Bosch Rexroth A6VM215HP5D10001B/71AWV0E4T220V-0 axial piston variable motor

Manufacturer: Bosch Rexroth

Manufacturer part number / published order designation: R902227932

Published model: A6VM215HP5D10001B/71AWV0E4T220V-0

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.

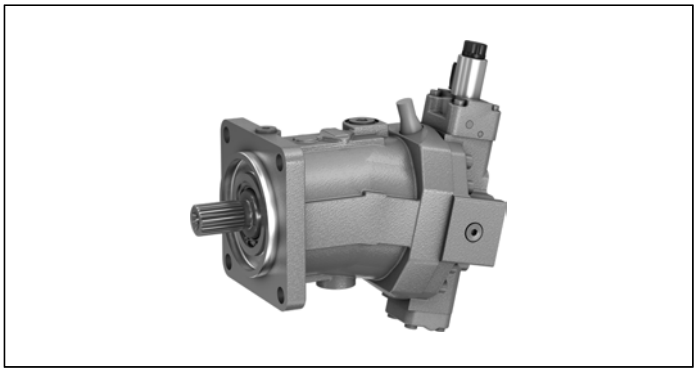
Source A: Bosch Rexroth A6Vm Americas Re A91610 2015 Original

Original pages	Compiled pages	Relevant content
1-12	2-13	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; Control function and required operating conditions
72-75	14-17	Fluid, shaft-seal, displacement and safe installation conditions; no unmatched execution dimensions assigned

Axial piston variable motor
A6VM series 71

Americas

RE-A 91610
Edition: 12.2015
Replaces: 04.2013



- Sizes 60 to 215
- Nominal pressure 6500 psi (450 bar)
- Maximum pressure 7250 psi (500 bar)
- Open and closed circuits

Features

- Variable motor with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuit
- For use in mobile and stationary applications
- The wide control range enables the variable motor to satisfy the requirement for high speed and high torque.
- The displacement can be infinitely varied from $V_{g\,max}$ to $V_{g\,min}$ = 0.
- The output speed is dependent 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 transmissions
- Wide selection of control devices
- Cost savings through elimination of gear shifts and possibility of using smaller pumps
- Compact, robust motor with long service life
- High power density
- Good starting efficiency
- Version with 9-piston rotary group
- Good low speed characteristics
- High uniformity

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Type code

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

Axial piston unit

01	Bent-axis design, variable, nominal pressure 6500 psi (450 bar), maximum pressure 7250 psi (500 bar)	**A6V**

Operating mode

02	Motor	**M**

Size (NG)

03	Geometric displacement, see technical data on page 8	in cm^3/rev	**060**	**085**	**115**	**150**	**170**	**215**
		in in^3/rev	**3.66**	**5.19**	**7.02**	**9.15**	**10.37**	**13.12**

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 electrical	positive control	U = 12 V DC	●	●	●	●	●	●	**EP1**
			U = 24 V DC	●	●	●	●	●	●	**EP2**
		negative control	U = 12 V DC	●	●	●	●	●	●	**EP5**
			U = 24 V DC	●	●	●	●	●	●	**EP6**
	Two-point control hydraulic	negative control		–	–	–	●	●	●	**HZ5**
				●	●	●	–	–	–	**HZ7**
	Two-point control electrical	negative control	U = 12 V DC	–	–	–	●	●	●	**EZ5**
			U = 24 V DC	–	–	–	●	●	●	**EZ6**
			U = 12 V DC	●	●	●	–	–	–	**EZ7**
			U = 24 V DC	●	●	●	–	–	–	**EZ8**
	Automatic control high-pressure related, Positive control	with minimum pressure increase	Δp ≤ approx. 145 psi (10 bar)	●	●	●	●	●	●	**HA1**
		with pressure increase	Δp = 1450 psi (100 bar)	●	●	●	●	●	●	**HA2**
	Automatic control speed related, negative control p_{St} / p_{HD} = 5/100	hydr. travel direction valve		●	●	●	●	●	●	**DA0**
		electric travel direction valve + electric $V_{g\,max}$ circuit	U = 12 V DC	●	●	●	●	●	●	**DA1**
			U = 24 V DC	●	●	●	●	●	●	**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 controls HA1 and HA2	hydraulic remote control, proportional		●	●	●	●	●	●	**T3**
		electric, two-point	U = 12 V DC	●	●	●	●	●	●	**U1**
			U = 24 V DC	●	●	●	●	●	●	**U2**
		electric and travel direction valve, electric	U = 12 V DC	●	●	●	●	●	●	**R1**
			U = 24 V DC	●	●	●	●	●	●	**R2**

Connector for solenoids[1] (see page 62)

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

● = Available ○ = On request – = Not available

1) Connectors for other electric components can deviate.

