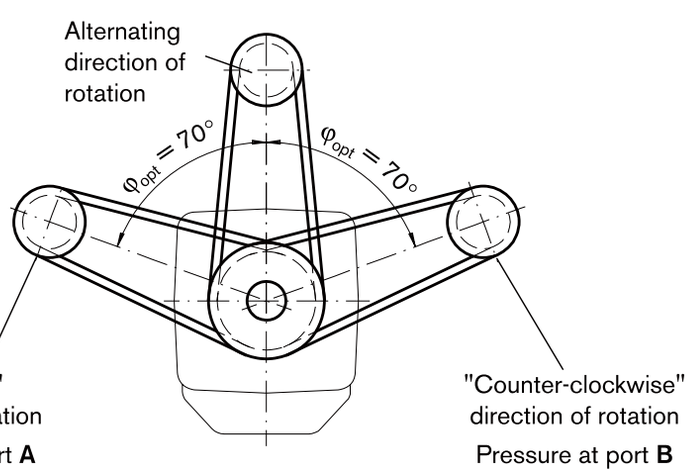
Effect of radial force F_q on the service life of bearings

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

Toothed gear drive



V-belt drive



Determining the operating characteristics

Input flow $q_v = \frac{V_g \cdot n}{1000 \cdot \eta_v}$ [L/min]

Speed $n = \frac{q_V \cdot 1000 \cdot \eta_v}{V_g}$ [min^{-1}]

Torque $T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$ [Nm]

Power $P = \frac{2\ \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

HD - Proportional Control hydraulic

The proportional hydraulic control provides infinite setting of the displacement, proportional to the pilot pressure applied to port X.

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

Note

- Maximum permissible pilot pressure: $p_{St} = 100$ bar
- The control oil is internally taken out of the high-pressure side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us.
  Please note that pressures up to 450 bar can occur at port G.
- Please state the desired beginning of control in plain text when ordering, e. g.: beginning of control at 10 bar.
- The beginning of control and the HD characteristic are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 5) and thus a parallel shift of the characteristic.
- A leakage flow of maximum 0.3 L/min can escape at port X due to internal leakage (operating pressure > pilot pressure). The control is to be suitably configured to avoid an independent build-up of pilot pressure.

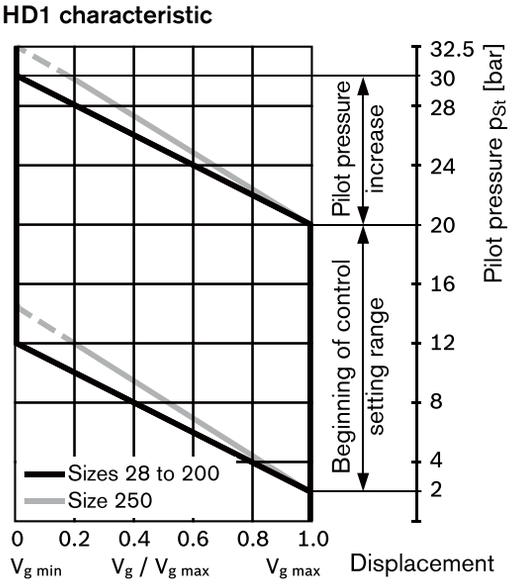
HD1
Pilot pressure increase $\Delta p_{St} = 10$ bar

A pilot pressure increase of 10 bar at port X results in a decrease in displacement from $V_{g\,max}$ to 0 cm^3 (sizes 28 to 160)

Beginning of control, setting range _____2 to 20 bar

Standard setting:
Beginning of control at 3 bar (end of control at 13 bar)

HD1 characteristic



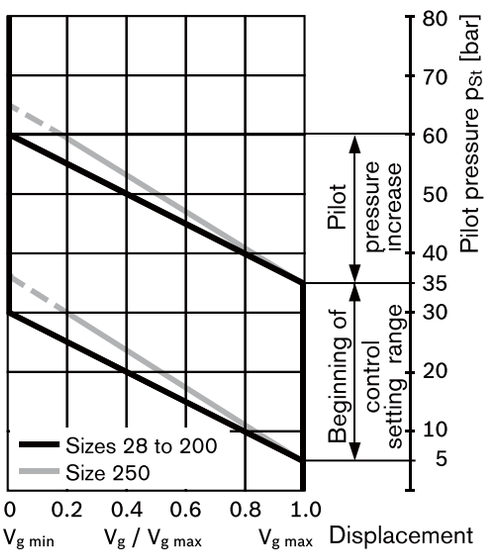
HD2
Pilot pressure increase $\Delta p_{St} = 25$ bar

A pilot pressure increase of 25 bar at port X results in a decrease in displacement from $V_{g\,max}$ to 0 cm^3 (sizes 28 to 160)

Beginning of control, setting range _____5 to 35 bar

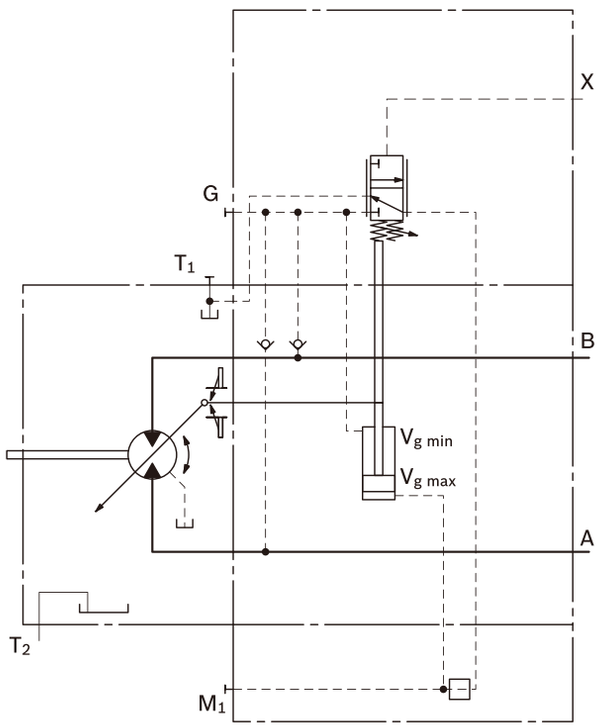
Standard setting:
Beginning of control at 10 bar (end of control at 35 bar)

HD2 characteristic



HD - Proportional Control hydraulic

Schematic HD1, HD2
Sizes 28 to 160



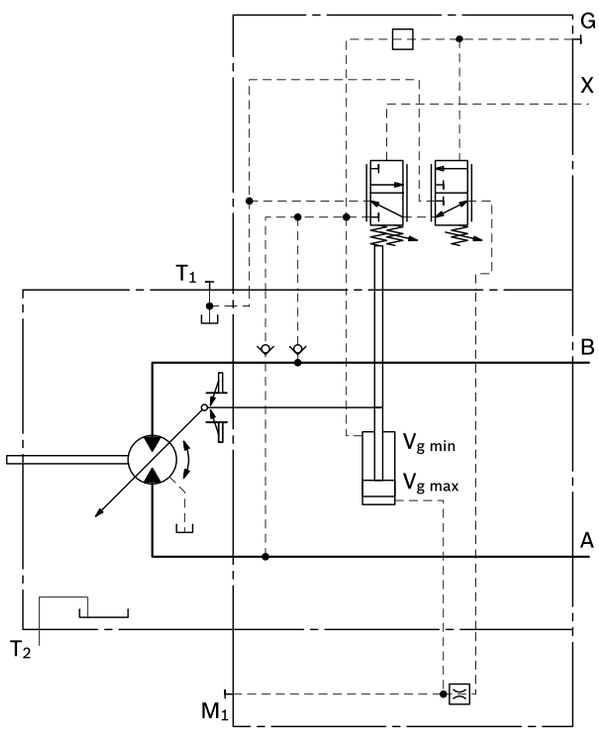
HD.D
Pressure control, fixed setting

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

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

Setting range of the pressure control valve
Sizes 28 to 160 _____ 80 to 400 bar

Schematic HD.D
Sizes 28 to 160



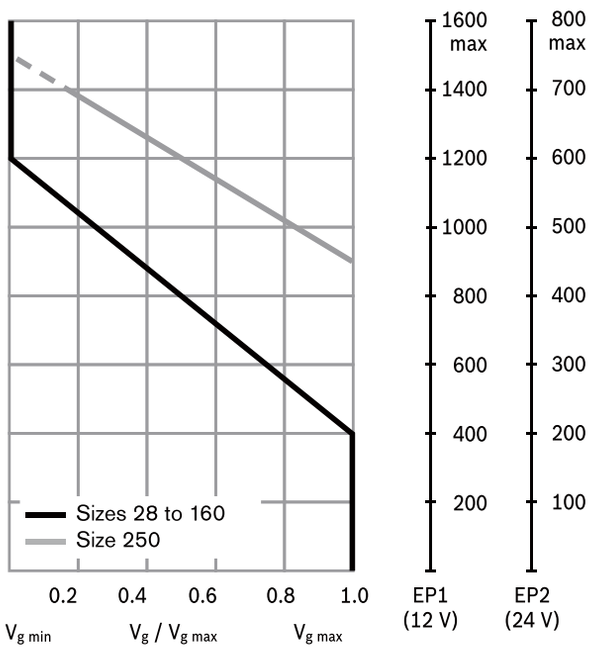
EP - Proportional control electric

The proportional electric control provides infinite setting of the displacement, proportional to the control current applied to the solenoid (sizes 28 to 200).

