

Bosch Rexroth

A6VM115HA1000004A/71MWV0P4Z92FV-S axial piston variable motor

Manufacturer: Bosch Rexroth

Manufacturer part number / published order designation: R902239831

Published model: A6VM115HA1000004A/71MWV0P4Z92FV-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: applicable family/component reference. Exact execution documentation remains incomplete. Do not treat standard component or stage drawings as approval of the complete custom assembly.

Execution notes and conditions

Binding exact execution installation drawing and supplied presets

Pressure-duty limits apply at full swivel:100% swivel angle and geometric maximum displacement, with the stated mineral-oil duty periods.

Binding execution drawing and supplied displacement/control stop settings not published in the SPC identity record.

Selected size drawings show standard base-motor alternatives; they do not certify every suffix-specific assembly.

The series photograph is representative; exact control, shaft and port execution may differ.

Special/custom execution suffix is retained literally; no undocumented physical option is inferred.

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 Series 65 71 Re91610 2025

Original pages	Compiled pages	Relevant content
1-12	3-14	Manufacturer series overview and edition; Published control, override and solenoid connector type key; Published displacement-setting, thread, rotation and seal type key; Published flange, shaft and working-port type key; Published mounted-valve and sensor options; Hydraulic fluid and viscosity requirements; Fluid temperature, cleanliness and sealing conditions; Qualified working and case-pressure limits and duty periods; Inlet-pressure and shaft-seal pressure curves and their conditions; Exact nominal-size column: geometric displacement, speed, flow and torque; Displacement versus speed envelope and permissible radial loading; Radial and axial loading limits for the standard motor
24-25	15-16	HA1 control function, circuit and qualified conditions; other control panels on the original page do not establish this execution
52-53	17-18	Nominal size 115: shaft and working-port arrangement drawings; special suffix geometry is not independently established; Nominal size 115: shaft/port dimensions and standards table; special suffix geometry is not independently established
55	19	Nominal size 115: HA1 control-envelope panel only; special suffix geometry is not independently established
82-83	20-21	Mounted flushing valve purpose, conditions and exact size/flow-code column; Flushing valve circuit and small-valve drawing for sizes 28-115

Original pages	Compiled pages	Relevant content
98	22	Series 71 setting-screw ranges; only the exact size 60-150 column applies, not an actual supplied preset
100-104	23-27	Filling and case-drain installation instructions; Case-drain installation position conditions; Project planning and load/application restrictions; Safety instructions

Axial piston variable motor A6VM series 65 and 71



Features

- ▶ Robust motor with long service life
- ▶ Approved for very high rotational speeds
- ▶ High starting efficiency
- ▶ For series 71, especially good slow-running behavior
- ▶ High control range (can be swiveled to zero)
- ▶ High torque
- ▶ Large variety of controls
- ▶ Optionally with mounted flushing and boost-pressure valve
- ▶ Optionally with mounted counterbalance valve
- ▶ Bent-axis design

- ▶ Series 65, size 28 to 200
 - Nominal pressure 400 bar
 - Maximum pressure 450 bar (size 28)
 - Maximum pressure 530 bar (size 55 to 200)
- ▶ Series 71, size 60 to 280
 - Nominal pressure 450 bar
 - Maximum pressure 530 bar (size 60 to 215)
 - Maximum pressure 500 bar (size 280)
- ▶ Open and closed circuit

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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		/			W	V	0						-

Axial piston unit

01	Bent-axis design, variable displacement	A6V
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Operating mode

02	Motor	M
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Size (NG)

03	Geometric displacement, see technical data on page 10	028	055	060	080	085	107	115	140	150	160	170	200	215	280
----	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Control device

		028 055 060 080 085 107 115 140 150 160 170 200 215 280																
04	Proportional control, hydraulic	positive control	$\Delta p_{St} = 10 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HP1
			$\Delta p_{St} = 25 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HP2
		negative control	$\Delta p_{St} = 10 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HP5
			$\Delta p_{St} = 25 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HP6
	Proportional control, electric	positive control	$U = 12 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP1
			$U = 24 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP2
		negative control	$U = 12 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP5
			$U = 24 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP6
	Two-point control, hydraulic	negative control		●	-	-	-	-	-	-	●	●	●	●	●	●	●	HZ5
				-	●	●	●	●	●	●	-	-	-	-	-	-	-	HZ7
	Two-point control, electric	negative control	$U = 12 \text{ V}$	●	-	-	-	-	-	-	●	●	●	●	●	●	●	EZ5
			$U = 24 \text{ V}$	●	-	-	-	-	-	-	●	●	●	●	●	●	●	EZ6
			$U = 12 \text{ V}$	-	●	●	●	●	●	●	-	-	-	-	-	-	-	EZ7
			$U = 24 \text{ V}$	-	●	●	●	●	●	●	-	-	-	-	-	-	-	EZ8
	Automatic high-pressure related control, positive control	With minimum pressure increase	$\Delta p \leq \text{approx. } 10 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HA1
		with pressure increase	$\Delta p = 100 \text{ bar}$	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HA2
	Automatic speed-related control, negative control	hydr. travel direction valve		●	●	●	●	●	●	●	●	●	●	●	●	●	-	DA0
		electr. travel direction valve + electr. $V_{g \text{ max}}$ override	$U = 12 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	DA1
			$U = 24 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	DA2
		$p_{St}/p_{HD} = 5/100$		●	●	●	●	●	●	●	●	●	●	●	●	●	-	DA2
		$p_{St}/p_{HD} = 3/100$	hydr. travel direction valve	-	-	-	-	-	-	-	-	-	-	-	-	-	●	DA7