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

Additional function 1

07	Without additional function	**0**

Additional function 2

08	Without additional function	**0**

Response time damping (for selection, see control)

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

10	$V_{g\,max}$-setting screw	$V_{g\,min}$-setting screw	**060**	**085**	**115**	**150**	**170**	**215**	
	Without setting screw	short (0-adjustable)	●	●	●	●	●	●	**A**
		medium	●	●	●	●	●	●	**B**
		long	●	●	●	●	●	●	**C**
		extra long	–	●	●	●	●	●	**D**
	Short	short (0-adjustable)	●	●	●	●	●	●	**E**
		medium	●	●	●	●	●	●	**F**
		long	●	●	●	●	●	●	**G**
		extra long	–	●	●	●	●	●	**H**
	Medium	short (0-adjustable)	●	●	●	●	●	●	**J**
		medium	●	●	●	●	●	●	**K**
		long	●	●	●	●	●	●	**L**
		extra long	–	●	●	●	●	●	**M**

Series

11	Series 7, index 1	**71**

Configuration of ports and fastening threads

12	ANSI, port threads with O-ring sealing according to ISO 11926	**A**

Direction of rotation

13	Viewed on drive shaft, bidirectional	**W**

Sealing material

14	FKM (fluoroelastomer)	**V**

Drive shaft bearing

15	Standard bearing	**0**

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

● = Available ○ = On request – = Not available

2) The settings for the setting screws can be found in the table (see pages 70 and 71).

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

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

Port plate for working ports			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**
	Port plate with 1-stage pressure limitation valves for mounting a counterbalance valve[3]	BVD20	●	●	●	–	–	–	**7**
		BVD25, BVE25	–	–	●	●	●	●	**8**

Valve (see pages 63 to 68)				060	085	115	150	170	215	
19	Without valve			●	●	●	●	●	●	**0**
	With counterbalance valve BVD/BVE mounted[4]			●	●	●	●	●	●	**W**
	With flushing and boost pressure valve, mounted Flushing on both sides Flushing flow at: $\Delta p = p_{ND} - p_G$ = 365 psi (25 bar) and v = 60 SUS (10 mm²/s) (p_{ND} = low pressure, p_G = case pressure) Only possible with port plates 1 and 2	**Flushing flow q_v [gpm (l/min)]**								
		0.9	(3.5)	●	●	●	–	–	–	**A**
		1.3	(5)	●	●	●	–	–	–	**B**
		2.1	(8)	●	●	●	●	●	●	**C**
		2.6	(10)	●	●	●	●	●	●	**D**
		3.7	(14)	●	●	●	–	–	–	**F**
		4.0	(15)	–	–	●[5]	●	●	●	**G**
		4.8	(18)	–	–	●[5]	●	●	●	**I**
		5.5	(21)	–	–	●[5]	●	●	●	**J**
		7.1	(27)	–	–	●[5]	●	●	●	**K**
		8.2	(31)	–	–	●[5]	●	●	●	**L**
		9.7	(37)	–	–	–	●	●	●	**M**

Speed sensor (see page 69)		060	085	115	150	170	215	
20	Without speed sensor	●	●	●	●	●	●	**0**
	Prepared for speed sensor DSM/DSA	●	●	●	●	●	●	**U**
	With speed sensor DSM/DSA mounted[6]	●	●	●	●	●	●	**V**

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

● = Available ○ = On request – = Not available

Notes

- ▶ Note the project planning notes on page 74.
- ▶ When ordering, please provide the relevant technical data additionally to the type code

3) Only possible in conjunction with HP, EP and HA control. Note the restrictions described on page 65.

4) State ordering code for counterbalance valve separately in accordance with data sheet 95522 for BVD or 95525 for BVE. Note the restrictions described on page 65.

5) Not for EZ7, EZ8 and HZ7.

6) State ordering code for sensor separately in accordance with data sheet 95132 for DSM or 95133 for DSA and note the requirements relating to the electronics.