– Beginning of control at $V_{g\ max}$ (maximum torque, minimum speed at minimum control current)

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

Characteristic



Note

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

Technical data, solenoid
Sizes 28 to 160

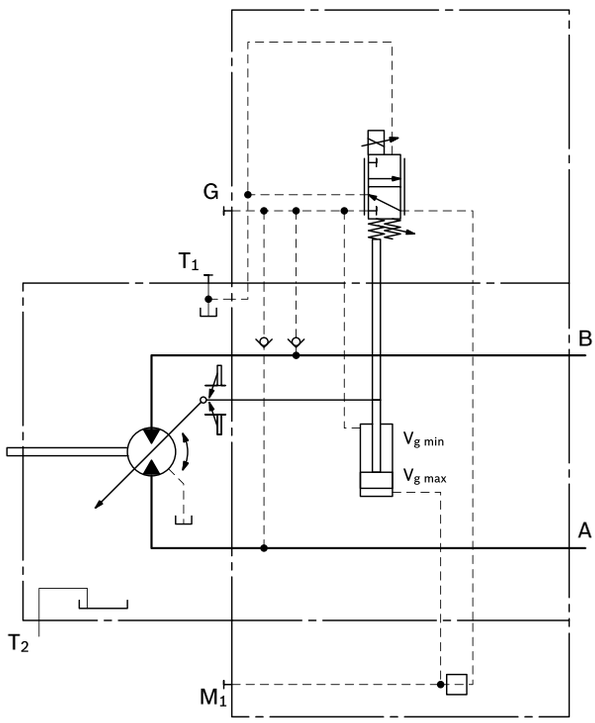
	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Beginning of control	400 mA	200 mA
End of control	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100 %	100 %

The following electronic controllers and amplifiers are available for controlling the proportional solenoids:

– Electric amplifier VT 2000, series 5X (for stationary application)

EP - Proportional control electric

Schematic EP1, EP2
Sizes 28 to 160



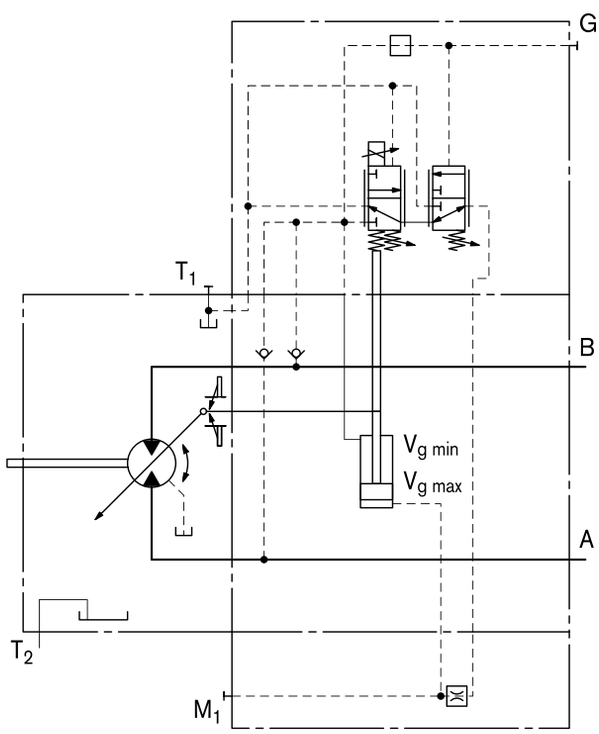
EP.D
Pressure control, fixed setting

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 of the pressure control, the motor will swivel towards a larger displacement.

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

Setting range of the pressure control valve
Sizes 28 to 160 _____ 80 to 400 bar
Size 250 _____ 80 to 350 to bar

Schematic EP.D
Sizes 28 to 160

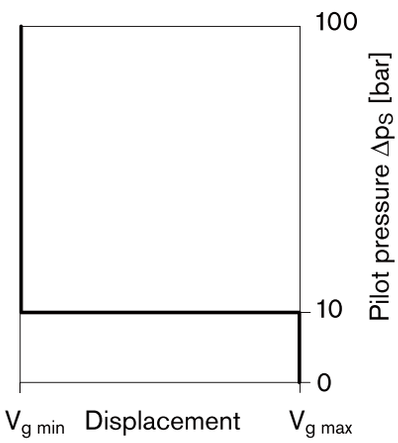


HZ - Two Point Control Hydraulic

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

- Position at $V_{g\,max}$ (without pilot pressure, maximum torque, minimum speed)
- Position at $V_{g\,min}$ (with pilot pressure > 10 bar activated, minimum torque, maximum permissible speed)

Characteristic HZ

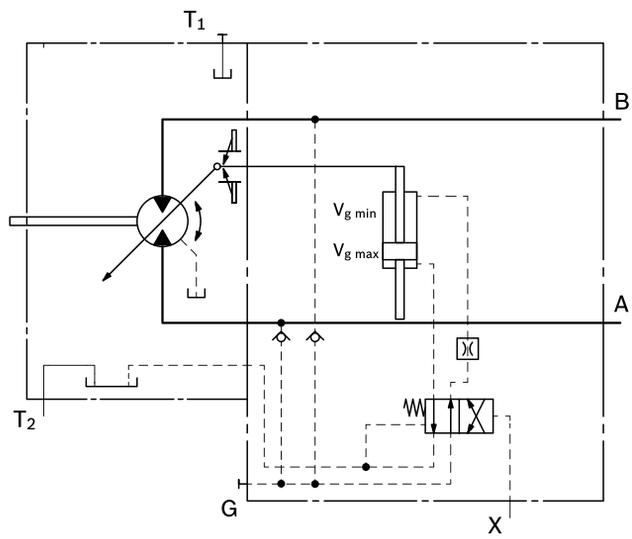


Note

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

Schematic HZ3

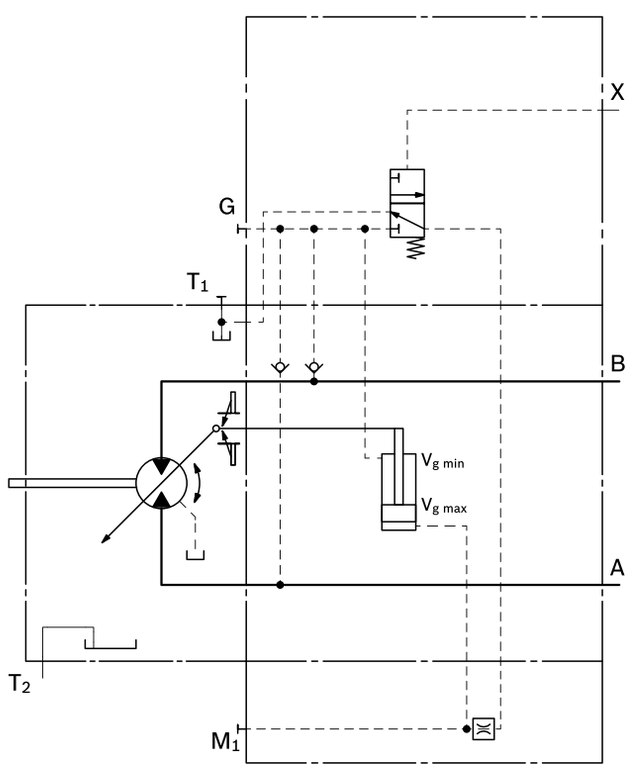
Sizes 55 to 107



Size 160
With integrated counterbalance valve BVI, see page 37

Schematic HZ1

Sizes 28, 160



EZ - Two Point Control Electric

The two-point electric control with switching solenoid (sizes 28 to 160) allows the displacement to be set to either $V_{g\ min}$ or $V_{g\ max}$ by switching the electric current at the switching solenoid or control valve on or off.

Note

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

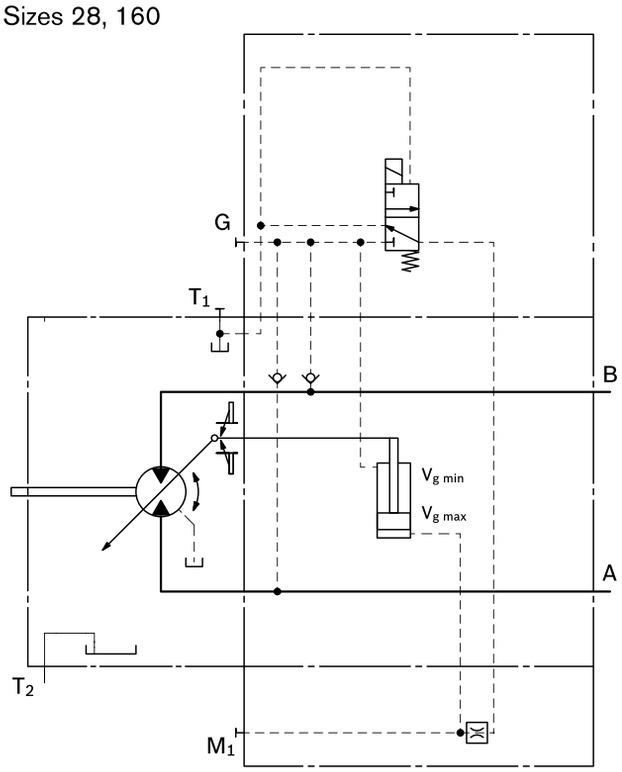
Technical data, solenoid with Ø37
Sizes 28, 160

	EZ1	EZ2
Voltage	12 V (±20 %)	24 V (±20 %)
Displacement $V_{g\ max}$	de-energized	de-energized
Displacement $V_{g\ min}$	energized	energized
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum required current	1.32 A	0.67 A
Duty cycle	100 %	100 %
Type of protection see connector design page 28		