Pressure control/override

		028 055 060 080 085 107 115 140 150 160 170 200 215 280																
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 controlled, proportional		●	●	●	●	●	●	●	●	●	●	●	●	●	●	T3
				●	●	●	●	●	●	●	●	●	●	●	●	●	●	T3
		electric, two-point	$U = 12 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	U1
			$U = 24 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	U2
		electric and travel direction valve, electric	$U = 12 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	R1
			$U = 24 \text{ V}$	●	●	●	●	●	●	●	●	●	●	●	●	●	-	R2

Connector for solenoids¹⁾

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

● = Available ○ = On request - = Not available

1) Connectors for other electric components may deviate.

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

Swivel angle sensor			028	055	060	080	085	107	115	140	150	160	170	200	215	280
07	Without swivel angle sensor		●	●	●	●	●	●	●	●	●	●	●	●	●	0
	Neutral position switch		-	-	-	●	●	●	●	●	●	●	●	●	-	N

Additional function		
08	Without additional function	0

Stroking 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 BVD/BVE counterbalance valves		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⁾						028 055 060 080 085 107 115 140 150 160 170 200 215 280																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
10	$V_{g \max}$ setting screw			$V_{g \min}$ setting screw																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	Without setting screw ³⁾	short (0-adjustable)			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Series		028	055	060	080	085	107	115	140	150	160	170	200	215	280
11	Series 6, index 5 (nominal pressure 400 bar)	●	●	-	●	-	●	-	●	-	●	-	●	-	65
	Series 7, index 1 (nominal pressure 450 bar)	-	-	●	-	●	-	●	-	●	-	●	-	●	71

Version of port and fastening threads		028	055	060	080	085	107	115	140	150	160	170	200	215	280
12	Metric ports based on ISO 6149 with O-ring seal, metric fastening thread according to DIN 13	-	●	●	●	●	●	●	●	●	●	●	●	●	M
	Metric ports threads with profile sealing ring based on DIN 3852, metric fastening thread according to DIN 13	●	-	-	-	-	-	-	-	-	-	-	-	-	N

Direction of rotation		
13	Viewed on drive shaft, bi-directional	W

Sealing material			
14	FKM (fluorocarbon rubber)		V

● = Available ○ = On request - = Not available

²⁾ Please refer to the tables for the setting values associated with the setting screws (from page 96).

³⁾ For size 28 with short threaded pin, not adjustable

⁴⁾ $V_{g \max}$ not adjustable for size 280, limitation due to cap

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21			
A6V	M						0			/			W	V	0					-			
Drive shaft bearing																							
15	Standard bearing																				0		
Mounting flange											028 055 060 080 085 107 115 140 150 160 170 200 215 280												
16	ISO 3019-2				100-4				●	-	-	-	-	-	-	-	-	-	-	-	L4		
					125-4				-	●	●	-	-	-	-	-	-	-	-	-	-	M4	
					140-4				-	-	-	●	●	-	-	-	-	-	-	-	-	-	N4
					160-4				-	-	-	-	-	●	●	-	-	-	-	-	-	-	P4
					180-4				-	-	-	-	-	-	-	●	●	●	●	-	-	-	R4
					200-4				-	-	-	-	-	-	-	-	-	-	-	-	●	●	●
Drive shaft											028 055 060 080 085 107 115 140 150 160 170 200 215 280												
17	Splined shaft ANSI B92.1a-1976				1 1/4 in 14T 12/24DP				-	●	●	●	○	-	-	-	-	-	-	-	S7		
					1 1/2 in 17T 12/24DP				-	-	○	○	●	-	-	-	-	-	-	-	-	S9	
					1 3/4 in 13T 8/16DP				-	-	-	-	-	●	●	●	●	○	-	-	-	T1	
					2 in 15T 8/16DP				-	-	-	-	-	-	-	-	●	●	●	●	-	T2	
					2 1/4 in 17T 8/16DP				-	-	-	-	-	-	-	-	-	-	-	-	●	T3	
	Splined shaft DIN 5480				W25×1.25×18×9g				●	-	-	-	-	-	-	-	-	-	-	-	Z5		
					W30×2×14×9g				●	●	○	-	-	-	-	-	-	-	-	-	-	Z6	
					W35×2×16×9g				-	●	●	●	○	-	-	-	-	-	-	-	-	Z8	
					W40×2×18×9g				-	-	-	●	●	●	●	-	-	-	-	-	-	Z9	
					W45×2×21×9g				-	-	-	-	-	●	●	●	●	●	●	-	-	A1	
					W50×2×24×9g				-	-	-	-	-	-	-	-	-	●	●	●	●	○	A2
					W60×2×28×9g				-	-	-	-	-	-	-	-	-	-	-	-	-	●	A4
Working port											028 055 060 080 085 107 115 140 150 160 170 200 215 280												
18	SAE working port A and B at rear				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	1			
	SAE working ports A and B lateral, opposite				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	2			
	SAE working port A and B at rear, with lateral measuring ports				-	-	-	●	●	●	●	●	●	●	●	●	●	-	4				
	SAE working port A and B at bottom, with integrated counterbalance valve ⁵⁾				-	-	-	-	-	○	○	●	●	●	●	-	-	-	6				
	Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (pilot operated) ⁶⁾				BVD20				-	●	●	●	●	●	●	-	-	-	-	7			
					BVD25				-	-	-	-	-	●	●	●	●	●	-	-	-	8	
					BVE25				-	-	-	-	-	●	●	-	-	-	-	-	-	8	
Port plate for mounting a counterbalance valve, with 1-stage pressure relief valve (direct operated) ⁶⁾				BVD25				-	-	-	-	-	-	-	-	-	●	●	○	5			
				BVE25				-	-	-	-	-	-	-	-	-	●	●	●	●	○	5	
				BVD/BVE32				-	-	-	-	-	-	-	-	-	-	-	-	●	●	● ⁷⁾	9