Hydraulic fluids

The variable motor A6VM is designed for operation with mineral oil HLP according to DIN 51524.
Application instructions and requirements for hydraulic fluids 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-resistan, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC)

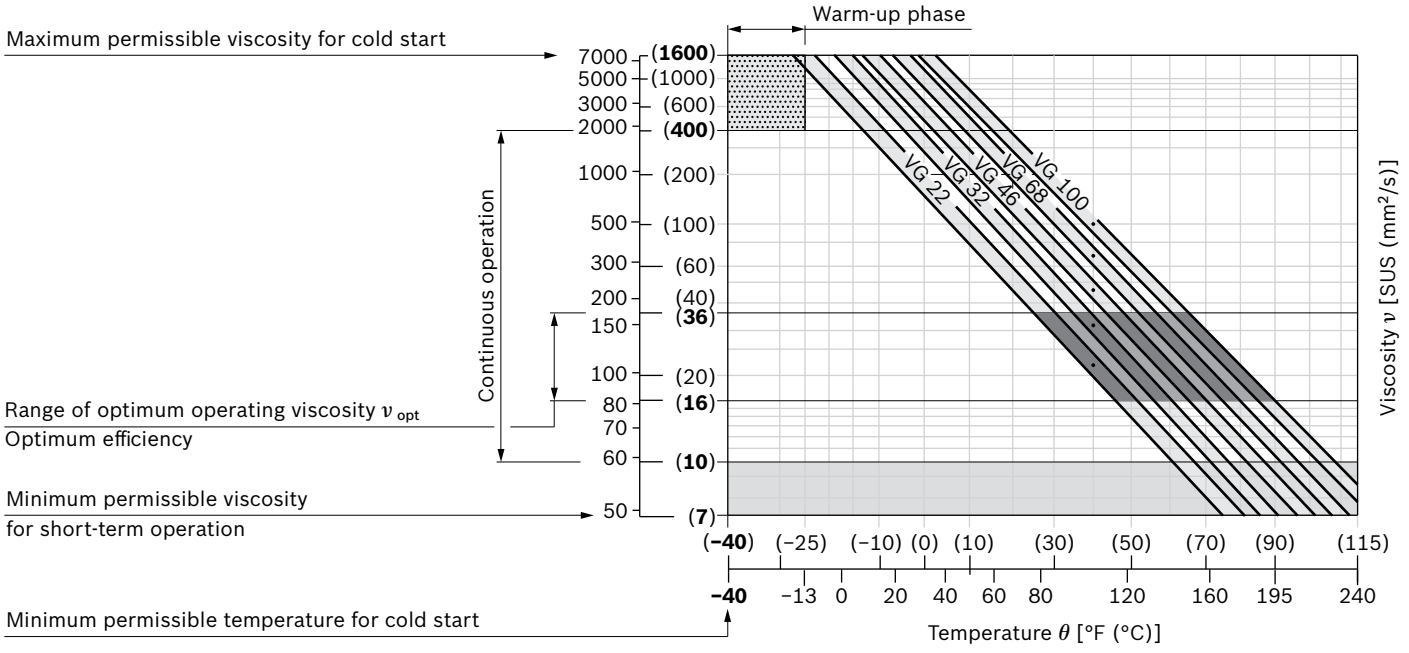
Details regarding the selection of hydraulic fluid
The hydraulic fluid should be selected such that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see selection diagram).

Note
At no point of the component may the temperature be higher than 240 °F (115 °C). The temperature difference specified in the table 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 page 63).

Viscosity and temperature of hydraulic fluids

	Viscosity		Temperature		Comment
Cold start	v_{max} ≤	7400 SUS (1600 mm²/s)	θ_{St} ≥	−40 °F (−40 °C)	t ≤ 3 min, n ≤ 1000 rpm, without load p ≤ 725 psi (p ≤ 50 bar)
Permissible temperature difference			ΔT ≤	45 °F (25 K)	between axial piston unit and hydraulic fluid in the system
Warm-up phase	v <	7400 to 1850 SUS (1600 to 400 mm²/s)	θ =	−40 °F to −13 °F (−40 °C to −25 °C)	at p ≤ 0.7 × p_{nom}, n ≤ 0.5 × n_{nom} and t ≤ 15 min
Continuous operation	v =	1850 to 47 SUS (400 to 10 mm²/s)			This corresponds, for example on the VG 46, to a temperature range of +41 °F to + 185 °F (+5 °C to +85 °C)(see selection diagram)
			θ =	−13 °F to +217 °F (−25 °C to +103 °C)	measured at port **T** Note the permissible temperature range of the shaft seal (ΔT = approx. 22 °F (12 K) between the bearing/shaft seal and port **T**)
	v_{opt} =	167 to 81 SUS (36 to 16 mm²/s)			Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} ≥	49 SUS (7 mm²/s)			t < 3 min, p < 0.3 × p_{nom}

▼ **Selection diagram**



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 very high hydraulic fluid temperatures (195 °F (90 °C) to maximum 217 °F (103 °C), measured at port **T**), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Influence of case pressure on beginning of control

An increase in case pressure affects the beginning of control 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.