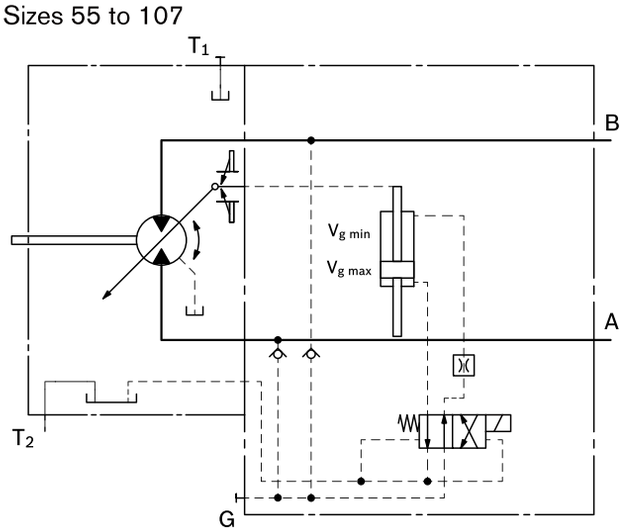
Technical data, solenoid with Ø45
Sizes 55 to 107

	EZ3	EZ4
Voltage	12 V (±20 %)	24 V (±20 %)
Displacement $V_{g\ max}$	de-energized	de-energized
Displacement $V_{g\ min}$	energized	energized
Nominal resistance (at 20 °C)	4.8 Ω	19.2 Ω
Nominal power	30 W	30W
Minimum required current	1.5 A	0.75 A
Duty cycle	100 %	100 %
Type of protection see connector design page 28		

Schematic EZ1, EZ2
Sizes 28, 160



Schematic EZ3, EZ4
Sizes 55 to 107



HA - Automatic control high-pressure related

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

The displacement of the A6VE motor with HA control is $V_{g\ min}$ (maximum speed and minimum torque). The control unit measures internally the operating pressure at A or B (no control line required) and upon reaching the beginning of control, the controller swivels the motor from $V_{g\ min}$ to $V_{g\ max}$ with increase of pressure. The displacement is modulated between $V_{g\ min}$ and $V_{g\ max}$, thereby depending on load conditions.

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

Note

- For safety reasons, 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 side of the motor (A or B). For reliable control, an operating pressure of at least 30 bar is required in A (B). If a control operation is performed at an operating pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port G via an external check valve. For lower pressures, please contact us.
  Please note that pressures up to 450 bar can occur at port G.
- The beginning of control and the HA characteristic are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 5) and thus a parallel shift of the characteristic. Only for HA1T (sizes 28 to 160).
- A leakage flow of maximum 0.3 L/min is present at port X (operating pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure is to be relieved from port X to the reservoir. **Only for control HA.T.**

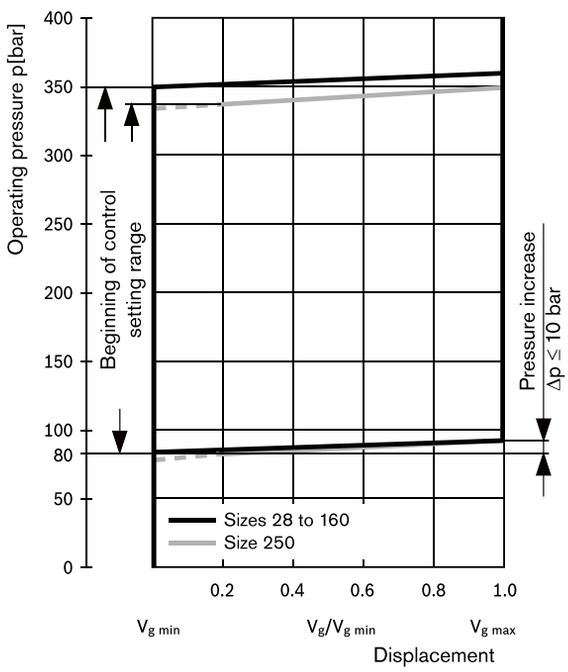
HA1, HA3
With minimum pressure increase

An operating pressure increase of $\Delta p \leq$ approx. 10 bar results in an increase in displacement from 0 cm^3 to $V_{g\ max}$ (sizes 28 to 160) or from 0.2 $V_{g\ max}$ to $V_{g\ max}$ (size 250).

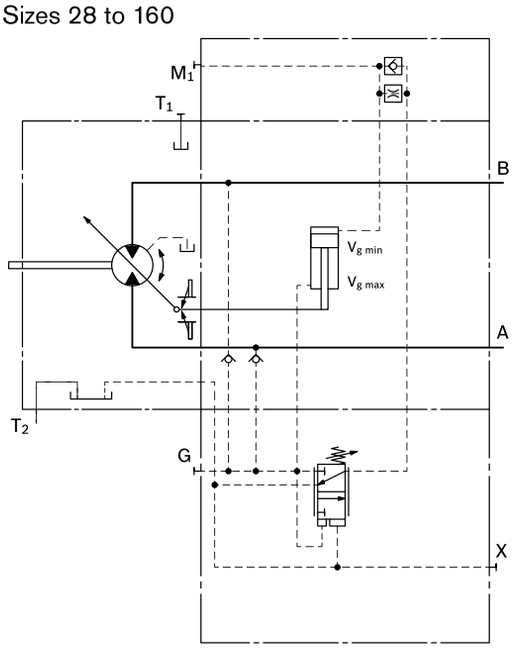
Beginning of control, setting range
Sizes 28 to 160 _____ 80 to 350 bar
Size 250 _____ 80 to 340 bar

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

Characteristic HA1, HA3



Schematic HA1
Sizes 28 to 160



HA - Automatic control high-pressure related

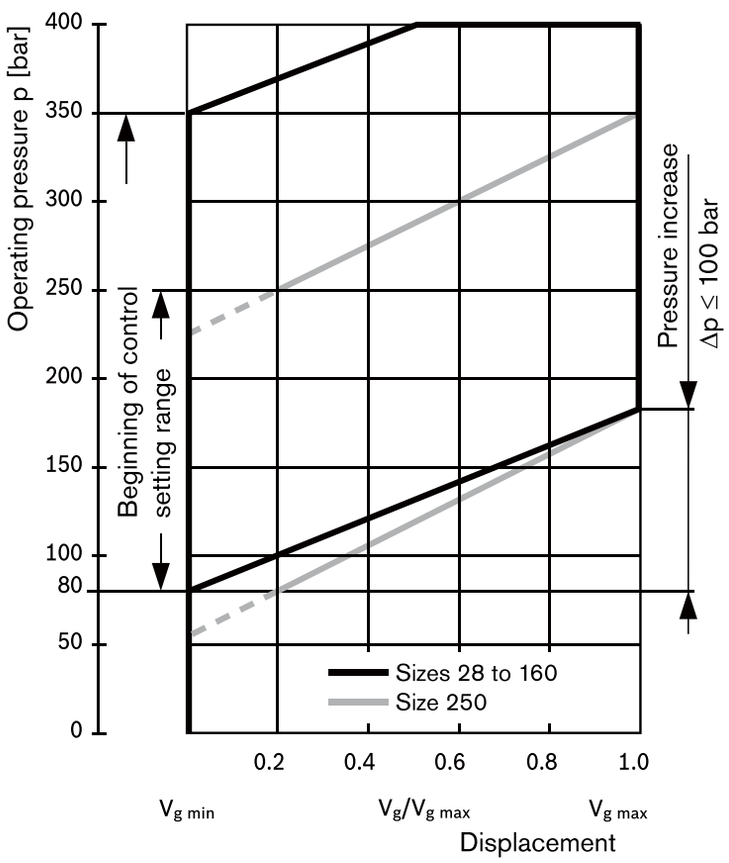
HA2
With pressure increase

An operating pressure increase of Δp = approx. 100 bar results in an increase in displacement from 0 cm^3 to $V_{g\,max}$ (sizes 28 to 160) or from 0.2 $V_{g\,max}$ to $V_{g\,max}$ (size 250).

Beginning of control, setting range
Sizes 28 to 160 _____ 80 to 350 bar
Size 250 _____ 80 to 250 bar

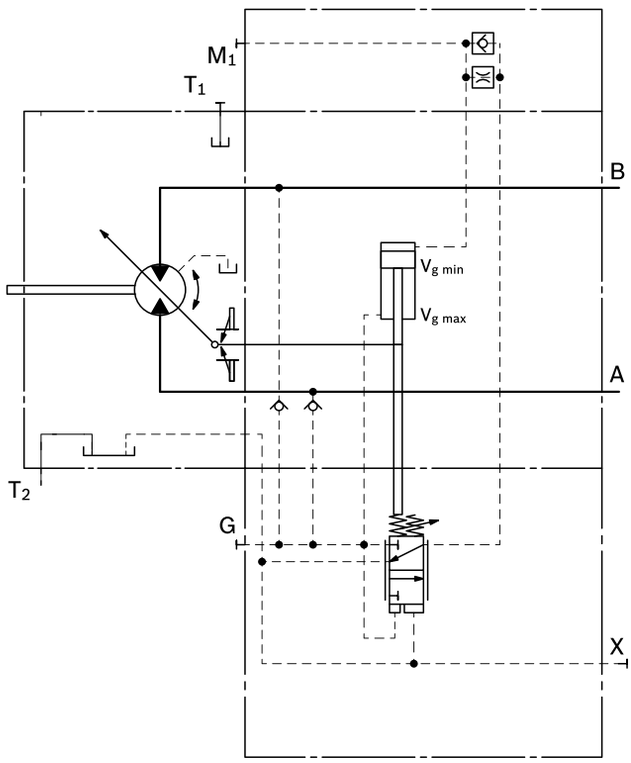
Please state the desired beginning of control in plain text when ordering, e. g.: beginning of control at 200 bar.

Characteristic HA2



Schematic HA2

Sizes 28 to 160



HA - Automatic control high-pressure related

HA.T
Override hydraulic remove control, proportional

With the HA.T control, the beginning of control can be influenced by applying a pilot pressure to port X.

