Brueninghaus Hydromatik Rexroth A6VM Motor

Hydraulic Variable motor A6VM55, A6VM80, A6VM107, A6VM140, A6VM160, A6VM200, A6VM250

Series 6
Size Nominal pressure: 350 bar
Peak pressure: 400 bar
Open and closed circuits

Features

– Variable motor with an axial tapered piston rotary group of bent-axis design for hydrostatic drives in open and closed circuits
– For use in mobile and stationary application areas
– The wide control range enables the variable motor to satisfy the requirement for high speed and high torque.
– The displacement is infinitely variable from Vg max to Vg min = 0.
– The output speed depends on the flow of the pump and the displacement of the motor.
– The output torque increases with the pressure differential between the high and low pressure side and with increasing displacement.
– Wide control range with hydrostatic transmission
– Wide selection of control devices
– Cost savings through elimination of gear shifts and possibility of using smaller pumps
– Compact, robust bearing system with long service life
– High power density
– Good starting characteristics
– Low moment of inertia

Ordering Code / Standard Program

	A6V		M					/	63	W		–	V							–	
01	02	03	04	05	06	07	08		09	10	11		12	13	14	15	16	17	18	19	20

Hydraulic fluid

01	Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearing "L" (without code)		
	HFB, HFC hydraulic fluid	Sizes 28 to 200 (without code)	
		Sizes 250 to 1000 (only in combination with long-life bearing "L")	E

Axial piston unit

02	Bent-axis design, variable	A6V

Drive shaft bearing

		80	107	160	200	
03	Standard bearing (without code)	●	●	●	●	
	Long-life bearing			–	–	L

Operation mode

04	Motor (plug-in-motor A6VE see RE 91606)	M

Size

		28	55	80	107	140	160	200	250	355	500	1000
05	≈ Displacement $V_{g\ max}$ in cm^3	28	55	80	107	140	160	200	250	355	500	1000

Control device

				28	55	80	107	140	160	200	250	355	500	1000	
06	Hydraulic control, pilot-pressure related		Δp = 10 bar	(●)	(●)	●	●	(●)	●	●	●	(●)	(●)	(●)	HD1
			Δp = 25 bar	(●)	(●)	●	●	(●)	●	●	●	(●)	(●)	(●)	HD2
			Δp = 35 bar	–	–	–	–	–	–	–	●	(●)	(●)	(●)	HD3
	Hydraulic two-point control			–	–	●	●	–	●	–	●	(●)	(●)	(●)	HZ
				(●)	–	–	–	(●)	●	●	–	–	–	–	HZ1
				–	(●)	●	●	–	–	–	–	–	–	–	HZ3
	Electric control, proportional		12V	(●)	(●)	●	●	(●)	●	●	●	(●)	(●)	(●)	EP1
			24V	(●)	(●)	●	●	(●)	●	●	●	(●)	(●)	(●)	EP2
	Electric two-point control		12V	(●)	–	–	–	(●)	(●)	●	●	(●)	(●)	(●)	EZ1
			24V	(●)	–	–	–	(●)	(●)	●	●	(●)	(●)	(●)	EZ2
			12V	–	(●)	●	●	–	–	–	–	–	–	–	EZ3
			24V	–	(●)	●	●	–	–	–	–	–	–	–	EZ4
	Automatic control, high-pressure related	Without pressure increase		(●)	(●)	●	●	(●)	●	●	●	(●)	(●)	(●)	HA1
		With pressure increase Δp = 100 bar		(●)	(●)	(●)	●	(●)	●	●	●	(●)	(●)	(●)	HA2
	Hydraulic control, speed related p_{St}/p_{HD} = 3/100,	Hydraulic travel direction valve		–	–	–	–	–	–	–	●	(●)	(●)	○	DA
	p_{St}/p_{HD} = 5/100,	Hydraulic travel direction valve		(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA1
		Electric travel direction valve + electric $V_{g\ max}$ control	12V	(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA2
			24V	(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA3
	p_{St}/p_{HD} = 8/100,	Hydraulic travel direction valve		(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA4
		Electric travel direction valve + electric $V_{g\ max}$ control	12V	(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA5
			24V	(●)	(●)	(●)	(●)	(●)	(●)	(●)	–	–	–	–	DA6

Pressure control (only for HD, EP)

			28	55	80	107	140	160	200	250	355	500	1000	
07	Without pressure control (without code)		(●)	(●)	●	●		●	●	●	(●)	(●)	(●)	
	Pressure control,	Direct	(●)	(●)	●	●		●	●	●	(●)	(●)	(●)	D
		Direct, with 2nd pressure setting	(●)	(●)	●	●		●	●	1)	1)	1)	1)	E
		Remote	–	–	–	–		–	–	●	(●)	(●)	(●)	G

Ordering Code / Standard Program

	A6V		M					/	63	W		–	V								–	
01	02	03	04	05	06	07	08		09	10	11		12	13	14	15	16	17	18	19		20

Overriding HA control (for HA1, HA2 only)

			28	55	80	107	140	160	200	250	355	500	1000	
08	Without override (without code)		●	●	●	●	●	●	●	●	●	●	●	
	Hydraulic override		●	●	●	●		●	●	●	●	●	●	T
	Electric override	12V	●	●	●	●		●	●	–	–	–	–	U1
		24V	●	●	●	●		●	●	–	–	–	–	U2
	Electric override + electric travel direction valve	12V	●	●	●	●		●	●	–	–	–	–	R1
		24V	●	●	●	●		●	●	–	–	–	–	R2

Series

09	Series 6, index 3	63

Direction of rotation

10	Viewed from shaft end, alternating	W

Setting range for displacement [2]

			28	55	80	107	140	160	200	250	355	500	1000	
11	$V_{g\ min} = 0$ to $0.7\ V_{g\ max}$ (without code)		●	●	●	●	●	●	●	–	–	–	–	
	$V_{g\ min} = 0$ to $0.4\ V_{g\ max}$	$V_{gmax} = V_{g\ max}$ to $0.8\ V_{g\ max}$	–	–	–	–	–	–	–	●	●	●	●	1
	$V_{g\ min} > 0.4\ V_{g\ max}$ to $0.8\ V_{g\ max}$	$V_{gmax} = V_{g\ max}$ to $0.8\ V_{g\ max}$	–	–	–	–	–	–	–	●	●	●	●	2