● = Available ○ = On request - = Not available

● = Available

○ = On request

- = Not available

5) Only in combination with HZ5, EZ5, EZ6, HP or EP with respective negative control
 6) Only possible in combination with HP, EP and HA control.

7) A port plate for mounting the MHB32 counterbalance valve with a 1-stage pressure relief valve (pilot operated) is available as a special version for applications without boost pressure supply.

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

Valve			028 055 060 080 085 107 115 140 150 160 170 200 215 280															
19	Without valve		●	●	●	●	●	●	●	●	●	●	●	●	●	●	0	
	With integrated brake release valve (only with port plate 6)		–	–	–	–	–	○	○	●	●	●	●	–	–	–	Y	
	With BVD/BVE counterbalance valves mounted ⁸⁾		–	●	●	●	●	●	●	●	●	●	●	●	●	●	W	
	With flushing and boost-pressure valve mounted, flushing on both sides		Flushing flow q_v [l/min]															
	Flushing flow at:		3.5	●	●	●	●	●	●	●	–	–	–	–	–	–	A	
	$\Delta p = p_{ND} - p_G = 25 \text{ bar}$ and $v = 10 \text{ mm}^2/\text{s}$		5	●	●	●	●	●	●	●	–	–	–	–	–	–	B	
	$(p_{ND} = \text{low pressure, } p_G = \text{case pressure})$		8	●	●	●	●	●	●	●	●	●	●	●	●	–	C	
	Only possible with port plates 1, 2 and 4		10	●	●	●	●	●	●	●	●	●	●	●	●	–	D	
			14	–	●	●	●	●	●	●	–	–	–	–	–	–	F	
			15	–	–	–	–	–	–	●	●	●	●	●	●	–	G	
			16	–	●	●	●	●	● ⁹⁾	● ¹⁰⁾	–	–	–	–	–	–	H	
			18	–	–	–	–	–	● ⁹⁾	● ¹⁰⁾	●	●	●	●	●	–	I	
			21	–	–	–	–	–	● ⁹⁾	● ¹⁰⁾	●	●	●	●	●	–	J	
			27	–	–	–	–	–	● ⁹⁾	● ¹⁰⁾	●	●	●	●	●	–	K	
			31	–	–	–	–	–	● ⁹⁾	● ¹⁰⁾	●	●	●	●	●	–	L	
			37	–	–	–	–	–	–	–	●	●	●	●	●	–	M	
adjustable		0 ... 60	–	–	–	–	–	–	–	–	–	–	–	–	●	V		

Speed sensor				028	055	060	080	085	107	115	140	150	160	170	200	215	280	
20	Without speed sensor			●	●	●	●	●	●	●	●	●	●	●	●	●	●	0
	Prepared for sensor DSA/20 and DST			●	●	●	●	●	●	●	●	●	●	●	●	●	●	W
	Speed sensor DSA/20 mounted ¹¹⁾			●	●	●	●	●	●	●	●	●	●	●	●	●	●	C
	Speed sensor DST mounted ¹²⁾			●	●	●	●	●	●	●	●	●	●	●	●	●	—	E

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

● = Available ○ = On request - = Not available

Notice

- Please observe the project planning notes on 103!
- 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.

⁸⁾ Type code of counterbalance valve according to data sheet 95522 (BVD20, BVD25), 95526 (BVE25), 95528 (BVE/BVD32), specify separately.

⁹⁾ Not for EZ3, 4, 7, 8 and HZ3, 7.

¹⁰⁾ Not for EZ7, EZ8 and HZ7.

¹¹⁾ Specify type code of the sensor acc. to data sheet 95126 (DSA/20) separately and observe the requirements for the electronics.

¹²⁾ Specify type code of the sensor acc. to data sheet 95131 (DST) separately and observe the requirements for the electronics.

Hydraulic fluid

The axial piston unit is designed for operation with HLP mineral oil according to DIN 51524.

Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

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

Selection of hydraulic fluid

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.

Hydraulic fluids with positive evaluation in the Fluid Rating are listed in the following data sheet:

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

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

Notice

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

Viscosity and temperature of hydraulic fluids

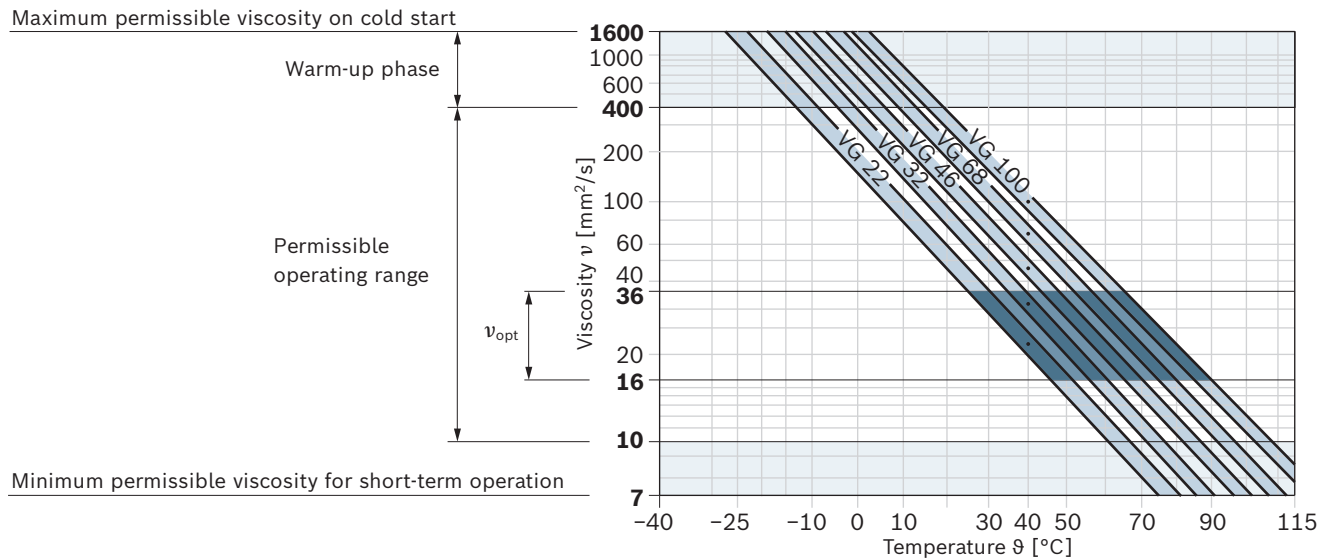
	Viscosity	Shaft seal	Temperature ³⁾	Comment
Cold start	$v_{max} \leq 1600 \text{ mm}^2/\text{s}$	NBR ²⁾	$\vartheta_{St} \geq -40^\circ\text{C}$	$t \leq 3 \text{ min}$, without load ($p \leq 50 \text{ bar}$), $n \leq 1000 \text{ rpm}$ Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
		FKM	$\vartheta_{St} \geq -25^\circ\text{C}$	
Warm-up phase	$v = 1600 \dots 400 \text{ mm}^2/\text{s}$			$t \leq 15 \text{ min}$, $p \leq 0.7 \times p_{nom}$ and $n \leq 0.5 \times n_{nom}$
Permissible operating range	$v = 400 \dots 10 \text{ mm}^2/\text{s}^{1)}$	NBR ²⁾	$\vartheta \leq +78^\circ\text{C}$	Measured at port T
		FKM	$\vartheta \leq +103^\circ\text{C}$	
	$v_{opt} = 36 \dots 16 \text{ mm}^2/\text{s}$			Optimal operating viscosity and efficiency range
Short-term operation	$v_{min} = 10 \dots 7 \text{ mm}^2/\text{s}$	NBR ²⁾	$\vartheta \leq +78^\circ\text{C}$	$t \leq 3 \text{ min}$, $p \leq 0.3 \times p_{nom}$, measured at port T
		FKM	$\vartheta \leq +103^\circ\text{C}$	

Notice:

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

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

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

For example, a viscosity of 10 mm²/s is achieved with the following hydraulic fluid and temperature:

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

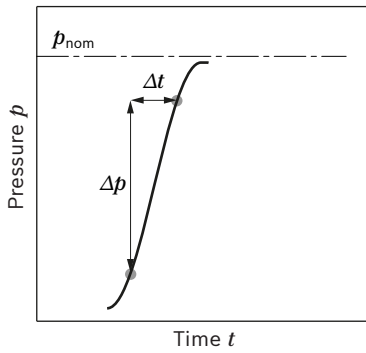
Flow direction

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

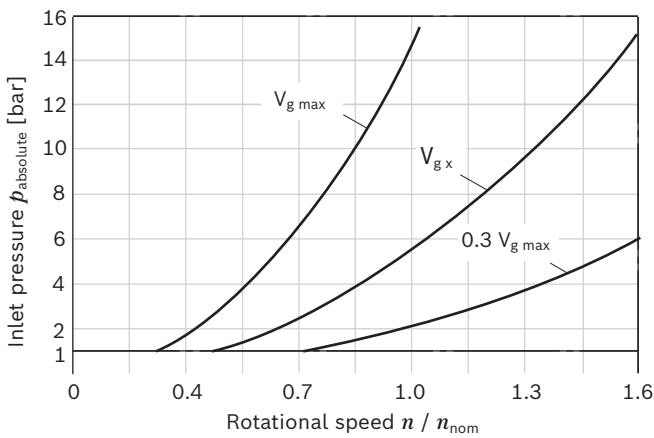
Working pressure range

Pressure at working port A or B				Definition
Nominal pressure p_{nom}	Series 65		400 bar	The nominal pressure corresponds to the maximum design pressure.
	Series 71		450 bar	
Maximum pressure p_{max}	Series 65	NG 28 to 200	450 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period. Within the total operating period of 300 h, a maximum pressure of 450 bar to 530 bar for series 65 (size 55 to 200) or 500 bar to 530 bar for series 71 (size 60 to 215) is permissible for a limited period of 50 h.
	Series 71	NG 60 to 280	500 bar	
	Maximum single operating period		10 s	
	Total operating period		300 h	
	Swivel angle		100%	
Maximum pressure p_{max}	Series 65	NG 55 to 200	530 bar	
	Series 71	NG 60 to 215	530 bar	
	Maximum single operating period		10 s	
	Total operating period		50 h	
Minimum pressure (high-pressure side)			25 bar	Minimum pressure on the high-pressure side (A or B) required to prevent damage to the axial piston unit.
Minimum pressure – operation as a pump (inlet)			see diagram (next page)	To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{Su} (pressure A + pressure B)			700 bar	The summation pressure is the sum of the pressures at the ports for the working lines (A and B)
Rate of pressure change $R_{\text{A max}}$				Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
With integrated pressure relief valve			9000 bar/s	
Without pressure relief valve			16000 bar/s	
Case pressure at port T				
Continuous differential pressure $\Delta p_{\text{T cont}}$			2 bar	Maximum, averaged differential pressure at the shaft seal (housing to ambient pressure)
Maximum differential pressure $\Delta p_{\text{T max}}$			see diagram (next page)	Permissible differential pressure at the shaft seal (case pressure to ambient pressure)
Pressure peaks $p_{\text{T peak}}$			10 bar	$t < 0.1 \text{ s}$

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



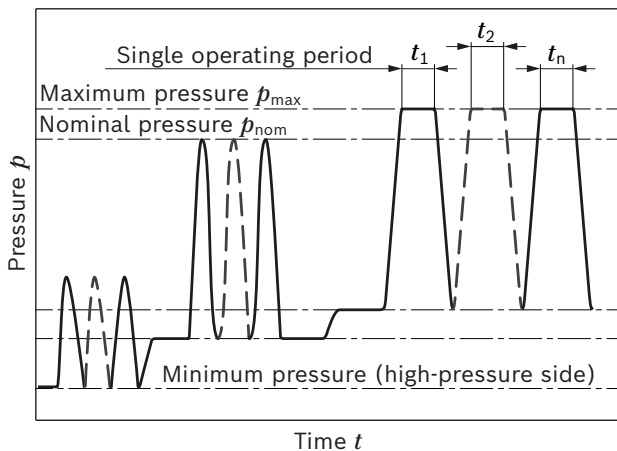
▼ **Minimum pressure – operation as a pump (inlet)**



This diagram is valid only for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to $16 \text{ mm}^2/\text{s}$.

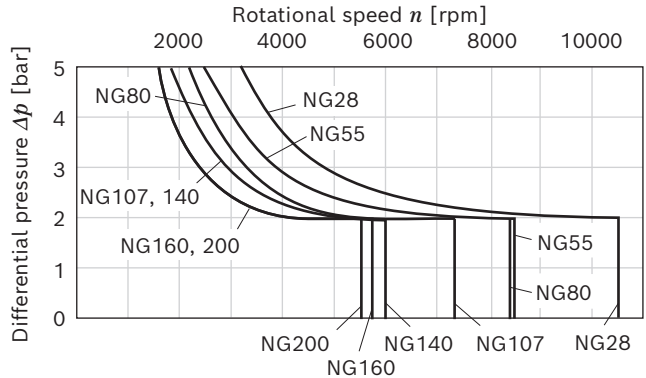
If the above-mentioned conditions cannot be ensured, please contact us.

▼ **Pressure definition**

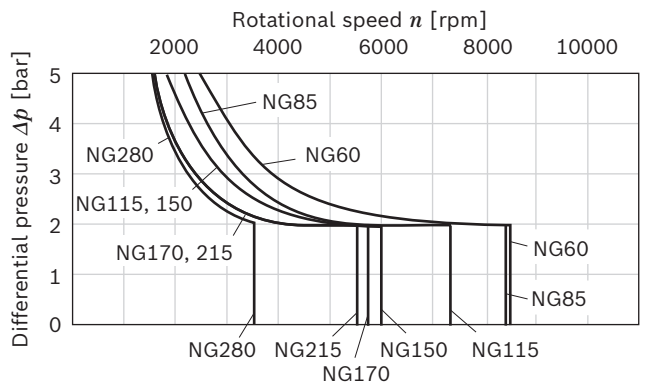


Total operating period = $t_1 + t_2 + \dots + t_n$

▼ **Maximum differential pressure at the shaft seal ring, series 65**



▼ **Maximum differential pressure at the shaft seal ring, series 71**



Notice

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

Effect of case pressure on beginning of control

An increase in case pressure affects the beginning of control of the variable motor when using the following control options:

HP, HA.T3: increase

DA: reduction

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 settings for the beginning of control are made at

$p_{\text{absolute}} = 2 \text{ bar}$ case pressure (size 28 to 215) or

$p_{\text{absolute}} = 1 \text{ bar}$ case pressure (size 280).

Technical data

Series 65

Size		NG		28	55	80	107	140	160	200
Displacement geometric, per revolution		$V_{g \max}$	cm ³	28.1	54.8	80.3	106.7	140.2	160.2	200
		$V_{g \min}$	cm ³	0	0	0	0	0	0	0
		$V_{g \times}$	cm ³	18	35	51	68	88	61	76
Maximum rotational speed ¹⁾ (complying with the maximum permissible inlet flow)	at $V_{g \max}$	n_{nom}	rpm	5550	4450	3900	3550	3250	3100	2900
	at $V_g < V_{g \times}$ (see diagram)	n_{max}	rpm	8750	7000	6150	5600	5150	4900	4600
	at $V_{g 0}$	n_{max}	rpm	10450	8350	7350	6300	5750	5500	5100
Inlet flow ²⁾	at n_{nom} and $V_{g \max}$	$q_{v \max}$	l/min	156	244	312	380	455	496	580
Torque ³⁾	at $V_{g \max}$ and $\Delta p = 400$ bar	M	Nm	179	349	509	681	891	1019	1273
Rotary stiffness	$V_{g \max}$ to $V_g/2$	$c_{\min}$	kNm/rad	6	10	16	21	34	35	44
	$V_g/2$ to 0 (interpolated)	$c_{\min}$	kNm/rad	18	32	48	65	93	105	130
Moment of inertia of the rotary group		J_{TW}	kgm ²	0.0014	0.0042	0.008	0.0127	0.0207	0.0253	0.0353
Case volume		V	l	0.5	0.75	1.2	1.5	1.8	2.4	2.7
Weight approx.		m	kg	16	28	36	46	61	62	78