Flow direction

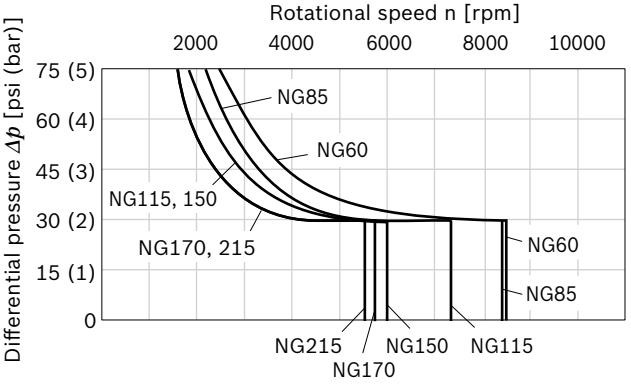
Direction of rotation, viewed on drive shaft	
clockwise (cw)	counter-clockwise (ccw)
A to **B**	**B** to **A**

Shaft seal

Permissible pressure loading

The service life of the shaft seal will be influenced by the speed of the axial piston unit and the leakage pressure in the housing (case pressure). Momentary pressure spikes (t < 0.1 s) of up to 145 psi (10 bar) are permitted. The service life of the shaft seal decreases with increasing frequency of pressure spikes and increasing mean differential pressure.

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

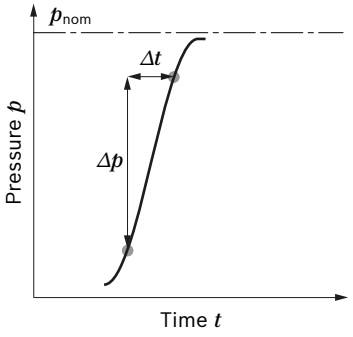


The FKM shaft seal may be used for leakage temperatures from -13 °F to +240 °F (-25 °C to +115 °C). For application cases below -13 °F (-25 °C), an NBR shaft seal is required (permissible temperature range:
-40 °F to +195 °F (-40 °C to +90 °C)).

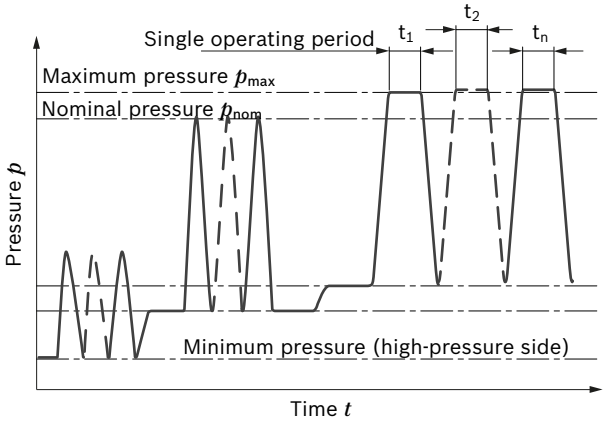
Operating pressure range

Pressure at working port 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 operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	10 s	
Total operating period	300 h	
Minimum pressure (high-pressure side)	365 psi (25 bar)	Minimum pressure at the high-pressure side (**A** or **B**) which is required in order to prevent damage to the axial piston unit.
Minimum pressure – pump operating mode (inlet)	See the diagram below	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 working port (inlet). This minimum pressure is dependent on the speed and displacement of the axial piston unit (see characteristic curve)
Summation pressure p_{Su} (pressure **A** + pressure **B**)	10150 psi (700 bar)	The summation pressure is the sum of the pressures at both working ports (**A** and **B**)
Rate of pressure change $R_{A\,max}$		Maximum permissible rate of pressure build-up and reduction during a pressure change over 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)	

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

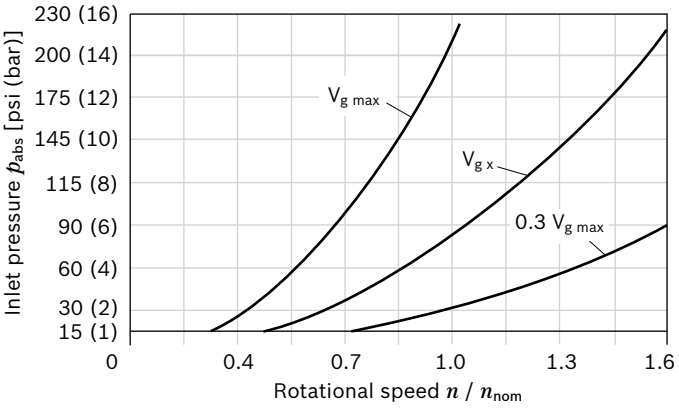


▼ **Pressure definition**



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

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



This diagram is valid only for the optimum viscosity range from v_{opt} = 170 to 73 SUS (36 to 16 mm²/s).
Please contact us if these conditions cannot be satisfied.