Seals

12	FKM (fluor-caoutchouc)	V

Shaft end

		28	55	80	107	140	160	200	250	355	500	1000	
13	Splined shaft DIN 5480	●	●	●	●	–	●	●	–	–	–	–	A
		●	●	●	●	●	●	–	●	●	●	●	Z
	Parallel keyed shaft DIN 6885	–	–	–	–	–	–	–	●	●	●	●	P

Mounting flange

		28	55	80	107	140	160	200	250	355	500	1000	
14	4-hole – ISO 3019-2	●	●	●	●	●	●	●	●	–	–	–	B
	8-hole – ISO 3019-2	–	–	–	–	–	–	–	–	●	●	●	H

Service line ports [3]

				28	55	80	107	140	160	200	250	355	500	1000	
15	SAE flange ports A/B, rear	01	0	●	●	●	●	●	●	●	●	●	●	●	010
			7	●	●	●	●	●	●	●	●	●	●	●	017
	SAE flange ports A/B side, opposite	02	0	●	●	●	●	●	●	●	●	●	●	●	020
			7	●	●	●	●	●	●	●	●	●	●	●	027
	Port plate for mounting a counterbalance valve on request	08	0	–	–	–	–	–	–	–	○	–	–	–	080
	SAE flange ports A/B side, opposite + rear	15	0	–	–	–	–	–	–	–	●	●	●	●	150
	Port plate with pressure-relief valves,	37	0	–	–	–	●	–	–	–	–	–	–	–	370
	For mounting a counterbalance valve [4] [5]	38	0	–	●	●	●	●	●	–	–	–	–	–	380

Valves

Without valve	0
With flush and boost pressure valve	7

Ordering Code / Standard Program

	A6V		M					/	63	W		–	V								–	
01	02	03	04	05	06	07	08		09	10	11		12	13	14	15	16	17	18	19		20

Speed measurement

		28	55	80	107	140	160	200	250	355	500	1000	
16	Without speed measurement (without code)	●	●	●	●	●	●	●	●	●	●	●	
	Prepared for speed measurement (ID) [6])	●	●	●	●	●	●	●	–	–	–	–	D
	Prepared for speed measurement (HDD) [6])	–	●	●	●	●	●	●	●	●	●	○	F

Swivel angle indicator

		28	55	80	107	140	160	200	250	355	500	1000	
17	Without swivel angle indicator (without code)	●	●	●	●	●	●	●	●	●	●	–	
	With optical swivel angle indicator	–	–	–	–	–	–	–	●	●	●	●	V
	With electric swivel angle indicator	–	–	–	–	–	–	–	●	●	●	●	E

Connector for solenoids (only sizes 28 to 200) [7])

		EP1/2	EZ1/2	EZ3/4	HA.U.	HA.R.[8])	DA.	
18	DEUTSCH - molded connector, 2-pin – without suppressor diode	●	●	○	○	●	●	P
	DEUTSCH - molded connector, 2-pin – with suppressor diode	–	○	–	–	–	○	Q
	HIRSCHMANN - connector – without suppressor diode	▲	▲	▲	▲	▲	▲	H

Start of control

		28	55	80	107	140	160	200	250	355	500	1000	
19	At $V_{g\ min}$ (standard for HA)	●	●	●	●	●	●	●	●	●	●	●	A
	At $V_{g\ max}$ (standard for HD, HZ, EP, EZ, DA)	●	●	●	●	●	●	●	●	●	●	●	B

Standard / special version[9])

20	Standard version	(without code)	
		With attachment part	-K
	Special version		-S
		With attachment part	-SK

[1]) Supplied as standard with version D

[2]) Please specify precise setting for $V_{g\ min}$ and $V_{g\ max}$ in plain text when ordering: $V_{g\ min}$ = ... cm³, $V_{g\ max}$ = ... cm³

[3]) Metric fixing thread

[4]) Only possible in combination with HD, EP, HA control

[5]) With HA.R1 and HA.R2 for the 2nd solenoid (ø 45), the version with DEUTSCH molded connector is available on request.

[6]) Adjustment data are included in the material number

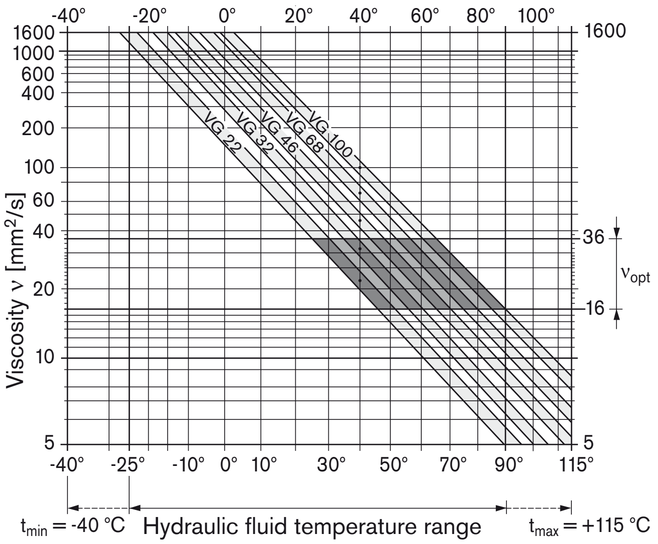
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable motor A6VM is not suitable for operation with HFA hydraulic fluid. If HFB, HFC, or HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit, the circuit temperature, in an open circuit, the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum viscosity range ($\nu_{opt.}$, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, can be higher than the circuit temperature or reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U or using a flushing and boost pressure valve (see pages 71 and 72).

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq$ -50 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up[1]	ν_{max} = 1600	$T_{St} \geq$ -40 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm (sizes 28 to 200), n ≤ 0.25 • n_{nom} (sizes 250 to 1000)
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	ν < 1600 to 400	T = -40 °C to -25 °C	At p ≤ 0.7 • p_{nom}, n ≤ 0.5 • n_{nom} and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 12 K	between hydraulic fluid in the bearing and at port T. The bearing temperature can be reduced by flushing via port U.
Maximum temperature		115 °C	in the bearing
		103 °C	measured at port T
Continuous operation	ν = 400 to 10 ν_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port T, no restriction within the permissible data
Short-term operation[2]	$\nu_{min} \geq$ 7	T_{max} = +103 °C	measured at port T, t < 3 min, p < 0.3 • p_{nom}
FKM shaft seal[1]		T ≤ +115 °C	see page 6

1) At temperatures below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).
2) Sizes 250 to 1000, please contact us.