Series 71

Size		NG		60	85	115	150	170	215	280
Displacement geometric, per revolution		$V_{g \max}$	cm ³	62.0	85.2	115.6	152.1	171.8	216.5	280.1
		$V_{g \min}$	cm ³	0	0	0	0	0	0	0
		$V_{g \times}$	cm ³	37	51	69	91	65	130	118
Maximum rotational speed ¹⁾ (complying with the maximum permissible inlet flow)	at $V_{g \max}$	n_{nom}	rpm	4450	3900	3550	3250	3100	2900	2500
	at $V_g < V_{g \times}$ (see diagram)	n_{max}	rpm	7200	6800	6150	5600	4900	4800	3550
	at $V_{g 0}$	n_{max}	rpm	8400	8350	7350	6000	5750	5500	3550
Inlet flow ²⁾	at n_{nom} and $V_{g \max}$	$q_{v \max}$	l/min	275	332	410	494	533	628	700
Torque ³⁾	at $V_{g \max}$ and $\Delta p = 450$ bar	M	Nm	444	610	828	1089	1230	1550	2006
Rotary stiffness	$V_{g \max}$ to $V_g/2$	$c_{\min}$	kNm/rad	15	22	37	44	52	70	72
	$V_g/2$ to 0 (interpolated)	$c_{\min}$	kNm/rad	45	68	104	124	156	196	209
Moment of inertia of the rotary group		J_{TW}	kgm ²	0.0043	0.0072	0.0110	0.0181	0.0213	0.0303	0.0479
Case volume		V	l	0.8	1.0	1.5	1.7	2.3	2.8	3.4
Weight approx.		m	kg	28	36	46	61	62	78	101

Speed range

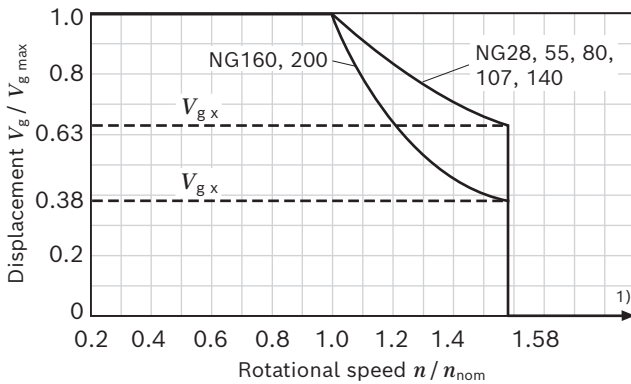
The minimum rotational speed $n_{\min}$ is not limited.
For applications with requirements on the evenness of the rotation at low rotational speeds, please contact us.

- 1) The values are applicable:
- for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to $16 \text{ mm}^2/\text{s}$
 - with hydraulic fluid based on mineral oils
- 2) Note inlet flow limitation due to counterbalance valve (page 86).
- 3) Torque without radial force, with radial force see page 12.

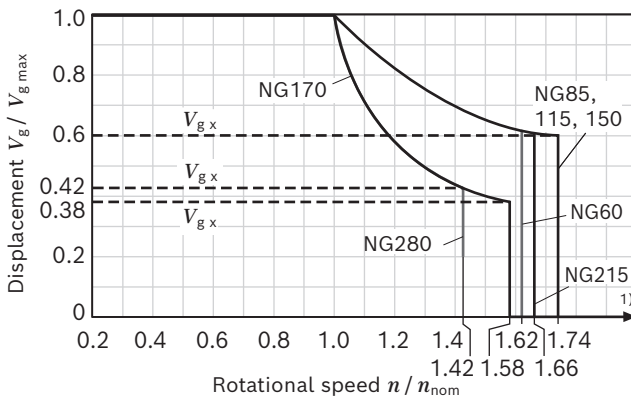
Notice

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

Permissible displacement in relation to rotational speed Series 65



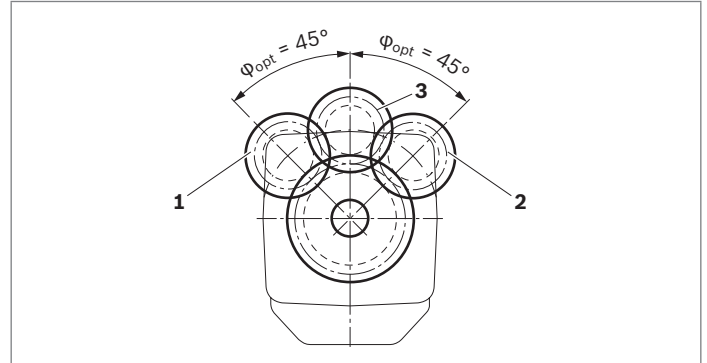
Permissible displacement in relation to rotational speed Series 71



