Bosch Rexroth A6VM085EP100P000A/71CWV0C2S91B0-S axial piston variable motor

Manufacturer: Bosch Rexroth

Manufacturer part number / published order designation: R902253736

Published model: A6VM085EP100P000A/71CWV0C2S91B0-S

About this compilation

Prepared by Hydmaster from selected manufacturer documentation. Original technical pages follow without cropped drawings, rewritten data or altered units. This cover and index are Hydmaster editorial material, not a manufacturer-issued exact-execution datasheet.

Coverage: selected pages relevant to the identified size and configuration. Other options or neighbouring models retained on an original page apply only where explicitly identified.

Execution notes and conditions

Supplied displacement stops and control settings are not specified. Shaft dimensions, connector pinout and valve-option suffix geometry are not assigned from an unmatched standard drawing.

Source-page index

Source page numbers below are physical pages of each complete original PDF. The original printed page labels and technical content remain unchanged. Compiled page numbers count this cover/index.

Source A: Bosch Rexroth A6Vm Americas Re A91610 2022 Original

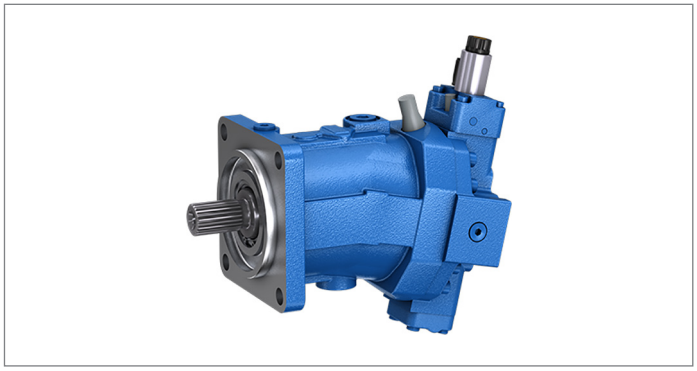
Original pages	Compiled pages	Relevant content
1-10	2-11	Fluid, shaft-seal, displacement and safe installation conditions; no unmatched execution dimensions assigned; Ordering key and regional execution applicability; Pressure definitions, duty limits and braking-inlet requirements
14-15	12-13	Control function and required operating conditions
78-81	14-17	Fluid, shaft-seal, displacement and safe installation conditions; no unmatched execution dimensions assigned

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

rexroth
A Bosch Company

Axial piston variable motor A6VM series 71

Americas



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

Features

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

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

Type code

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

Axial piston unit

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

Operating mode

02	Motor	**M**

Size (NG)

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

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

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

● = Available ○ = On request – = Not available ▲ = to be discontinued

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

Connector for solenoids[1] (see page 63)

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

Swivel angle detection (see page 64)

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

Additional function

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

Stroking time damping (for selection, see control)

			060 to 215	
09	Without damping (standard with HP and EP)		●	**0**
	Damping	HP, EP, HP5,6D. and EP5,6D., HZ, EZ, HA with counterbalance valves BVD/BVE	●	**1**
		One-sided in inlet to large stroking chamber (HA)	●	**4**
		One-sided in outlet from large stroking chamber (DA)	●	**7**

Setting range for displacement[2]

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

Series

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

Version of ports and fastening threads

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

Direction of rotation

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

Sealing material

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

Drive shaft bearing

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

● = Available ○ = On request – = Not available ▲ = to be discontinued

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

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

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

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

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

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

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

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

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

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

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

● = Available ○ = On request – = Not available ▲ = to be discontinued

Notice

- Note the project planning notes on page 80.
- In addition to the type code, please specify the relevant technical data when placing your order.
- Please note that not all type code combinations are available although the individual functions are marked as being available

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

6) Not for EZ7, EZ8 and HZ7.