Technical data

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.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

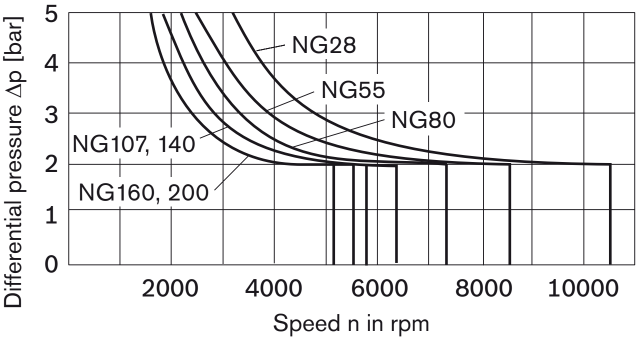
Shaft seal

Permissible pressure loading

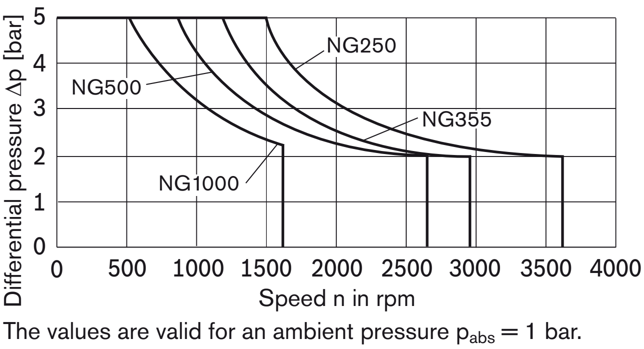
The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.

Sizes 28 to 200



Sizes 250 to 1000



The values are valid for an ambient pressure $p_{abs} = 1$ bar.

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering.
Please contact us.

Influence 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:

HD, HA.T (sizes 28 to 200)	increase
HD, EP, HA, HA.T (sizes 250 to 1000)	increase
DA	decrease

With the following controls, an increase in the case pressure has no influence on the beginning of control:
EP, HA, HA.R, HA.U (sizes 28 to 200)

The factory settings for the beginning of control are made at $p_{abs} = 2$ bar (sizes 28 to 200) and $p_{abs} = 1$ bar (sizes 250 to 1000) case pressure.

Direction of flow

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

Long-life bearings

Sizes 250 to 1000

For long service life and use with HF hydraulic fluids. Identical external dimensions as motor with standard bearings. Subsequent conversion to long-life bearings is possible. Bearings and case flushing via port U is recommended.

Flushing flow (recommended)

NG	250	355	500	1000
$q_{v\ flush}$ (L/min)	10	16	16	16

Technical data

Operating pressure range

(operating with mineral oil)

Pressure at service line port A or B

Sizes 28 to 200

Nominal pressure p_{nom} ________ 400 bar absolute

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

Sizes 250 to 1000

Nominal pressure p_{nom} ________ 350 bar absolute

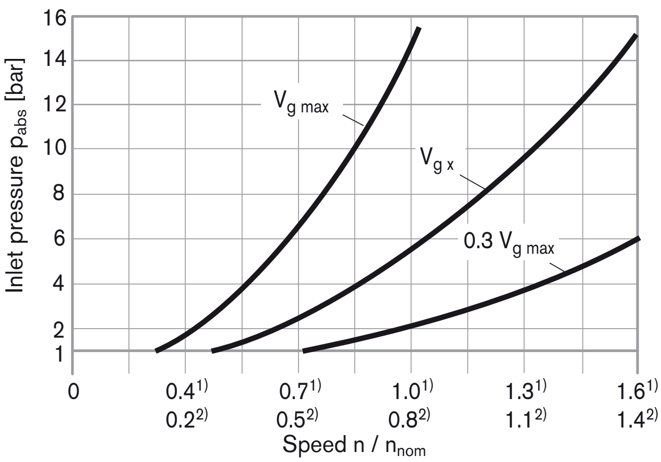
Maximum pressure p_{max} ________ 400 bar absolute
Single operating period ________ 10 s
Total operating period ________ 300 h

Minimum pressure (high-pressure side) ___25 bar absolute

Summation pressure (pressure A + pressure B) p_{Su} _ 700 bar

Rate of pressure change $R_{A\,max}$
with integrated pressure-relief valve ________ 9000 bar/s
without pressure-relief valve ________ 16000 bar/s

Minimum pressure – pump mode (inlet)
To prevent damage to the axial piston motor in pump operating 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).



1) For sizes 28 to 200
2) For sizes 250 to 1000

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

Note
Values for other hydraulic fluids, please contact us.

Definition

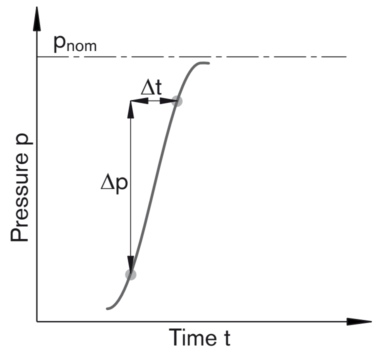
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

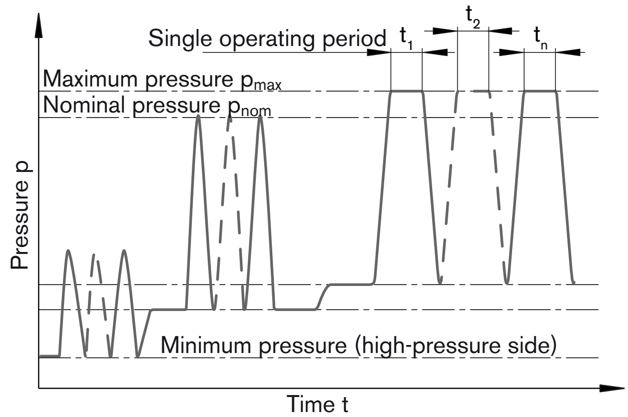
Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