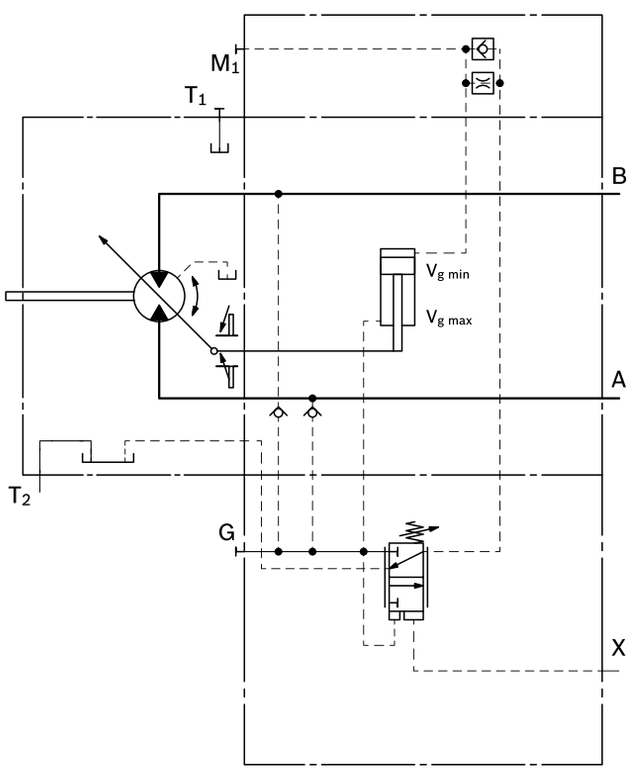
For each 1 bar of pilot pressure increase, the beginning of control is reduced by 17 bar (sizes 28 to 160).

Example (sizes 28 to 160):

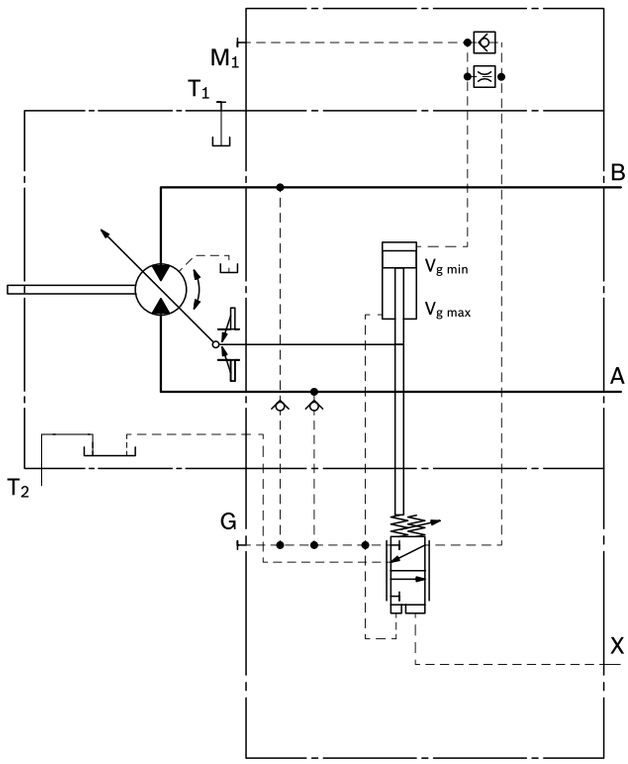
Beginning of control setting	**300 bar**	**300 bar**
Pilot pressure at port X	0 bar	10 bar
Beginning of control at	300 bar	130 bar

Note
Maximum permissible pilot pressure 100 bar.

Schematic HA1.T
Sizes 28 to 160



Schematic HA2.T
Sizes 28 to 160

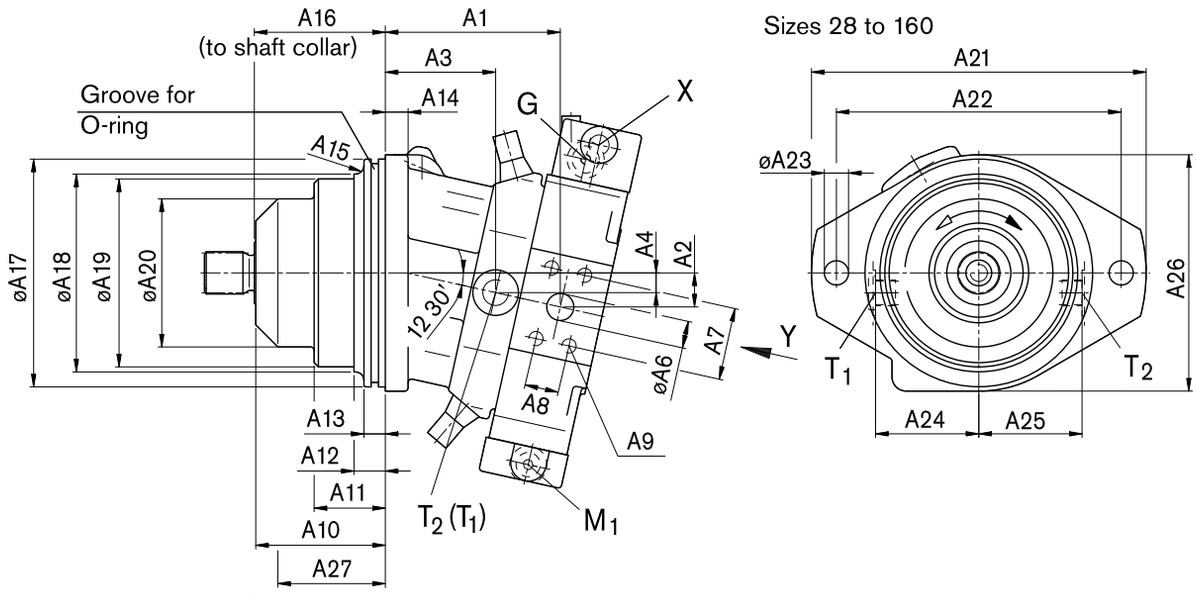


Unit Dimensions

HD1, HD2 – Proportional control hydraulic

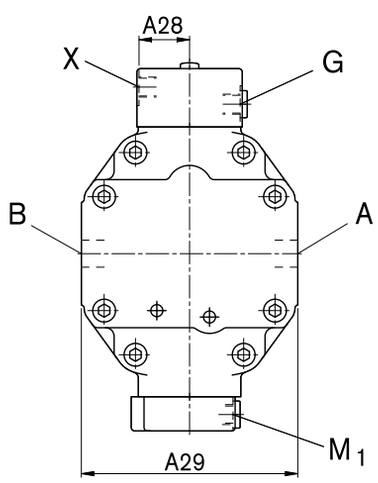
Port plate 02 – SAE flange port A and B at side, opposite

For dimensions of control devices, see data sheet for variable motor A6VM (RE 91604)



Differential dimension of mounting flange A6VM to A6VE

View Y



Ports

Size	Service line port A, B SAE J518	Drain port T_1; T_2 DIN 3852
28	3/4 in	M18 x 1.5; 12 deep
55	3/4 in	M18 x 1.5; 12 deep
80	1 in	M18 x 1.5; 12 deep
107	1 in	M18 x 1.5; 12 deep
160	1 1/4 in	M26 x 1.5; 16 deep

Unit Dimensions

Standard flange L (sizes 28 to 160), **M** (size 250)

NG	A1	A2	A3	A4	øA6	A7	A8	A9 (DIN 13)[2)]	A10	A11	A12	A13	A14	A15
28	91	20	47	10	ø19	50.8	23.8	M10 x 1.5; 17 deep	88	54	–	15	14	R10
55	123	24	77	14	ø19	50.8	23.8	M10 x 1.5; 17 deep	91	50	22	15	16	R6
80	129	28	78	16	ø25	57.2	27.8	M12 x 1.75; 17 deep	109.5	65	30	15	18	R10
107	137	30	84	18	ø25	57.2	27.8	M12 x 1.75; 17 deep	121.8	72	35	15	18	R12
160	171	34	109	20	ø32	66.7	31.8	M14 x 2; 19 deep	122	67	29	15	20	R5

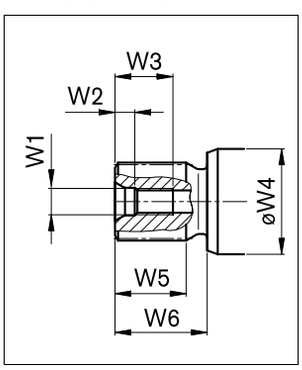
NG	A16	A17	A18	A19	A20	A21	A22	øA23	A24	A25	A26	A27	A28	A29	O-ring[4)]
28	89	$135_{-0.025}$	110	–	86	188	160	ø13.5	62.5	62.5	142	64	35.5	132	126x4
55	92	$160_{-0.025}$	139	132	104	235	200	ø17	72.5	72.5	166	59	35.5	152	150x4
80	110.5	$190_{-0.029}$	151	143	116	260	224	ø21	78.5	78.5	198	79	35.5	164	182x4
107	122.8	$200_{-0.029}$	168	160	132	286	250	ø21	86.5	86.5	210	82	40.5	180	192x4
160	123	$200_{-0.029}$	188	180	146	286	250	ø21	98.5	98.5	210	83	40.5	204	192x4

Adapter flange U (size 107)

NG	A1	A2	A3	A4	A5	A6	A7	A8	A9 (DIN 13)[2)]	A10	A11	A12	A13	A14
107	150	30	96	18	15.5	25	57.2	27.8	M12 x 1.75; 17 deep	109.5	59.7	22.7	18	15

NG	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	O-ring[4)]
107	R8	110.5	$190_{-0.025}$	168	160	132	260	224	22	86.5	86.5	198	91.5	13.8	70	182x4