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

Hydraulic fluids

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

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

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

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

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

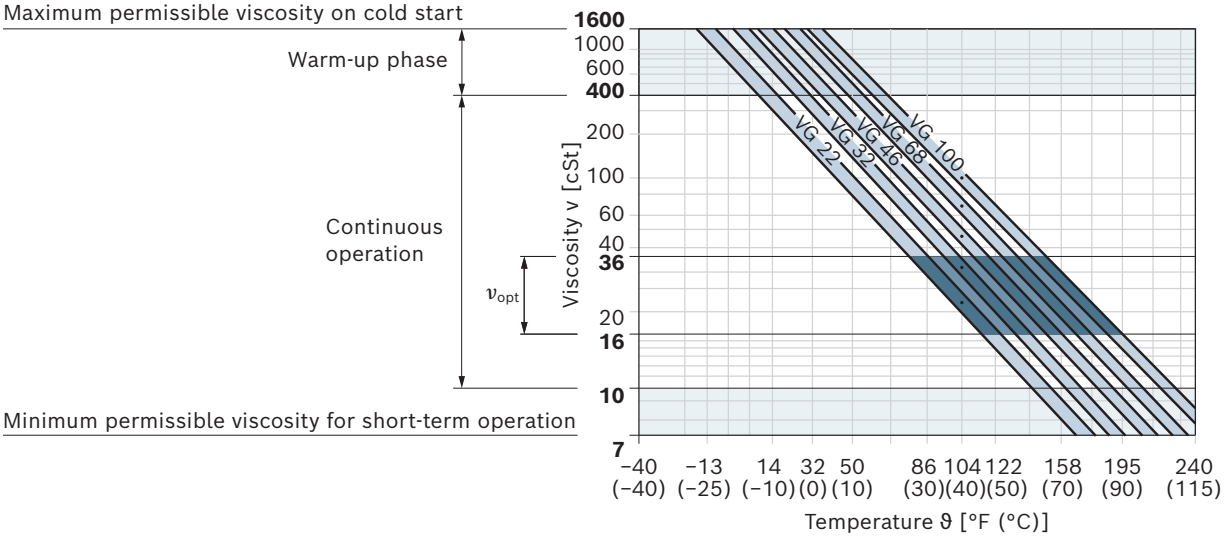
Notice
The axial piston unit is not suitable for operation with HFA hydraulic fluids. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed