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 = $t_1 + t_2 + ... + t_n$

Technical data

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

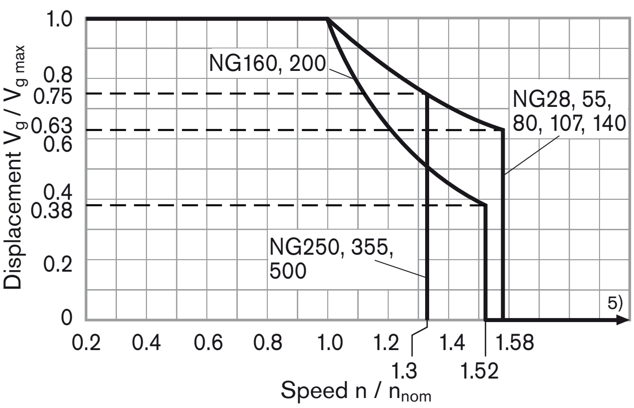
Size		NG	28	55	80	107	140	160	200	250	355	500	1000
Displacement geometric[1], per revolution	$V_{g\,max}$	cm^3	28.1	54.8	80	107	140	160	200	250	355	500	1000
	$V_{g\,min}$	cm^3	0	0	0	0	0	0	0	0	0	0	0
	$V_{g\,x}$	cm^3	18	35	51	68	88	61	76	188	270	377	762
Speed maximum[2] (while adhering to the maximum permissible input flow)													
at $V_{g\,max}$	n_{nom}	rpm	5550	4450	3900	3550	3250	3100	2900	2700	2240	2000	1600
at $V_g < V_{g\,x}$ (see diagram below)	n_{max}	rpm	8750	7000	6150	5600	5150	4900	4600	3600	2950	2650	1600
at $V_{g\,0}$	n_{max}	rpm	10450	8350	7350	6300	5750	5500	5100	3600	2950	2650	1600
Input flow[3]													
at n_{nom} and $V_{g\,max}$	$q_{V\,max}$	L/min	156	244	312	380	455	496	580	675	795	1000	1600
Torque[4]													
at $V_{g\,max}$ and $\Delta p = 400$ bar	T	Nm	179	349	509	681	891	1019	1273	–	–	–	–
at $V_{g\,max}$ and $\Delta p = 350$ bar	T	Nm	157	305	446	596	778	891	1114	1391	1978	2785	5571
Rotary stiffness													
$V_{g\,max}$ to $V_g/2$	c_{min}	KNm/rad	6	10	16	21	34	35	44	60	75	115	281
$V_g/2$ to 0 (interpolated)	c_{max}	KNm/rad	18	32	48	65	93	105	130	181	262	391	820
Moment of inertia for rotary group	J_{GR}	kgm^2	0.0014	0.0042	0.008	0.0127	0.0207	0.0253	0.0353	0.061	0.102	0.178	0.55
Maximum angular acceleration	α	rad/s^2	47000	31500	24000	19000	11000	11000	11000	10000	8300	5500	4000
Case volume	V	L	0.5	0.75	1.2	1.5	1.8	2.4	2.7	3.0	5.0	7.0	16.0
Mass (approx.)	m	kg	16	26	34	47	60	64	80	100	170	210	430

1) The minimum and maximum displacement are infinitely adjustable, see ordering code, page 3.
(standard setting for sizes 250 to 1000 if not specified in the order: $V_{g\,min} = 0.2 \cdot V_{g\,max}$, $V_{g\,max} = V_{g\,max}$).
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, see page 74
4) Torque without radial force, with radial force see page 9

Note

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, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible startup angular acceleration (lower than the maximum angular acceleration) can be found in data sheet 90261.

Permissible displacement in relation to speed



5) Values in this range on request

Determining the operating characteristics

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

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

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

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

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 ($\eta_t = \eta_v \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces of the drive shafts

Size	NG		28	28	55	55	80	80	107	107	140
Drive shaft	ø	mm	30	25	35	30	40	35	45	40	45
Maximum radial force[1] at distance a (from shaft collar)	$F_{q\ max}$	N	4838	6436	8069	7581	10283	10266	12215	13758	15982
	a	mm	17.5	14	20	17.5	22.5	20	25	22.5	25
with permissible torque	T_{max}	Nm	179	179	349	281	509	444	681	681	891
≙ Permissible pressure Δp at $V_{g\ max}$	$p_{nom\ perm.}$	bar	400	400	400	322	400	349	400	400	400
Maximum axial force[2] F_{ax} ±	$+F_{ax\ max}$	N	315	315	500	500	710	710	900	900	1030
	$-F_{ax\ max}$	N	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$F_{ax\ perm./bar}$	N/bar	4.6	4.6	7.5	7.5	9.6	9.6	11.3	11.3	13.3

Size	NG		160	160	200	250	355	500	1000
Drive shaft	ø	mm	50	45	50	50	60	70	90
Maximum radial force[1] at distance a (from shaft collar)	$F_{q\ max}$	N	16435	18278	20532	1200[3]	1500[3]	1900[3]	2600[3]
	a	mm	27.5	25	27.5	41	52.5	52.5	67.5
with permissible torque	T_{max}	Nm	1019	1019	1273	[4]	[4]	[4]	[4]
≙ Permissible pressure Δp at $V_{g\ max}$	$p_{nom\ perm.}$	bar	400	400	400	[4]	[4]	[4]	[4]
Maximum axial force[2] F_{ax} ±	$+F_{ax\ max}$	N	1120	1120	1250	1200	1500	1900	2600
	$-F_{ax\ max}$	N	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$F_{ax\ perm./bar}$	N/bar	15.1	15.1	17.0	[4]	[4]	[4]	[4]

1) With intermittent operation.
2) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.
3) When at a standstill or when axial piston unit operating in non-pressurized conditions. Higher forces are permissible when under pressure, please contact us.
4) Please contact us.