Drive shafts

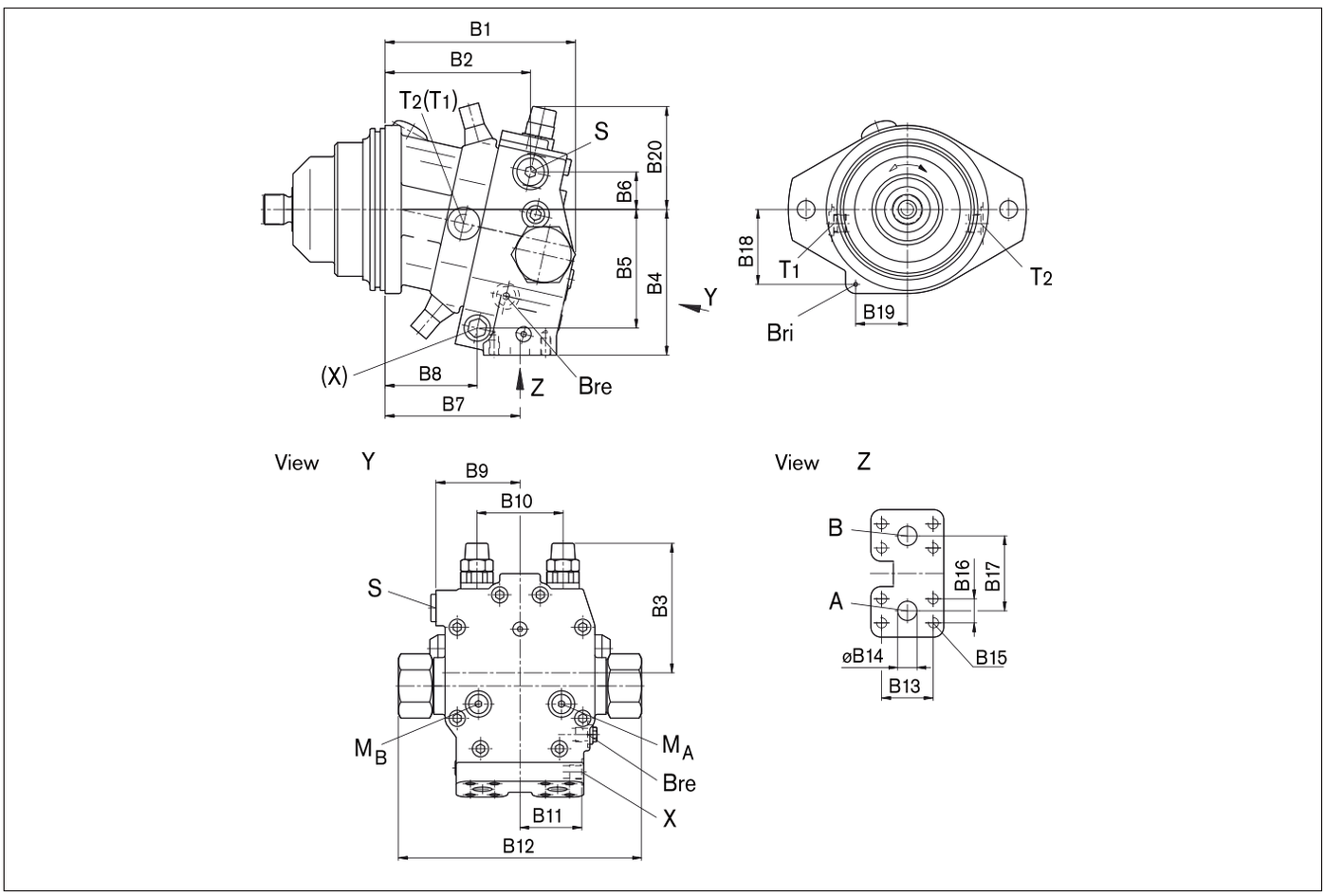


NG	Splined shaft DIN 5480	W1	W2	W3	øW4	W5	W6
28	**A** (W30x2x14x9g)	M10 x 1.5	7.5	22	ø35	27	35
55	**Z** (W30x2x14x9g)	M12 x 1.75	9.5	28	ø45	27	35
80	**A** (W40x2x18x9g)	M16 x 2	12	36	ø50	37	45
107	**Z** (W40x2x18x9g)	M12 x 1.75	9.5	28	ø60	37	45
160	**A** (W50x2x24x9g)	M16 x 2	12	36	ø70	44	55

Unit Dimensions

HA3 – Automatic control high-pressure related

Port plate 22 – SAE flange port A and B at bottom, with integrated counterbalance valve



Ports

NG	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15 (DIN 13)	B16	B17
55	192	144	127	144	117	37	133	91	83	85	64	259	50.8	19	M10 x 1.5; 17 deep	23.8	80
80	198	150	136	162	132	40	138	93	83	90	69	259	57.2	25	M12 x 1.75; 17 deep	27.8	86
107	202	161	139	171.5	143	40	144	99	85	96	72	259	57.2	25	M12 x 1.75; 17 deep	27.8	86
160	240	195	152	197	162	47	177	128	102	108	78	259	66.7	32	M14 x 2; 19 deep	31.8	94

NG	B18	B19	B20	Service line port A, B SAE J518	Drain port T_1; T_2 DIN 3852	Infeed S DIN 3852
55	74	51	102	3/4 in	M18 x 1.5; 12 deep	M22 x 1.5; 14 deep
80	90	53	114	1 in	M18 x 1.5; 12 deep	M22 x 1.5; 14 deep
107	96	58	122	1 in	M18 x 1.5; 12 deep	M22 x 1.5; 14 deep
160	94	65	136	1 1/4 in	M26 x 1.5; 16 deep	M27 x 2; 16 deep

Ports

Designation	Port for	Standard	Size	Maximum pressure [bar]	State
X	Pilot signal (open with HZ and HA3T, plugged with HA3)	ISO 6149	M14 x 1.5; 11.5 deep	100	O
M_A, M_B	Measuring stroking chamber	DIN 3852	M14 x 1.5; 11.5 deep	420	X
Bre	Brake release, external	DIN 3852	M14 x 1.5; 11.5 deep	30	O/X
Bri	Brake release, internal	–	ø4	30	X/O

Connector for Solenoids

DEUTSCH DT04-2P-EP04

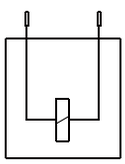
Sizes 28 to 160

Molded, 2-pin, without bidirectional suppressor diode

There is the following type of protection with mounted mating connector:
IP67 _____

and IP69K _____

Circuit symbol



Mating connector

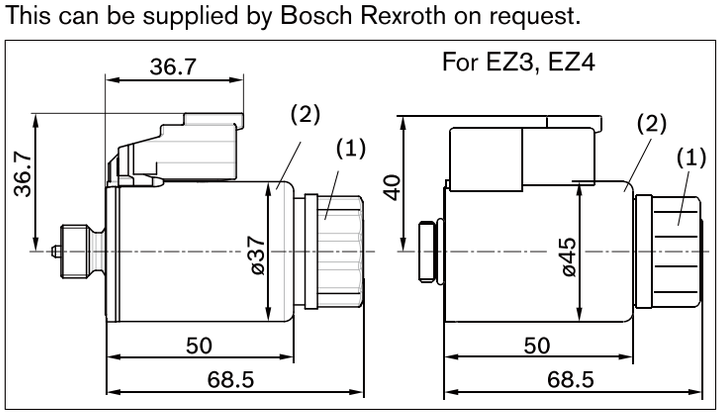
Consisting of:

– 1 housing _____

– 1 wedge _____

– 2 sockets _____

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.



Flushing and Boost Pressure Valve

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

In an open circuit, it is used only for flushing the housing.

In a closed circuit, it ensures a minimum boost pressure level in addition to the case flushing.

Hydraulic fluid is directed from the respective low pressure side into the motor housing. This is then fed into the reservoir, together with the case drain fluid. The hydraulic fluid, removed out of the closed circuit must be replaced by cooled hydraulic fluid from the boost pump.

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

Cracking pressure of pressure retaining valve
(observe when setting the primary valve)
fixed setting _____ 16 bar

Switching pressure of flushing piston Δp _____ 8±1 bar

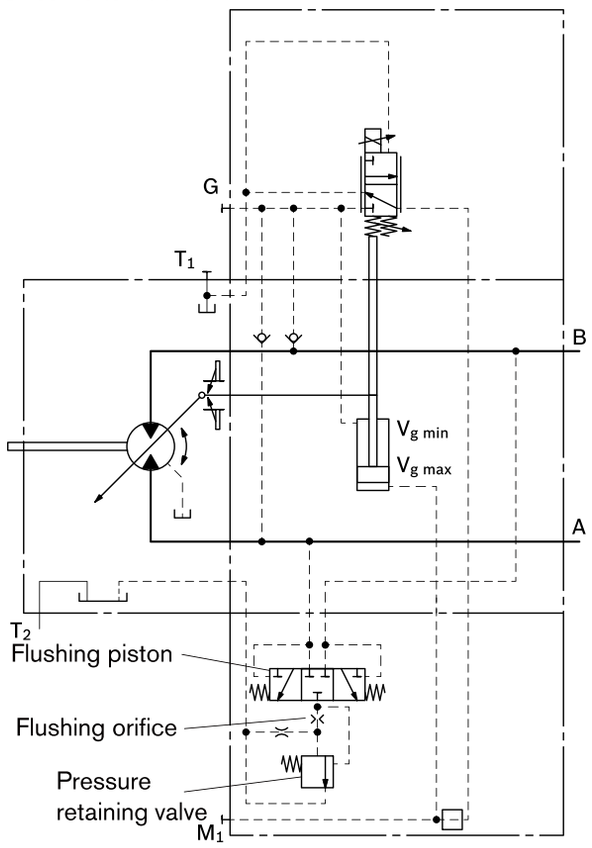
Flushing flow q_v

Orifices can be used to set the flushing flows as required.
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)