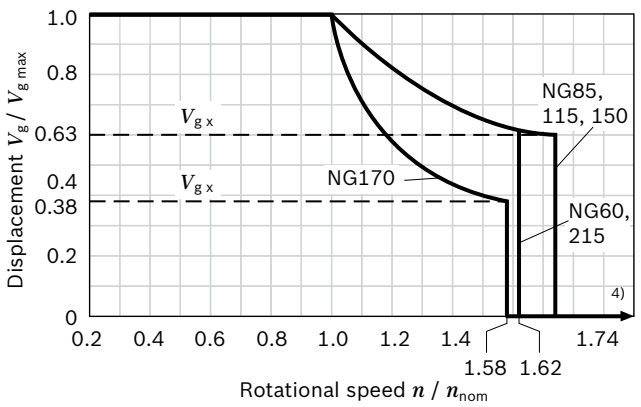
Note

Operating pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

Technical data

Size		NG		60	85	115	160	170	215
Displacement geometric, per revolution		$V_{g\,max}$	in³	3.78	5.20	7.05	9.28	10.48	13.21
			cm³	62.0	85.2	115.6	152.1	171.8	216.5
		$V_{g\,min}$	in³	0	0	0	0	0	0
			cm³	0	0	0	0	0	0
		$V_{g\,x}$	in³	2.26	3.11	4.21	5.55	3.97	5.00
			cm³	37	51	69	91	65	82
Maximum speed[1] (complying with the maximum permissible inlet flow)	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 $V_{g\,max}$	$q_{v\,max}$	gpm	73	88	108	131	141	166
			l/min	276	332	410	494	533	628
Torque[3]	at $V_{g\,max}$ and Δp = 6500 psi (450 bar)	T	lb-ft	326	448	608	800	903	1139
			Nm	444	610	828	1089	1230	1550
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	lb-ft/rad	10695	16521	27511	32084	38279	51334
			kNm/rad	14500	22400	37300	43500	51900	69600
	$V_g/2$ to 0 (interpolated)	c_{min}	lb-ft/rad	33412	49785	76559	91458	115355	144267
			kNm/rad	45300	67500	103800	124000	156400	195600
Moment of inertia for rotary group		J_{TW}	lb-ft²	0.1020	0.1709	0.2610	0.4295	0.5055	0.7190
			kgm²	0.0043	0.0072	0.0110	0.0181	0.0213	0.0303
Maximum angular acceleration		α	rad/s²	21000	17500	15500	11000	11000	10000
Case volume		V	gal	0.21	0.26	0.40	0.45	0.61	0.74
			l	0.8	1.0	1.5	1.7	2.3	2.8
Weight, approx.		m	lbs	62	79	101	134	137	172
			kg	28	36	46	61	62	78

▼ **Permissible displacement in relation to speed**



Notes

- Theoretical values, without efficiency levels 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.

Determining the operating characteristics

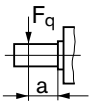
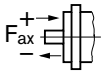
Inlet flow	$q_v = \frac{V_g \times n}{231 \times \eta_v}$	[gpm]	$\left(\frac{V_g \times n}{1000 \times \eta_v}\right)$ [l/min]
Rotational speed	$n = \frac{q_v \times 231 \times \eta_v}{V_g}$	[rpm]	$\left(\frac{q_v \times 1000 \times \eta_v}{V_g}\right)$ [rpm]
Torque	$T = \frac{V_g \times \Delta p \times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

Key

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

1) The values are valid:
   - For the optimum viscosity range from ν_{opt} = 170 to 75 SUS (36 to 16 mm²/s)
   - with hydraulic fluid on the basis of mineral oil
2) Note inlet flow limitation due to counterbalance valve (see page 65).
3) Torque without radial force, With radial force see page 9.
4) Values in this range on request

Permissible radial and axial forces of the drive shafts

Size	NG		60	85	115	150	150	170	215
Drive shaft		in	1 1/4	1 1/2	1 3/4	1 3/4	2	2	2
Maximum radial force[1] 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
Torque maximum at $F_{q\,max}$	T_{max}	lb-ft	229	439	611	656	803	679	939
		Nm	310	595	828	890	1089	1230	1445
Differential pressure maximum at $V_{g\,max}$ and $F_{q\,max}$	Δp_{max}	psi	4550	6400	6500	5350	6500	6500	6100
		bar	315	440	450	370	450	450	420
Maximum axial force, at standstill or pressure-free 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) operating 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