Viscosity and temperature of hydraulic fluids

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

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

▼ **Selection diagram**



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

Filtration of the hydraulic fluid

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

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

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

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

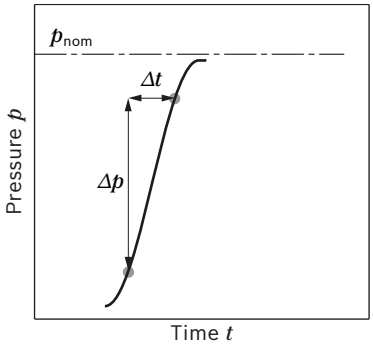
Flow direction

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

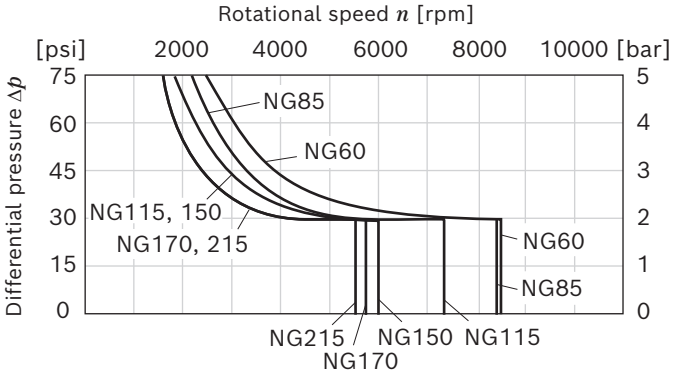
Working pressure range

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

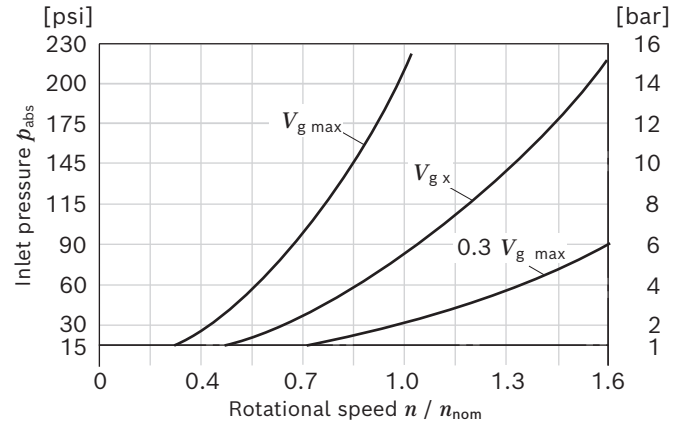
▼ **Rate of pressure change $R_{A\,max}$**



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

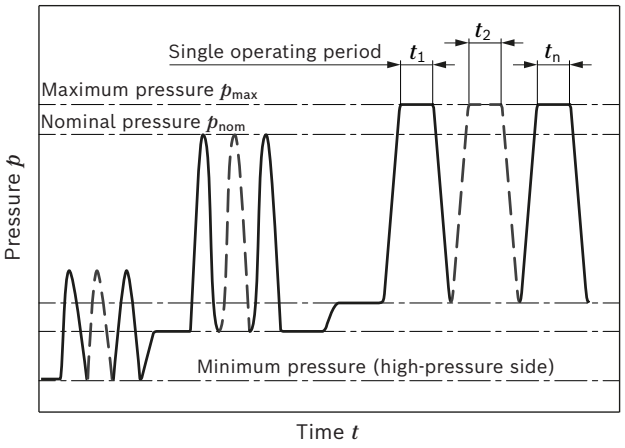


▼ **Minimum pressure – pump operating mode (inlet)**



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

▼ **Pressure definition**



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

Notice

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

Effect of case pressure on beginning of control

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

Technical data

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

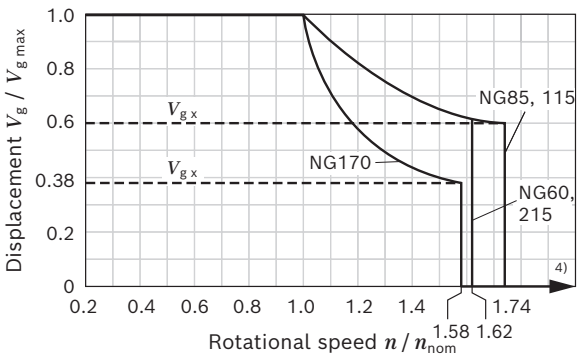
Speed range

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

Notices

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

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



Determining the operating characteristics

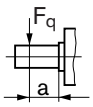
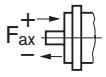
Inlet flow q_v	$= \frac{V_g \times n}{231 \times \eta_v}$ [gpm]	$\left(\frac{V_g \times n}{1000 \times \eta_v}\right)$ [l/min]
Rotational speed n	$= \frac{q_v \times 231 \times \eta_v}{V_g}$ [rpm]	$\left(\frac{q_v \times 1000 \times \eta_v}{V_g}\right)$ [rpm]
Torque M	$= \frac{V_g \times \Delta p \times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

Key

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

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

Permissible radial and axial loading on the drive shafts

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

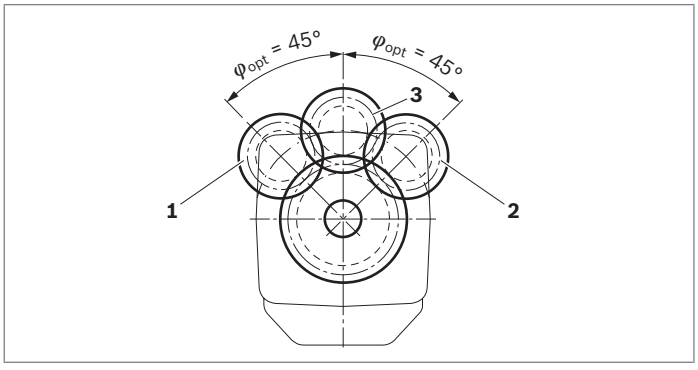
Effect of radial force F_q on bearing service life

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

Notices

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

▼ **Gear output drive**



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

1) Please contact us.