Size	Flushing flow q_V [L/min]
28, 55	3.5
80	5
107	8
160	10
250	10

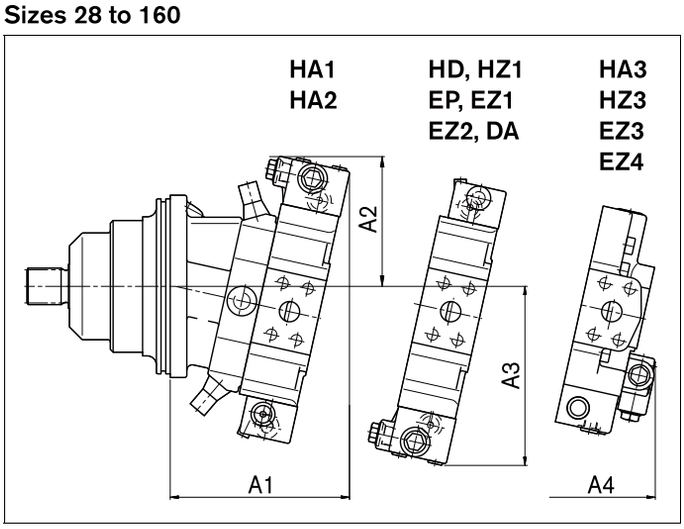
With sizes 28 to 160, orifices can be supplied for flushing flows from 3.5 to - 10 L/min. For other flushing flows, please state the required flushing flow when ordering. The flushing flow without orifice is approx. 12 to 14 L at low pressure $\Delta p_{ND} = 25$ bar.

Schematic EP
Sizes 28 to 160



Dimensions

Sizes 28 to 160



NG	A1	A2	A3	A4
28	152	125	161	–
55	182	133	176	176
80	194	141	192	176
107 (L flange)	204	143	202	186
107 (U flange)	217	143	202	199
160	245	154	220	–

Counterbalance valve BVD

Function

Travel drive/winch counterbalance valves are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if the motor speed is greater than it should be for the given input flow while braking, travelling downhill, or lowering a load.

If the inlet pressure drops, the counterbalance spool throttles the return flow and brakes the motor until the inlet pressure returns to approx. 20 bar.

Note

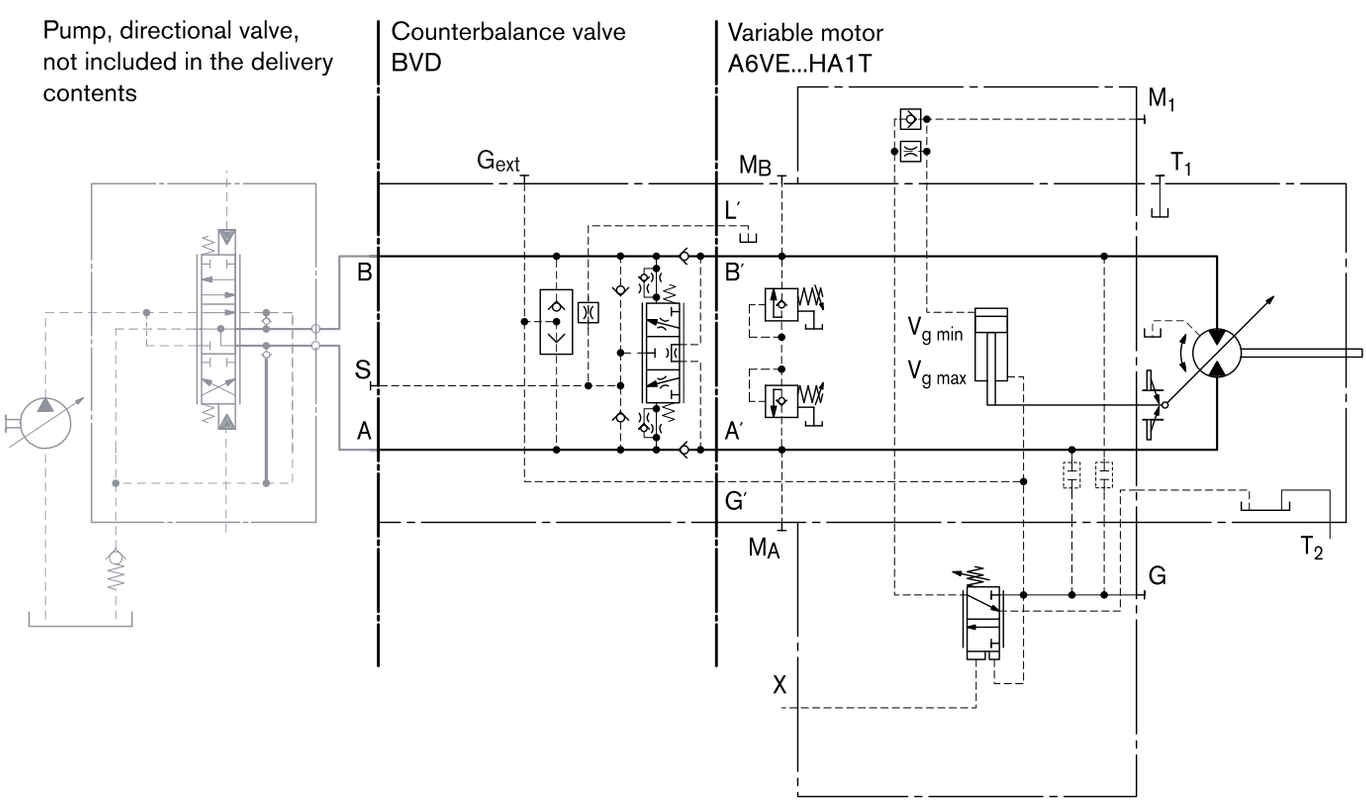
- BVD available for sizes 55 to 160 and BVE available for sizes 107 and 160.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set. Ordering example: TS-A6VE HA1T/63W-VAL38800A+BVD20F27S/41B-V03K16D0400S12
- For safety reasons, controls with beginning of control at $V_{g\ min}$ (e. g. HA) are not permissible for winch drives!
- The counterbalance valve does not replace the mechanical service brake and park brake.
- For the design of the brake release valve, we must know for the mechanical park brake:
  - the pressure at the start of opening
  - the volume of the counterbalance spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
  - the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

Travel drive counterbalance valve BVD...F

Application option

- Travel drive on wheeled excavators

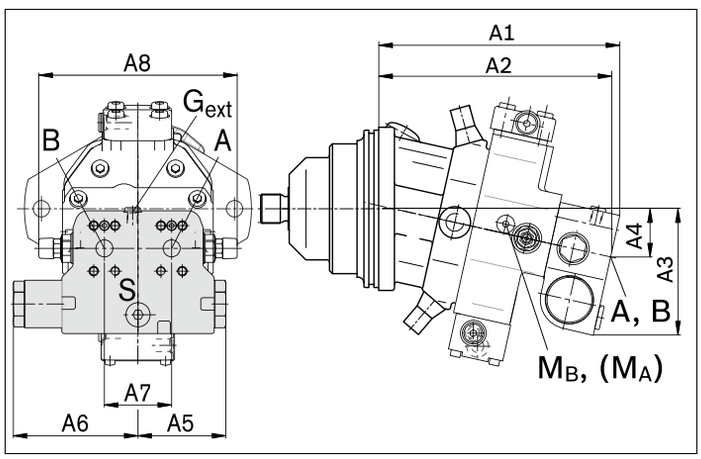
Example schematic for travel drive for wheeled excavators
TS-A6VE HA1T/63W-VAL38800A+BVD20F27S/41B-V03K16D0400S12



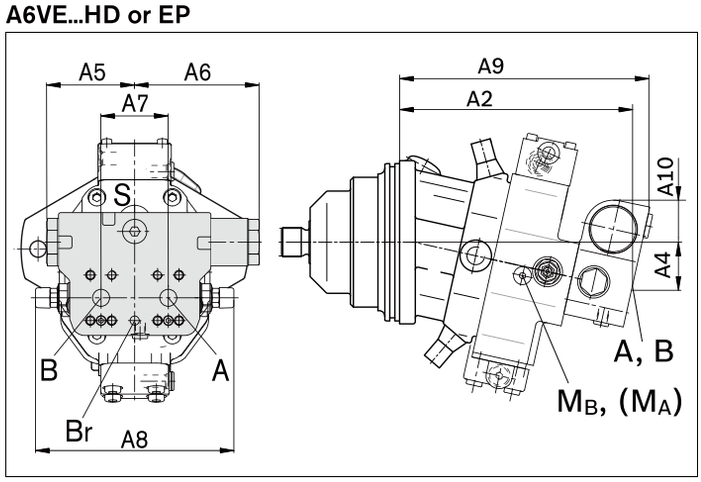
Counterbalance valve BVD

Dimensions

A6VE...HA1/2



A6VE...HD or EP



A6VE	Counterbalance valve											
NG...plate	Type	Ports	Dimensions									
		A, B	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
55...38	BVD20...17	3/4 in	252	243	143	50	98	139	75	222	267	50
80...38	BVD20...27	1 in	261	252	148	55	98	139	75	222	276	46
107...37	BVD20...28	1 in	280	271	152	59	98	139	84	234	295	41
107...38	BVD25...38	1 1/4 in	298	288	165	63	120.5	175	84	238	311	56
160...38	BVD25...38	1 1/4 in	334	324	170	68	120.5	175	84	238	349	51

Ports

Designation	Port for	Version	A6VE Plate	Standard	Size	Maximum pressure [bar]	State
A, B	Service line			SAE J518	see table above	420	O
S	Infeed	BVD20		DIN 3852	M22 x 1.5; 14 deep	30	X
		BVD25, BVE25		DIN 3852	M27 x 2; 16 deep	30	X
Br	Brake release, reduced high-pressure	L	7	DIN 3852	M12 x 1.5; 12.5 deep	30	O
			8	DIN 3852	M12 x 1.5; 12 deep	30	O
G_{ext}	Brake release, high-pressure	S		DIN 3852	M12 x 1.5; 12.5 deep	420	X
M_A, M_B	Measuring pressure A and B			ISO 6149	M18 x 1.5; 14.5 deep	420	X