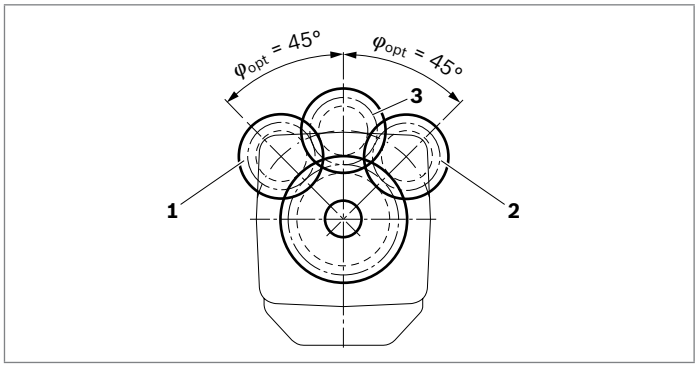
Effect of radial force F_q on the service life of bearings

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:

Notes

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

▼ **Toothed gear output drive**



1 Direction of rotation "counter-clockwise", pressure at port **B**
2 Direction of rotation "clockwise", pressure at port **A**
3 Bidirectional direction of rotation

1) With intermittent operation

HP – Proportional hydraulic control

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

HP1, HP2 positive control

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

HP5, HP6 negative control

- 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} = 1450 psi (100 bar)
- The control oil is internally taken from the high pressure side of the motor (**A** or **B**). For reliable control, an operating pressure of at least 435 psi (30 bar) is required in **A** (**B**). If a control operation is performed at an operating pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (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 7250 psi (500 bar) can occur at port **G**.
- Please state the desired beginning of control in plain text when ordering, e. g.: beginning of control at 145 psi (10 bar).
- The beginning of control and the HP characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 6) and thus a parallel displacement of the characteristic.
- A leakage flow of maximum 0.08 gpm (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.

Response time damping

The response time damping is influencing the stroke characteristics of the motor and thus the reaction speed of the machine.

Standard with Size 60 to 215

HP without damping.

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

Option with Size 60 to 215

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

▼ **Overview Throttle Pins**

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

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

HP1 positive control

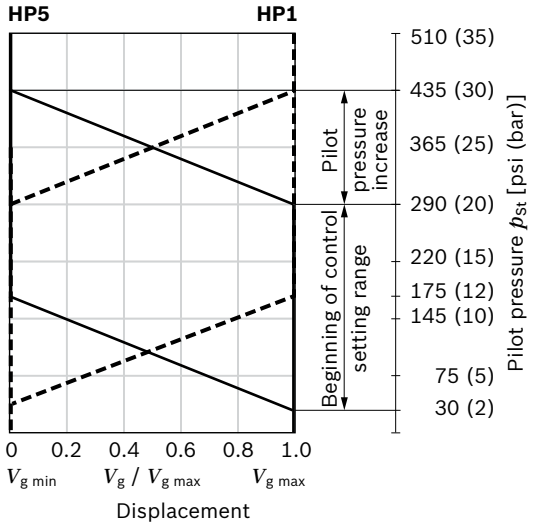
A pilot pressure increase of 145 psi (10 bar) at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP5 negative control

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

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

▼ **Characteristic curve**



HP2, HP6 pilot pressure increase Δp_{St} = 365 psi (25 bar)

HP2 positive control

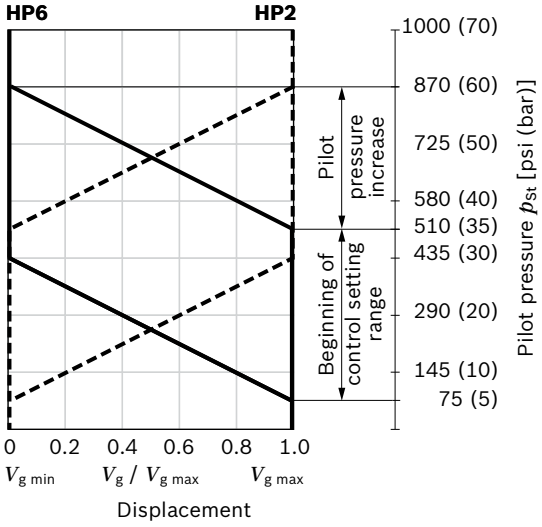
A pilot pressure increase of 365 psi (25 bar) at port **X** results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$.