EP – Proportional control, electric

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

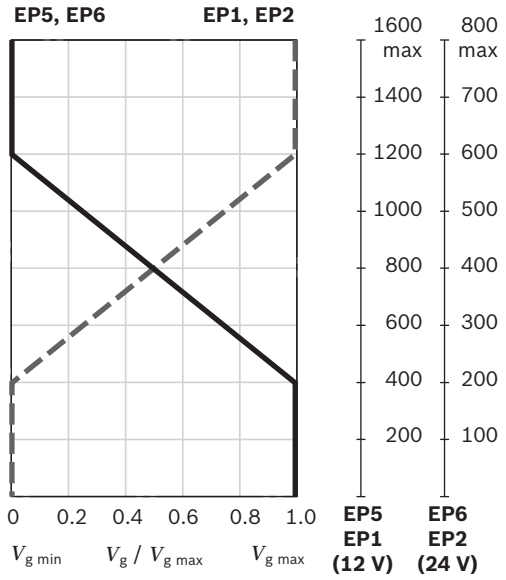
EP1, EP2 positive control

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

EP5, EP6 negative control

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

▼ **Characteristic curve**



Notice

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

Stroking time damping

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

Standard

EP without damping.

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

Optional

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

▼ **Throttle pin overview**

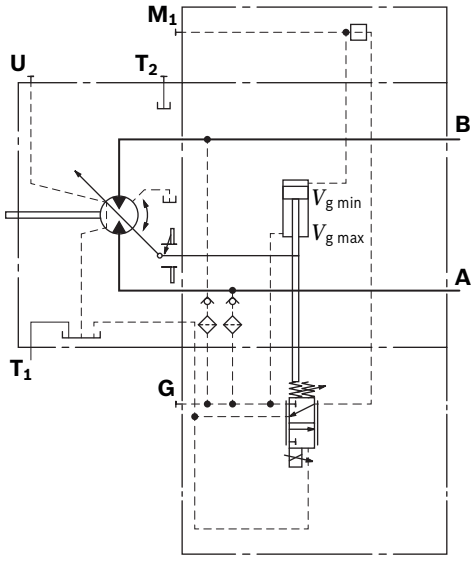
Size		60	85	115	150	170	215
Groove size	[inch]	0.018	0.018	0.022	0.022	0.022	0.026
	([mm])	(0.45)	(0.45)	(0.55)	(0.55)	(0.55)	(0.65)

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

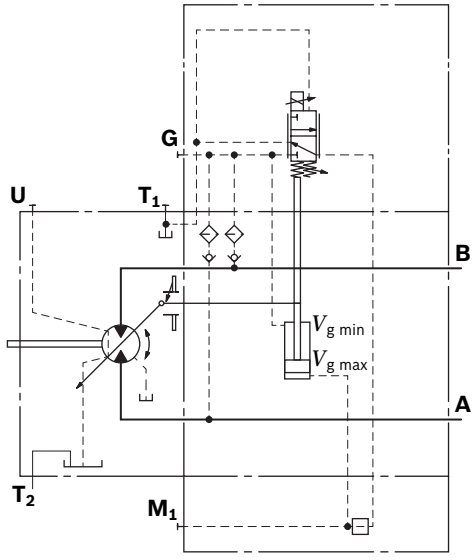
Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.