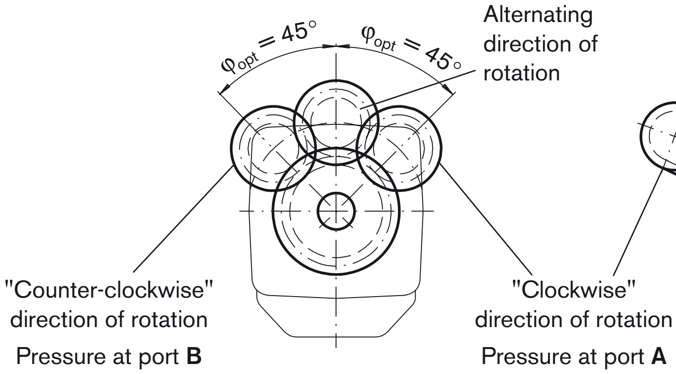
Note
Influence of the direction of the permissible axial force:

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

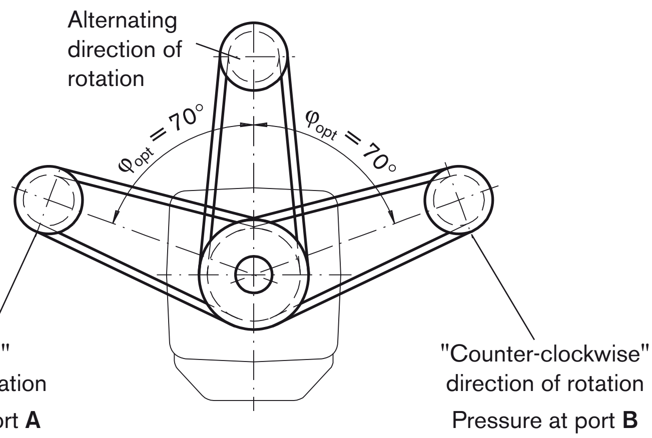
Effect of radial force F_q on the service life of bearings

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



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 6) 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.

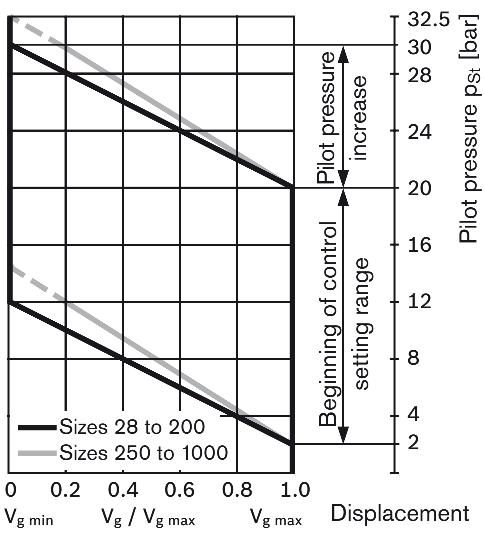
HD1
Pilot pressure increase $\Delta p_{St} = 10$ bar

A pilot pressure increase of 10 bar at port X results in a decrease in displacement from $V_{g\ max}$ to 0 cm³ (sizes 28 to 200) or from $V_{g\ max}$ to 0.2 $V_{g\ max}$ (sizes 250 to 1000).

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



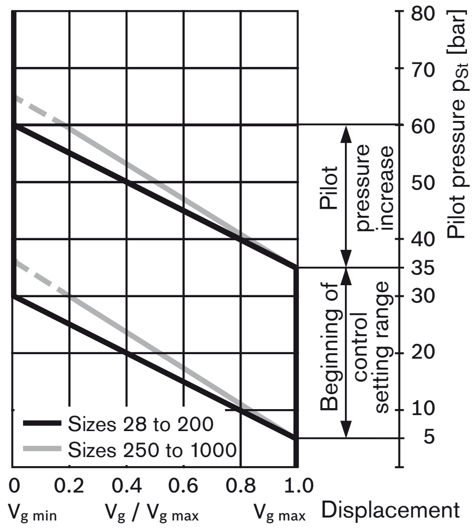
HD2
Pilot pressure increase $\Delta p_{St} = 25$ bar

A pilot pressure increase of 25 bar at port X results in a decrease in displacement from $V_{g\ max}$ to 0 cm³ (sizes 28 to 200) or from $V_{g\ max}$ to 0.2 $V_{g\ max}$ (sizes 250 to 1000).

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



HD3
Pilot pressure increase $\Delta p_{St} = 35$ bar

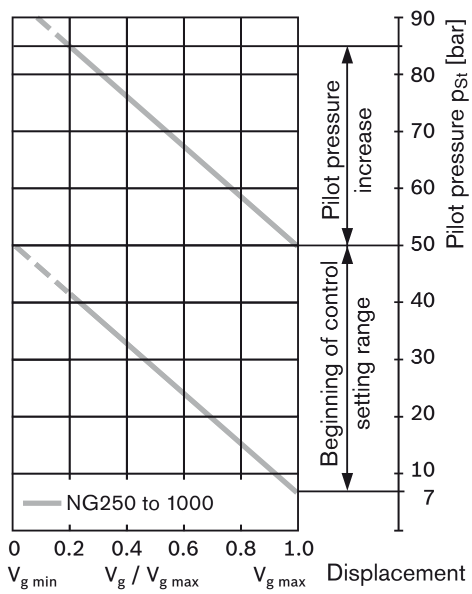
(sizes 250 to 1000)

A pilot pressure increase of 35 bar at port X results in a decrease in displacement from $V_{g\ max}$ to 0.2 $V_{g\ max}$.

Beginning of control, setting range ______________7 to 50 bar

Standard setting:
Beginning of control at 10 bar (end of control at 45 bar)

HDR3 characteristic



EP – Proportional control electric

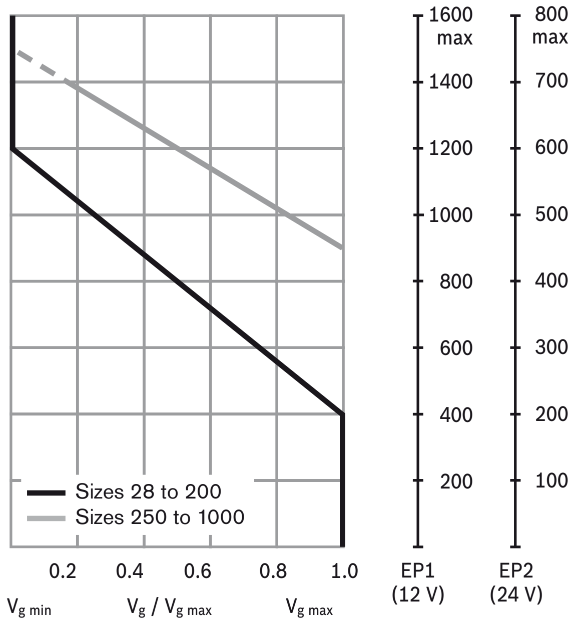
The proportional electric control provides infinite setting of the displacement, proportional to the control current applied to the solenoid (sizes 28 to 200) or proportional valve (sizes 250 to 1000).

For sizes 250 to 1000, the pilot oil supply at port P requires an external pressure of p_{min} = 30 bar (p_{max} = 100 bar).