Counterbalance valve BVD

Mounting the counterbalance valve

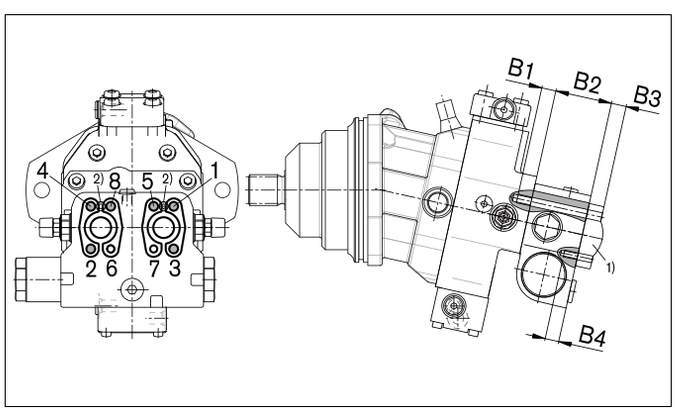
When delivered, the counterbalance valve is mounted to the motor with two tacking screws (transport protection). The tacking screws may not be removed while mounting the service lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be mounted to the motor port plate using the provided tacking screws. The counterbalance valve is finally mounted to the motor by screwing on the SAE flange with the following screws:

6 screws (**1, 2, 3, 4, 5, 8**) _____ length B1+B2+B3
2 screws (**6, 7**) _____ length B3+B4

Tighten the screws in two steps in the specified sequence from 1 to 8 (see following scheme).

In the first step, the screws must be tightened with half the tightening torque, and in the second step with the maximum tightening torque (see following table).

Thread	Strength class	Tightening torque [Nm]
M6 x 1 (tacking screw)	10.9	15.5
M10 x 1.5	10.9	75
M12 x 1.75	10.9	130
M14 x 2	10.9	205



1) SAE flange
2) Tacking screw (M6 x 1, length = B1 + B2, DIN 912)

NG...plate	55...38	80...38, 107...37	107...38, 160...38
B1	M10 x 1.5 17 deep	M12 x 1.75 15 deep	M14 x 2 19 deep
B2	68	68	85
B3	customer-specific		
B4	M10 x 1.5 15 deep	M12 x 1.75 16 deep	M14 x 2 19 deep

3) Minimum required thread reach 1 x Ø-thread

Counterbalance valve Integrated BVI

Function

The integrated counterbalance valve is designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if the motor speed is greater than it should be for the given input flow while braking or traveling downhill.

Note

– The integrated counterbalance valve must be ordered additionally, see ordering code below.

– The counterbalance valve does not replace the mechanical service brake and park brake.

– For the design of the brake release valve, we must know for the mechanical park brake:

- the pressure at the start of opening
- the volume of the counterbalance 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)

Application options

– Track drive in excavator crawlers

Ordering code

BVI			00		–	
01	02	03	04	05		06

Counterbalance valve

01	Counterbalance valve integrated	**BVI**

	Brake piston version	**qv [L/min]**	
02	Volume preselected	≤ 150	**51**
		= 150 – 210	**52**
		= 210 – 270	**53**
		= 270 – 330	**54**
		= 330 – 400	**55**
		≥ 400	**56**

Throttle mounting

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

Check valve

04	Without residual opening	**00**

Brake release valve

05	With brake release valve (standard with HZ)	Without disable function	**1**
	With brake release valve (standard with HA)	With disable function	**2**

Standard / special version

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

Counterbalance valve Integrated BVI

Table of values

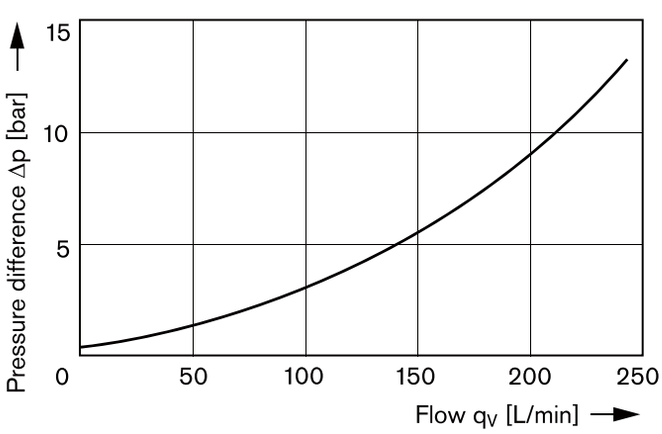
Operating pressure	nominal pressure	p	bar	350
	peak pressure	p	bar	420
Flow, maximum		$q_{v\ max}$	L/min	400
Counterbalance spool	start of opening	p	bar	12
	fully open	p	bar	26
Pressure-reducing valve for brake release (fixed setting)	control pressure	p	bar	21^{+4}
	beginning of control	p	bar	10^{+4}

Comparison between port plates 02 and 22

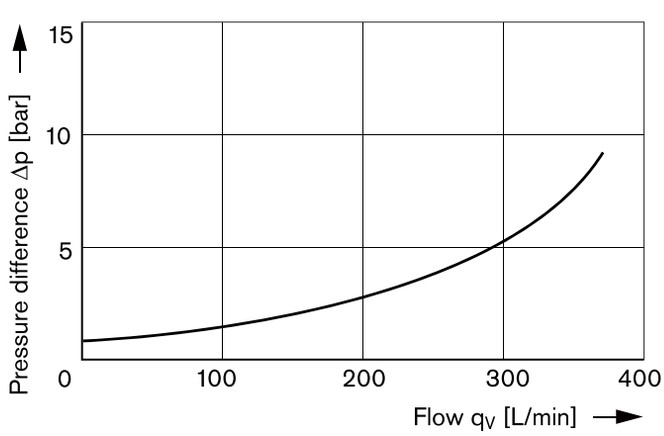
Maximum permissible input flow with restricted nominal pressure 350 bar, maximum pressure 420 bar

	Without restrictions standard plate (02)		**Restricted values plate with integrated counterbalance valve (22)**		
Motor NG	**p_{nom}/p_{max} [bar]**	**$q_{V\ max}$ [L/min]**	**Code**	**p_{nom}/p_{max} [bar]**	**with BVI q_V [L/min]**
55	400/450	276	22	350/420	240
80		332			
107		410			
160		533			400