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

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



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



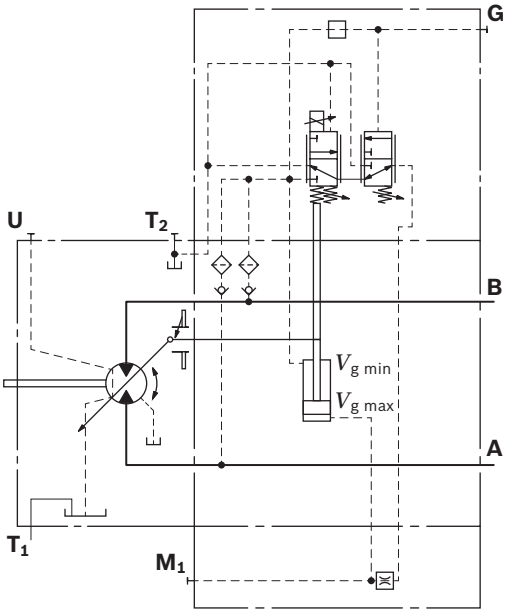
EP5D1, EP6D1 Pressure control, fixed setting

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

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

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

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



Installation instructions

General

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

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

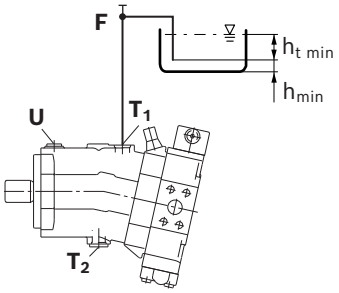
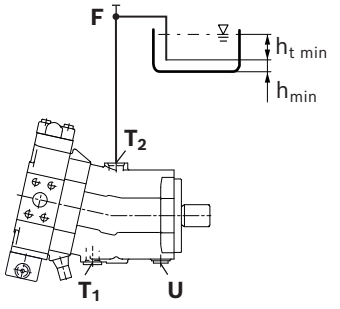
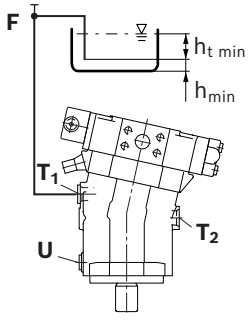
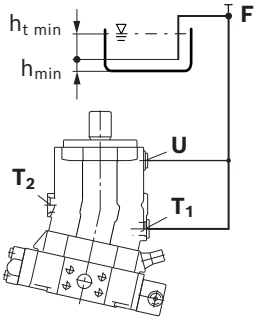
Notice
Effects on the control system are to be expected in certain installation positions. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

Installation position

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

Below-reservoir installation (standard)

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

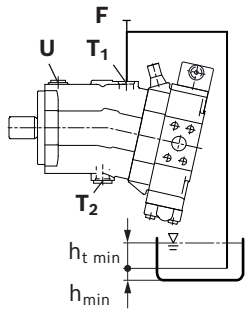
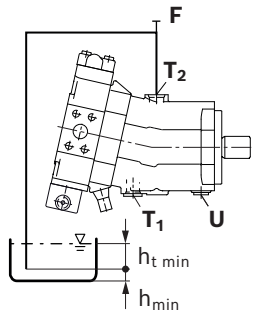
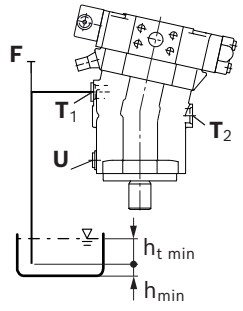
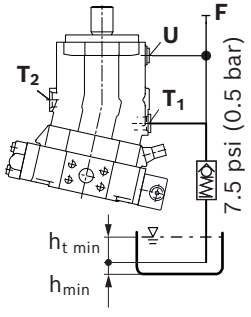
Installation position	Air bleed	Filling
1 		T_1
2 		T_2
3 		T_1
4 	U	T_1

Above-reservoir installation

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

Recommendation for installation position 8 (drive shaft up):

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

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

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

Notice

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

Project planning notes

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

Safety instructions

- During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk.
  The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.
- In certain conditions, moving parts in high-pressure relief valves might get stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid). This can result in restriction or loss of load-holding functions in lifting winches.
  Therefore it is the machine and/or system manufacturer's responsibility to make sure that the load can always be put in a safe mode if needed. Also, he needs to ensure that these measures are properly implemented.
- When using the axial piston motor in winch drives, make certain that the technical limit values are not exceeded under all operating conditions. If the axial piston motor is extremely overloaded (e.g. if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst. The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.