– 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.

The following only needs to be noted for sizes 250 to 1000:

– The beginning of control and the EP characteristic are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 6) and thus a parallel shift of the characteristic.

Technical data, solenoid
Sizes 28 to 200

	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 %
Type of protection see connector design page 70		

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

– BODAS controller RC
  Series 20 ______ RE 95200
  Series 21 ______ RE 95201
  Series 22 ______ RE 95202
  Series 30 ______ RE 95203, RE 95204
  and application software

– Analog amplifier RA ______ RE 95230

– Electric amplifier VT 2000, series 5X (see RE 29904) (for stationary application)

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

Technical data, proportional valve
Sizes 250 to 1000

	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
Beginning of control at $V_{g\,max}$	900 mA	450 mA
End of control at $V_{g\,min}$	1400 mA	700 mA
Limiting current	2.2 A	1.0 A
Nominal resistance (at 20 °C)	2.4 Ω	12 Ω
Duty cycle	100 %	100 %
Type of protection see connector design page 70		

See also proportional pressure-reducing valve DRE 4K (RE 29181).

Note

The spring return feature in the control part is not a safety device

The control part can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.

EZ – Two-point control electric

The two-point electric control with switching solenoid (sizes 28 to 200) or control valve (sizes 250 to 1000) 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, 140, 160, 200

	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 70		

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 70		

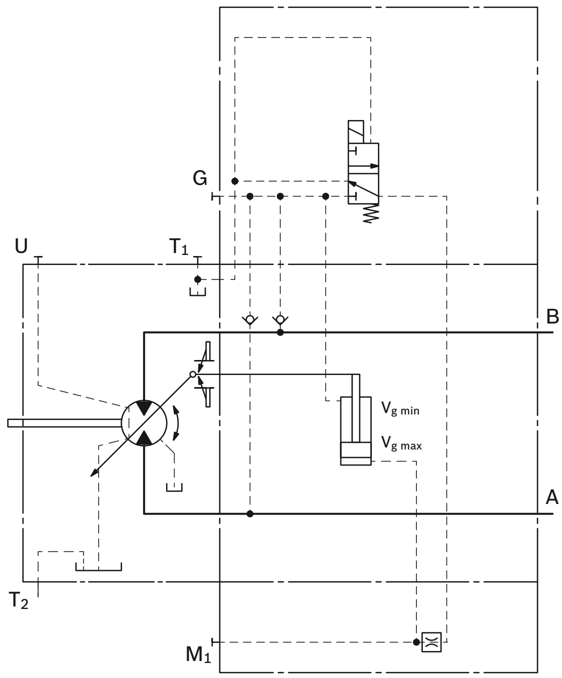
Technical data, control valve

Sizes 250 to 1000

	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)	6 Ω	23 Ω
Nominal power	26 W	26W
Minimum required current	2 A	1.04 A
Duty cycle	100 %	100 %
Type of protection see connector design page 70		

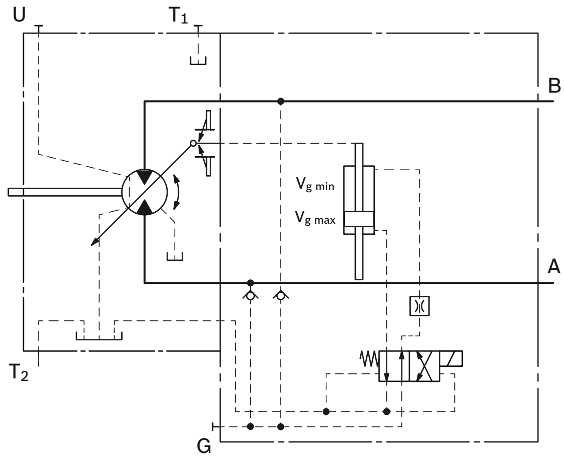
Schematic EZ1, EZ2

Sizes 28, 140, 160, 200



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 A6VM 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 7) and thus a parallel shift of the characteristic. Only for HA1T (sizes 28 to 200) and HA1, HA2, HA.T, (sizes 250 to 1000).
- 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**.

HA – Automatic control high-pressure related

HA.**R1**, HA.**R2**
Override electric,
travel direction valve electric (see page 29)

Sizes 28 to 200

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

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

Depending on the direction of rotation (direction of travel), the travel direction valve is actuated through the pressure spring or the switching solenoid a (see page 29 for further details).

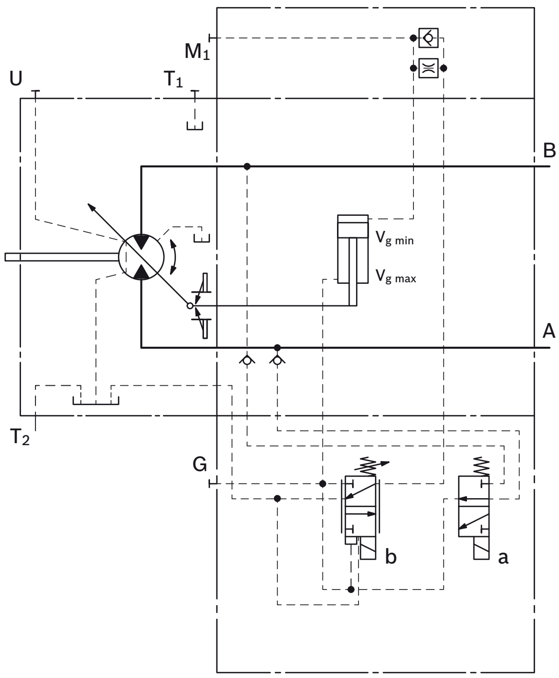
Technical data, solenoid a with Ø37
(travel direction valve)

		R1	R2
Voltage		12 V (±20 %)	24 V (±20 %)
No override		de-energized	de-energized
Direction of rotation	Operating pressure in		
ccw	B	energized	energized
cw	A	de-energized	de-energized
Nominal resistance (at 20 °C)		5.5 Ω	21.7 Ω
Nominal power		26.2 W	26.5 W
Minimum required current		1.32 A	0.67 A
Duty cycle		100 %	100 %
Type of protection see connector design page 70			