Infeed characteristic M22 x 1.5

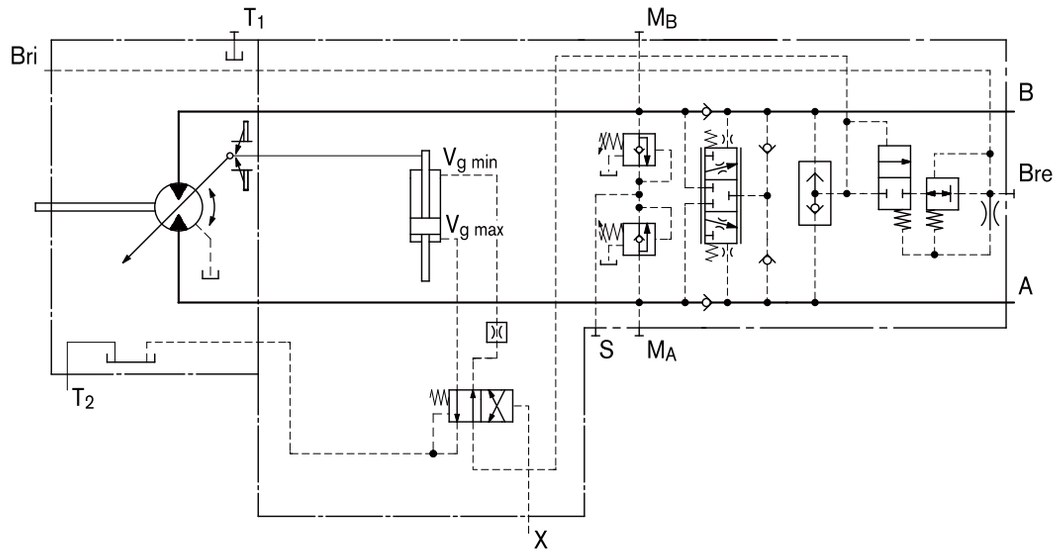


Infeed characteristic M27 x 2

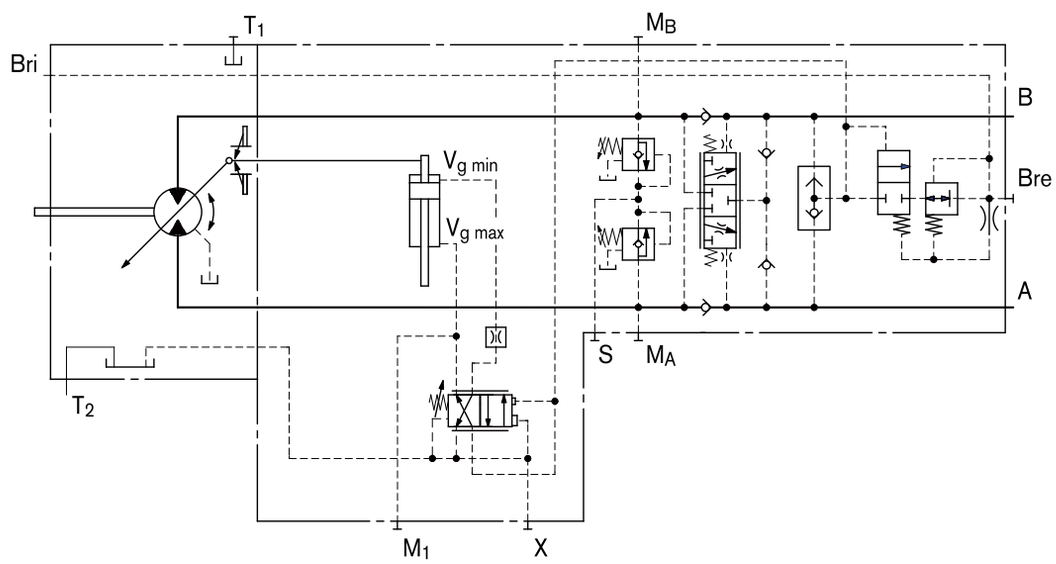


Counterbalance valve Integrated BVI

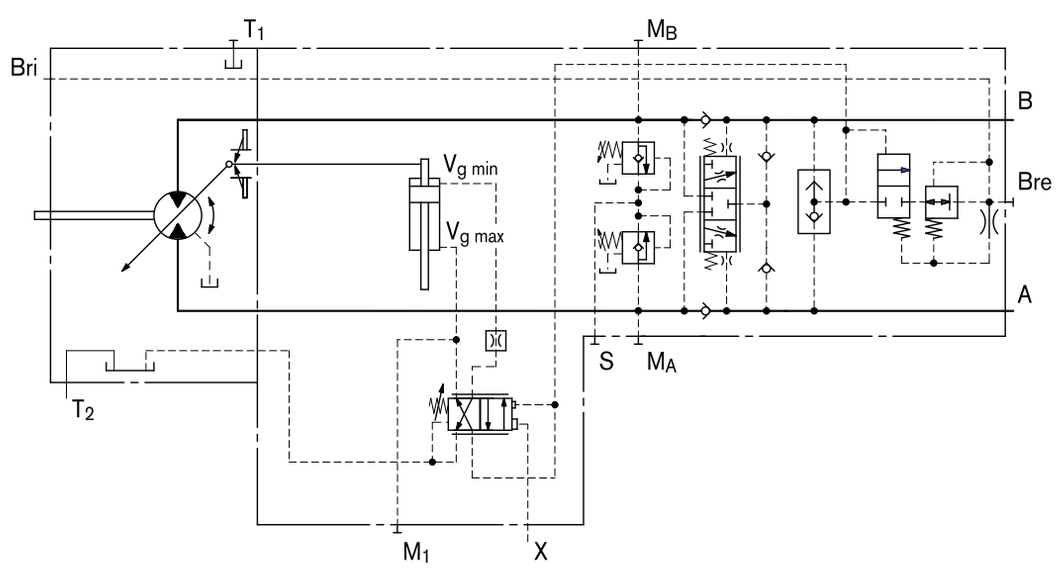
Schematic HZ3



Schematic HA3



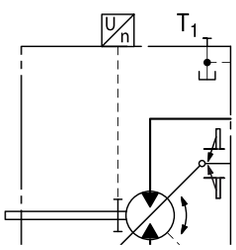
Schematic HA3.T



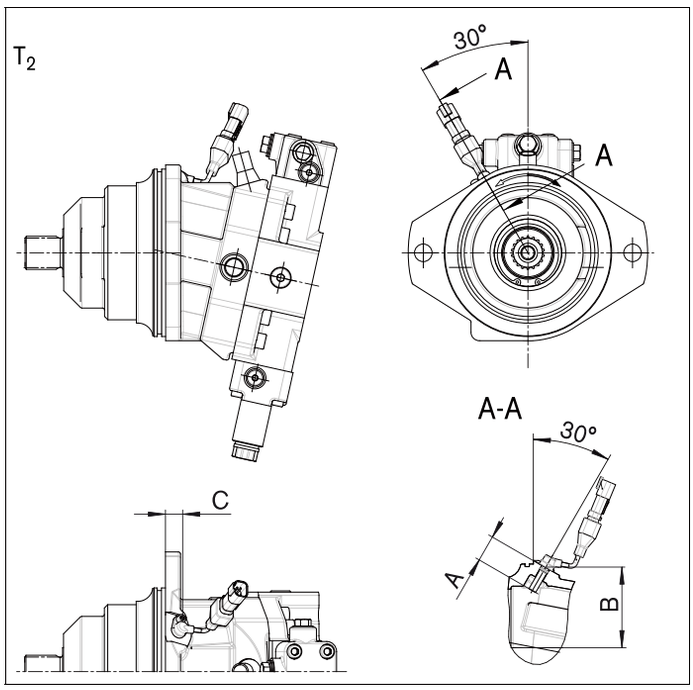
Speed Sensor

Version TS-A6VE...U ("prepared for speed sensor", i.e. without sensor) is equipped with a toothed ring on the rotary group. On deliveries "prepared for speed sensor", the port is plugged with a pressure-resistant cover.
With the speed sensor DSA mounted, a signal proportional to motor speed can be generated. The sensor measures the speed and direction of rotation.
Ordering code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet (DSA).
The sensor is mounted on the port provided for this purpose with a mounting bolt. We recommend ordering the TS-A6VE variable motor complete with installed sensor

Schematic



Dimensions
Version "V" with mounted speed sensor



NG	55	80	107	160
Number of teeth	54	58	67	75
A	32	32	32	32
B	83.3	87.3	96.3	104.3
C	26	16.5	14.2	28.5

Installation Instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

The case drain fluid in the motor housing must be directed to the reservoir via the highest available drain port (T_1, T_2).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Installation position

See the following examples 1 to 6.
Further installation positions are possible upon request.

Recommended installation positions: 1 and 2.

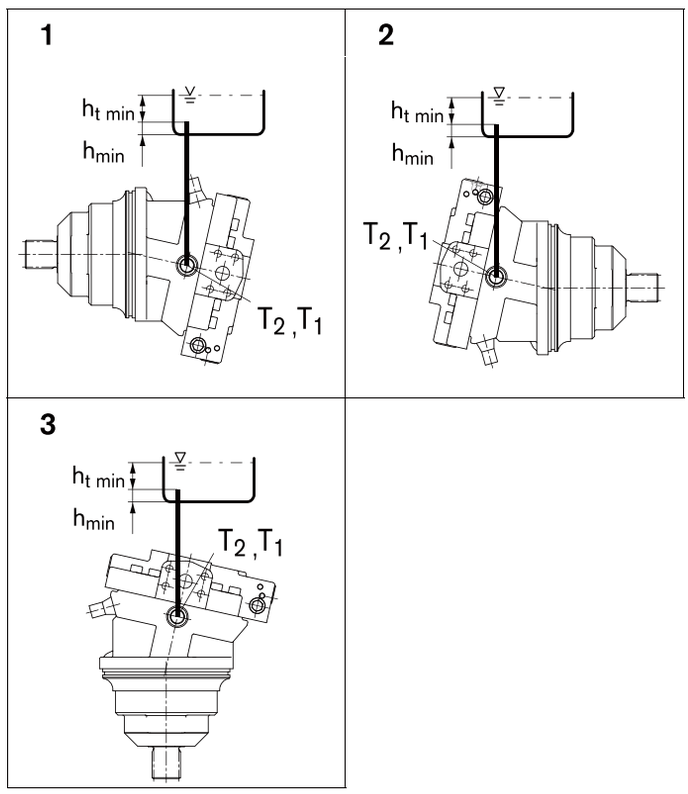
Note
In certain installation conditions, an influence on the control characteristics can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristics and changes in response time.

Installation position	Air bleed	Filling
1	–	T_2, T_1
2	–	T_2, T_1
3	–	T_2, T_1
4	L_1	T_2, T_1 (L_1)
5	L_1	T_2, T_1 (L_1)
6	L_1	T_2, T_1 (L_1)

L_1	Filling / air bleed
T_1, T_2	Drain port
$h_{t\,min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)

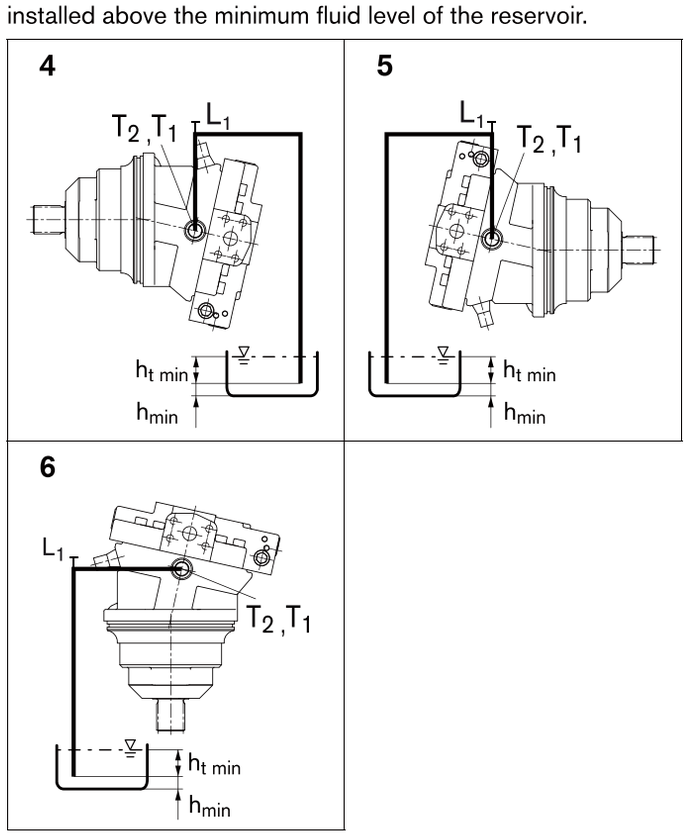
Below-reservoir installation (standard)

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



Above-reservoir installation

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



The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract.

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