HP6 negative control

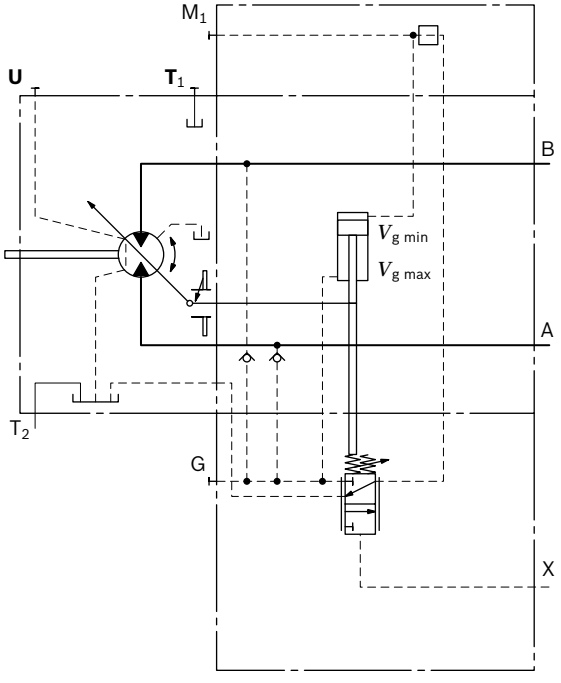
A pilot pressure increase of 365 psi (25 bar) at port **X** results in a decrease in displacement from $V_{g\,max}$ to $V_{g\,min}$.

- Beginning of control, setting range 75 to 725 psi (5 to 50 bar)
- Standard setting:
  Beginning of control at 145 psi (10 bar) (end of control at 510 psi (35 bar))

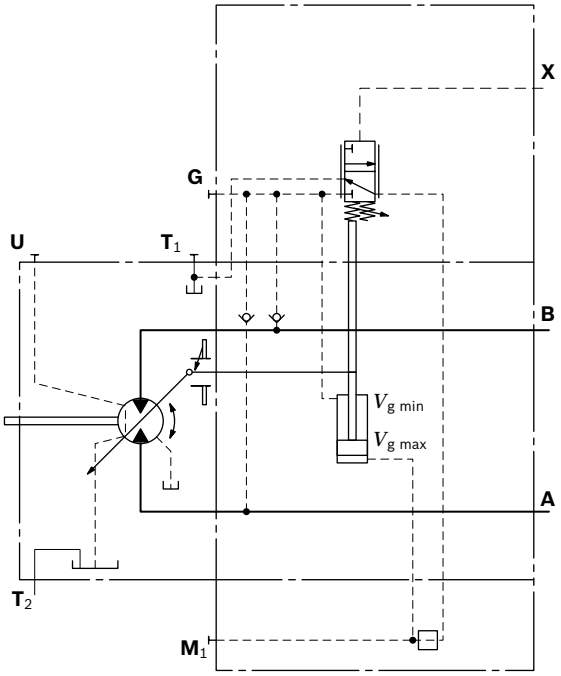
▼ **Characteristic curve**



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



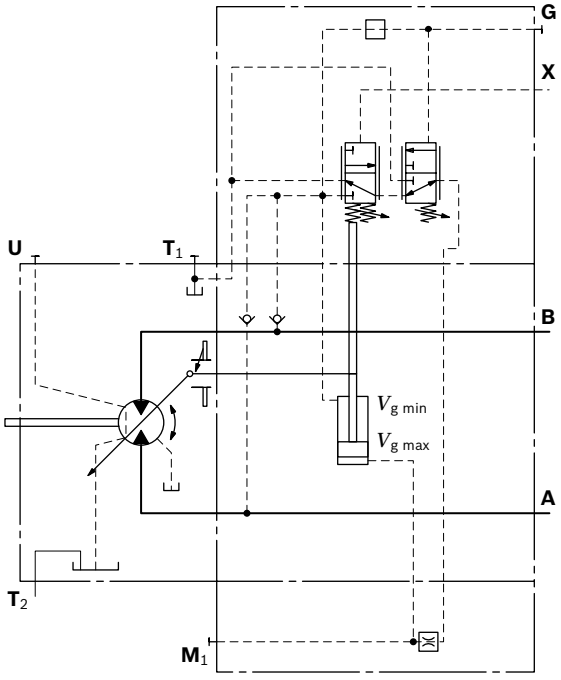
▼ **Circuit diagram HP5, HP6 (negative control)**



HP5D1, HP6D1 Pressure control, fixed setting

The pressure control overrides the HP control function.
If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement.
The increase in 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 1150 to 6500 psi (80 to 450 bar)

▼ **Circuit diagram HP5D1, HP6D1 (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 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**).
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 maximum permissible case pressure of all connected units is not exceeded at any operational conditions.
If this is not possible, separate drain lines must be laid.
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.