Effect of the radial force F_q on the bearing service life

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

▼ Gear output drive



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

Notice

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

Determination of the characteristics

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

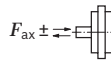
Key

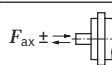
V_g	Displacement per revolution [cm ³]
Δp	Differential pressure [bar]
n	Rotational speed [rpm]
η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

1) Values in this range on request

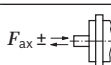
Permissible radial and axial loading on the drive shafts

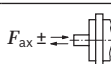
Series 65

Size	NG		55	80	107	140	160	200			
Drive shaft	Ø	in	1 1/4	1 1/4	1 3/4	1 3/4	1 3/4	2			
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	7811	7559	12256	16036	14488	20047		
		a	mm	24.0	24.0	33.5	33.5	33.5	33.5		
Maximum torque at $F_{q \max}$		$M_{q \max}$	Nm	310	300	681	891	920	1273		
Maximum differential pressure at $V_{g \max}$ and $F_{q \max}$		$\Delta p_{q \max}$	bar	315	236	400	400	361	400		
Maximum axial force at stand-still or depressurized operation 		$+ F_{ax \max}$	N	0	0	0	0	0	0		
		$- F_{ax \max}$	N	500	710	900	1030	1120	1250		
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm/bar}}$	N/bar	7.5	9.6	11.3	13.3	15.1	17.0		

Size		NG		28	28	55	55	80	80	107	107	140	160	160	200
Drive shaft		Ø	mm	W25	W30	W30	W35	W35	W40	W40	W45	W45	W45	W50	W50
Maximum radial force at distance a (from shaft collar)		Fq max	N	6436	4838	7581	8069	10867	10283	13758	12215	15982	18278	16435	20532
		a	mm	14.0	17.5	17.5	20.0	20.0	22.5	22.5	25.0	25.0	25.0	27.5	27.5
Maximum torque at Fq max		Mq max	Nm	179	179	281	349	470	509	681	681	891	1019	1019	1273
Maximum differential pressure at Vgmax and Fq max		Δpq max	bar	400	400	322	400	369	400	400	400	400	400	400	400
Maximum axial force at stand-still or depressurized operation		+ Fax max	N	8	0	0	0	0	0	0	0	0	0	0	0
		− Fax max	N	315	315	500	500	710	710	900	900	1030	1120	1120	1250
Permissible axial force per bar working pressure		+ Fax perm/bar	N/bar	4.6	4.6	7.5	7.5	9.6	9.6	11.3	11.3	13.3	15.1	15.1	17.0

Series 71

Size	NG		60	85	115	150	150	170	215	280	
Drive shaft	Ø	in	1 1/4 in	1 1/2 in	1 3/4 in	1 3/4 in	2 in	2 in	2 in	2 1/4 in	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	7620	12463	14902	15948	17424	19370	22602	26821
		a	mm	24.0	27.0	33.5	33.5	33.5	33.5	33.5	40.0
Maximum torque at $F_{q \max}$		$M_{q \max}$	Nm	310	595	828	890	1089	1230	1445	1916
Maximum differential pressure at $V_{g \max}$ and $F_{q \max}$		$\Delta p_{q \max}$	bar	315	440	450	370	450	450	420	430
Maximum axial force at stand-still or depressurized operation 		$+ F_{ax \max}$	N	0	0	0	0	0	0	0	0
		$- F_{ax \max}$	N	500	710	900	1300	1300	1120	1250	1575
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm/bar}}$	N/bar	7.5	9.6	11.3	13.3	13.3	15.1	17.0	19.4

Size	NG		60	85	115	150	170	215	280	
Drive shaft	Ø	mm	W35	W40	W40	W45	W45	W50	W60	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	10266	12323	16727	19534	21220	25016	26913
		a	mm	20.0	22.5	22.5	25.0	25.0	27.5	35.0
Maximum torque at $F_{q \max}$		$M_{q \max}$	Nm	444	610	828	1089	1200	1550	2005
Maximum differential pressure at $V_{g \max}$ and $F_{q \max}$		$\Delta p_{q \max}$	bar	450	450	450	450	440	450	450
Maximum axial force at stand-still or depressurized operation 		$+ F_{ax \max}$	N	0	0	0	0	0	0	0
		$- F_{ax \max}$	N	500	710	900	1300	1120	1250	1575
Permissible axial force per bar working pressure		$+ F_{ax \text{ perm/bar}}$	N/bar	7.5	9.6	11.3	13.3	15.1	17.0	19.4

HA – Automatic control, high-pressure related

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

The displacement of the A6VM motor with HA control is $V_{g \min}$ (maximum rotational speed and minimum torque). The control device measures internally the working pressure at **A** or **B** (no control line required) and upon reaching the beginning of control, the controller swivels the motor with increasing working pressure from $V_{g \min}$ to $V_{g \max}$. The displacement is modulated between $V_{g \min}$ and $V_{g \max}$ depending on the load.