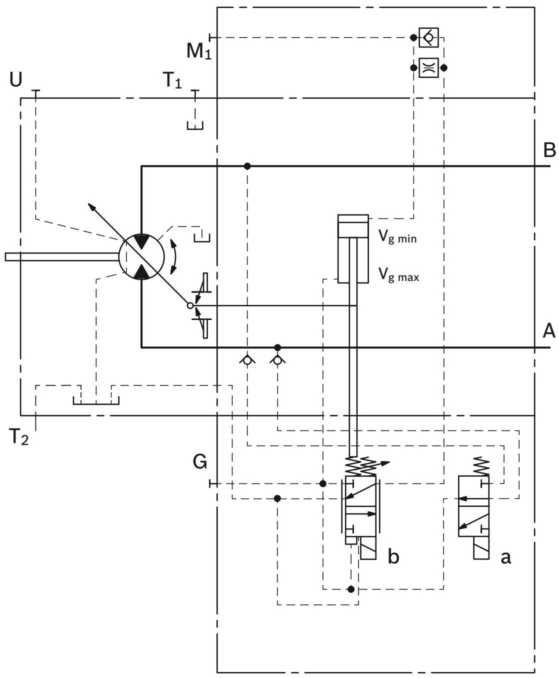
Technical data, solenoid b with Ø45
(electric override)

	R1	R2
Voltage	12 V (±20 %)	24 V (±20 %)
No override	de-energized	de-energized
Displacement $V_{g\ max}$	energized	energized
Nominal resistance (at 20 °C)	4.8 Ω	19.2 Ω
Nominal power	30 W	30 W
Minimum required current	1.5 A	0.75 A
Duty cycle	100 %	100 %
Type of protection see connector design page 70		

Schematic HA1R1, HA1R2



Schematic HA2R1, HA2R2



DA – Automatic control speed-related

DA2, DA3, DA5, DA6
Electric travel direction valve + electric $V_{g\,max}$-circuit

The travel direction valve is either spring offset or switched by energizing switching solenoid a, depending on the direction of rotation (travel direction).

When the switching solenoid b is energized, the DA control is overridden and the motor swivels to maximum displacement (high torque, lower speed) (electric $V_{g\,max}$-circuit).

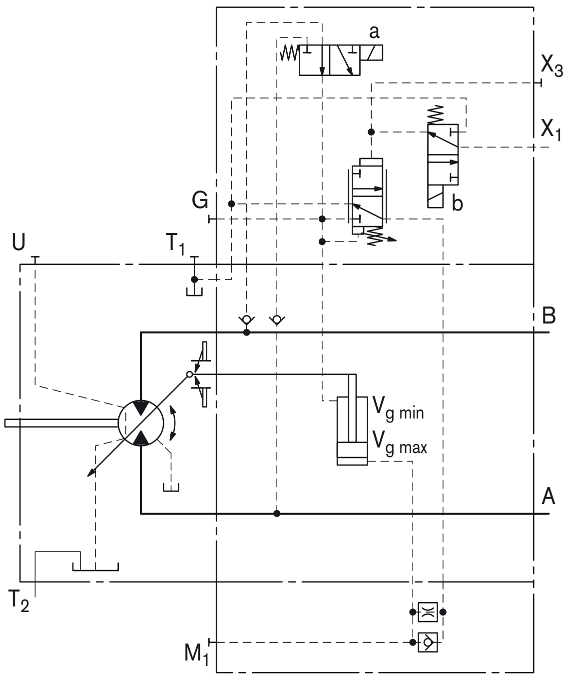
Technical data, solenoid a with Ø37
(travel direction valve)

		DA2, DA5	DA3, DA6
Voltage		12 V (±20 %)	24 V (±20 %)
Direction of rotation	Operating pressure in		
ccw	B	de-energized	de-energized
cw	A	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 70			

Technical data, solenoid b with Ø37
(electric override)

	DA2, DA5	DA3, DA6
Voltage	12 V (±20 %)	24 V (±20 %)
No override	de-energized	de-energized
Displacement $V_{g\,max}$	energized	energized
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum required current	1.32 A	0.67 A
Duty cycle	100 %	100 %
Type of protection see connector design page 70		

Schematic DA2, DA3, DA5, DA6
Sizes 28 to 200



Connector for solenoids

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

DEUTSCH DT04-2P-EP04

Sizes 28 to 200

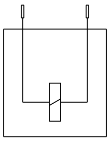
Molded, 2-pin, without bidirectional suppressor diode

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

IP67 ______________________ DIN/EN 60529

and IP69K ______________________ DIN 40050-9

Circuit symbol

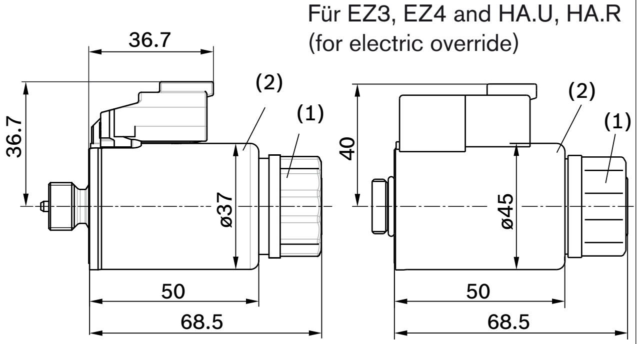


Mating connector

DEUTSCH DT06-2S-EP04
Bosch Rexroth Mat. No. R902601804

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 delivery contents. This can be supplied by Bosch Rexroth on request.



HIRSCHMANN DIN EN 175 301-803-A/ISO 4400

Sizes 250 to 1000

Without bidirectional suppressor diode

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

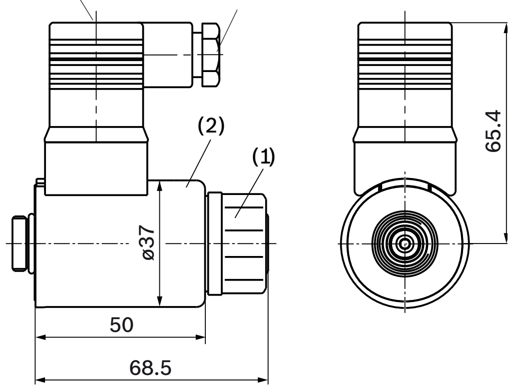
IP65 ______________________ DIN/EN 60529

The seal ring in the cable fitting is suitable for line diameters of 4.5 mm to 10 mm.

The HIRSCHMANN connector is included in the delivery contents of the motor.