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

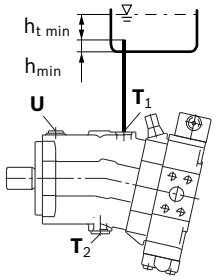
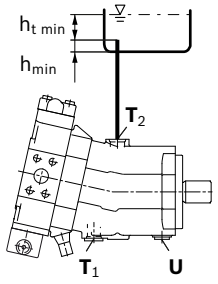
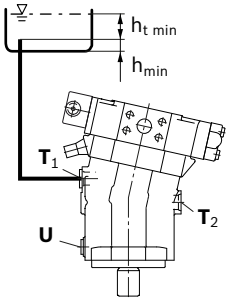
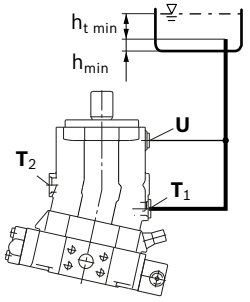
Key	
U	Bearing flushing / air bleed port
F	Filling / air bleeding
T_1, T_2	Drain port
$h_{t\,min}$	Minimum required immersion depth (7.87 inch (200 mm))
h_{min}	Minimum required distance to tank base (3.94 inch (100 mm))

Installation position

See examples **1** to **8** below.
Additional installation positions are available upon request.
Recommended installation position: **1** and **2**

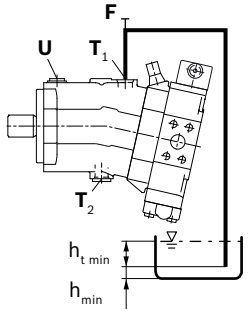
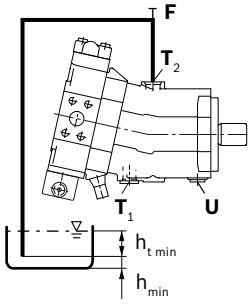
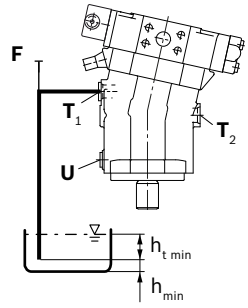
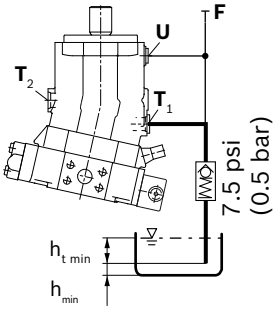
Below-reservoir installation (standard)

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

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

Installation position	Air bleed	Filling
5 	**U** (**F**)	**T1** (**F**)
6 	**F**	**T2** (**F**)
7 	**F**	**T1** (**F**)
8 	**U**	**T1** (**F**)

Note

Port **F** is not part of the motor and can be provided by the customer 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 person.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The data and notes contained herein must be adhered to.
- For safety reasons, control systems 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 condition of the axial piston unit (operating pressure, fluid temperature), the characteristic 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 times apply under optimal storage conditions, details of these conditions can be found in the data sheet 90312 or the instruction manual.
- Not all variants of the product are approved for use in safety functions 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 the recommended 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 proportional electrohydraulic coil with a Pulse Width Modulated (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.
- Please note the details regarding the tightening torques of port threads and other threaded joints
- Working ports
  - The ports and fixing threads are designed for the specified peak pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, volume flow, hydraulic fluid, temperature) with the required safety factors.
  - The service and function ports are only designed to accommodate hydraulic lines

Safety instructions

- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g., by wearing protective clothing).
- Moving parts in control equipment (e.g. valve pistons) can, under certain circumstances get blocked in position as a result of contamination (e.g. impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the flow of hydraulic fluid and the build-up of momentum in the axial piston unit can no longer meet the operator's specifications. Even the use of various filter elements (external or internal flow filtering) cannot rule out errors, but can only help minimize risks. The machine/system manufacturer must check whether additional measures are required on the machine for the relevant application in order to bring the powered load into a safe position (e.g. safe stop) and ensure any measures are properly put into practice.
- In certain conditions, moving parts in high pressure relief valves might get stuck in an undefined position due to contamination. This can result in restriction or loss of load holding functions in lifting winches. Therefore it is the machine and/or system manufacturers 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.