Mounting bolt M3
Tightening torque
M_A = 0.5 Nm

Cable fitting M16 x 1.5
Tightening torque
M_A = 1.5 - 2.5 Nm



Changing connector orientation

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (WAF26, 12-sided DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.

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

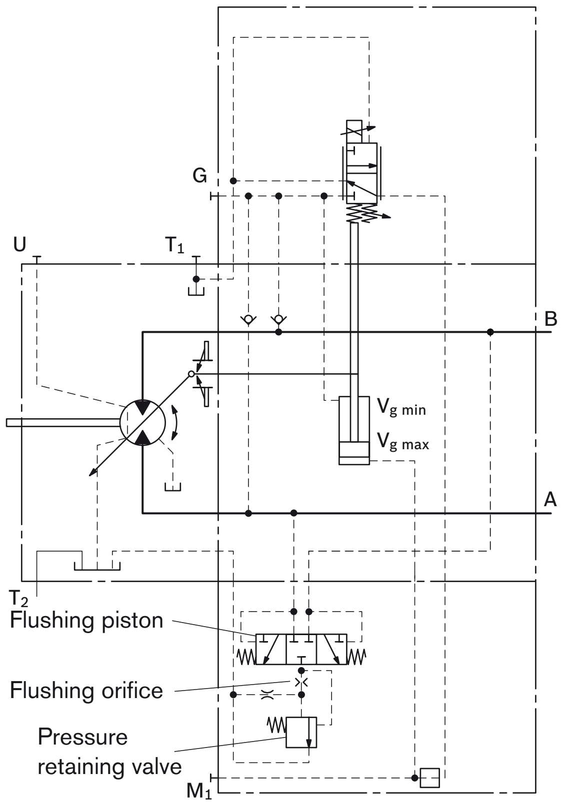
Switching pressure of flushing piston Δp ____ 8±1 bar

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)

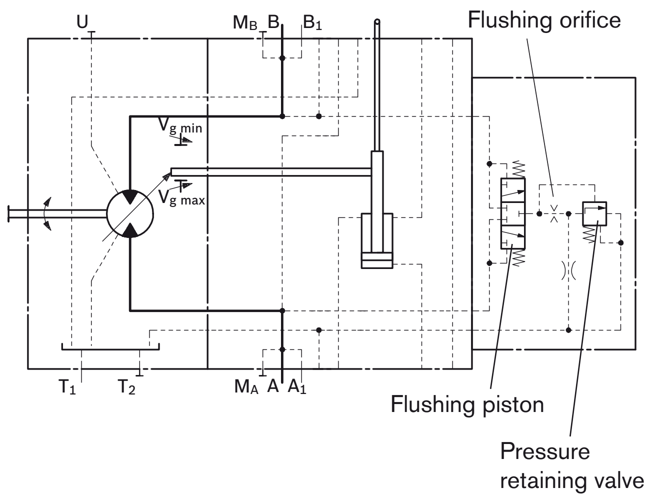
Size	Flushing flow q_V [L/min]	Mat. No. of orifice
28, 55	3.5	R909651766
80	5	R909419695
107	8	R909419696
140, 160, 200	10	R909419697
250	10	R909419697
355, 500, 1000	16	R910803019

With sizes 28 to 200, 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 200



Schematic
Sizes 250 to 1000



Details model of Rexroth A6VM motor		
R902050639 A6VM200DA1/63W-VAB017DB	R902121728 A6VM160HA2/63W-VZB017FA K	R902092142 AA6VM160HA1T/63W-VSD527A E
R902050953 A6VM140DA1/63W-VZB020DB	R902121734 A6VM80EP1/63W-VXB017FXB S	R902092143 A6VM28HD6/63W-VAB020B E
R902052390 A6VM140HD1D/63W-VZB010B	R902121735 A6VM107EPX/63W-VXB017FPB S	R902092147 AA6VM55HA1/63W-VSD520A E
R902054692 A6VM107HD1E/63W-VZB020B	R902121750 A6VM80HA1R2/63W-VXB017CA S	R902092167 AA6VM107HD1/63W-VSD52000B
R902054886 A6VM200EP2/63W-VAB010WB	R902121756 A6VM107HA1R2/63W-VXB0170CA S	R902092169 AA6VM107HD1/63W-VSD52000B
R902060117 AA6VM200HD1/63W-VSD510B	R902121762 A6VM140HA1R2/63W-VXB017CA S	R902092214 AA6VM160HA2X/63W-VSD520A ES
R902060120 A6VM160HZ1/63W-VZB027B	R902121768 AA6VM160HD1/63W-VSD510B E	R902092253 A6VM160HA1TX/63W-VPB020A ES
R902060180 A6VM140HD2D/63W-VZB010B	R902121897 A6VM160HD1D/63W-VZB380B SK	R902092353 AA6VM160HA2T/63W-VSD527DA E
R902060418 A6VM200EP2D/63W-VAB020WB	R902121918 AA6VM160EP1/63W-VSDXXXFPB SK	R902092367 AA6VM107HA1T/63W-VSD517A E
R902060460 A6VM160HA1A/63W-VZB380A S	R902124047 A6VM140HA2R2/63W-VZB017PA	R902092502 AA6VM107HZ3/63W-VSD51700B
R902063606 A6VM160HD1/63W-XPB010B S	R902124083 AA6VM160HA1TX/63W-VSD527A ES	R902092584 AA6VM200HD1D/63W-VSD527B E
R902063758 A6VM140HA1T/63W-VZB380DA	R902124171 AA6VM107HD2/63W-VSD52000B	R902092589 AA6VM160HD1D/63W-VSD527B E
R902063883 A6VM107HA1TA/63W-VAB370A SK	R902124172 AA6VM80HA1/63W-VSC520A E	R902092591 AA6VM160HZ1/63W-VSD510B E
R902065743 A6VM160EP2D/63W-VZB017HB	R902124256 AA6VM160HD1/63W-VSD510B E	R902092630 AA6VM80HD1/63W-VSC520A E
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R902065844 A6VM200HD1/63W-VAB027A	R902124371 AA6VM80EP1/63W-VSC520PB E	R902092716 AA6VM160HA1TX/63W-VSD527A ES
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R902075377 A6VM107HA1/63W-VZB370A SK	R902130931 AA6VM160HD2/63W-VSD527B E	R902094513 A6VM80EP1/63W-VXB027FXB S
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