HA1, HA2 positive control

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

Notice

- ▶ For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g \min}$ (standard for HA).
- ▶ The control oil is internally taken out of the high-pressure passage of the motor (A or B). For reliable control, a working pressure of at least 30 bar is required in A (B). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us. Please note that at port **G** up to 450 bar (size 28), 530 bar (size 55 to 215) or 500 bar (size 280) can occur.
- ▶ The beginning of control and the HA.T3 characteristic curve are influenced by case pressure. An increase in case pressure causes an increase in the beginning of control (see page 9) and thus a parallel shift of the characteristic curve.
- ▶ A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir. **Only for HA.T control.**

Stroking time damping

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

Standard for size 28 to 280

HA1, HA2 with throttle pin on one side, throttle from $V_{g \min}$ to $V_{g \max}$ (see table)

▼ Throttle pin overview

NG	28	55	80	107	140	160	200	280
		60	85	115	150	170	215	
Groove size [mm]	0.30	0.45	0.45	0.55	0.55	0.55	0.65	2×1.0

Standard for size 55 to 215

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

▼ Throttle screw

NG		55	80	107	140	160	200
		60	85	115	150	170	215
Diameter	[mm]	0.80	0.80	0.80	0.80	0.80	0.80

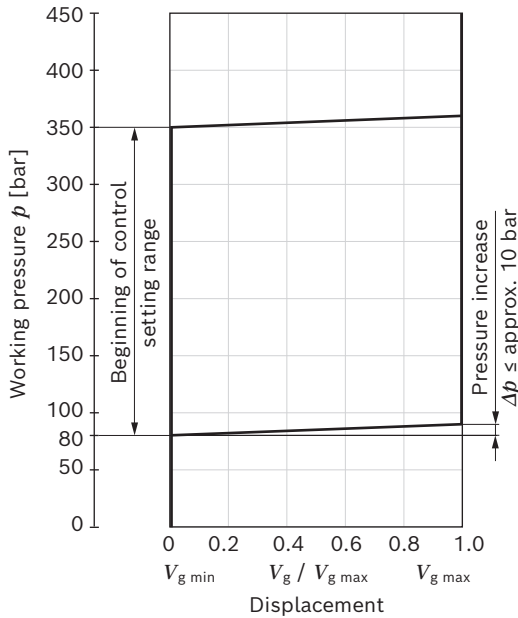
HA1 with minimum pressure increase, positive control

A working pressure increase of $\Delta p \leq$ approx. 10 bar results in an increase in displacement from $V_{g \min}$ to $V_{g \max}$.

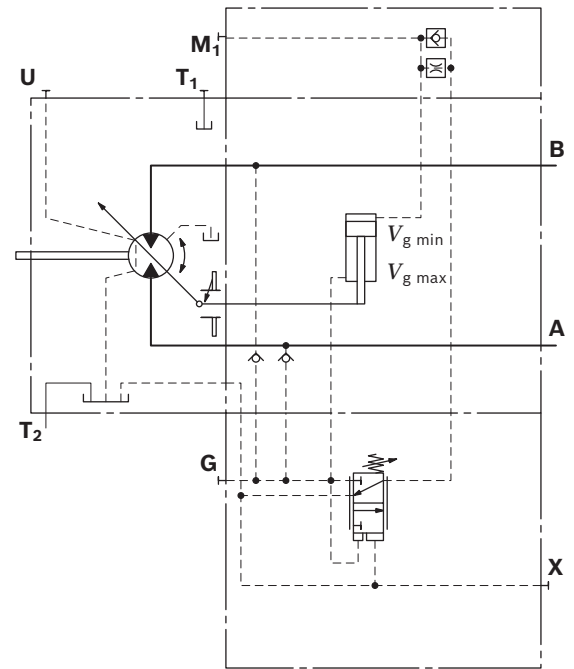
Beginning of control, setting range 80 to 350 bar

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

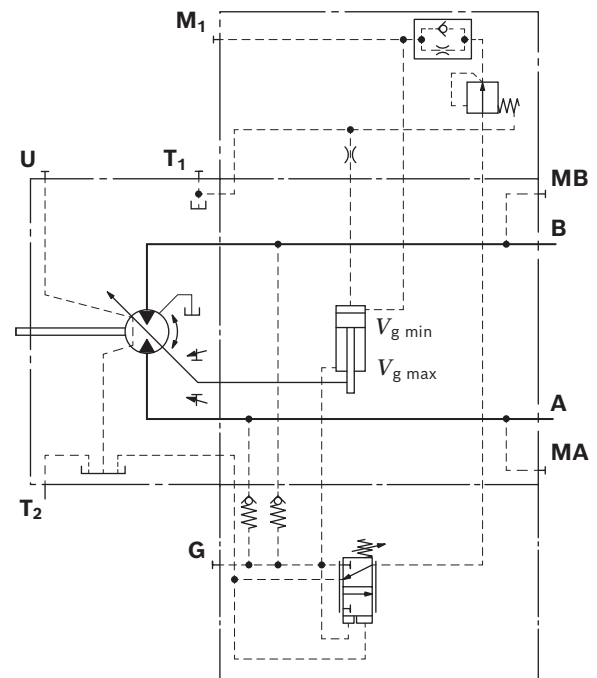
▼ Characteristic curve HA1



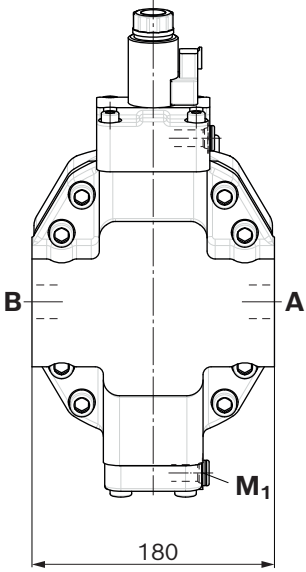
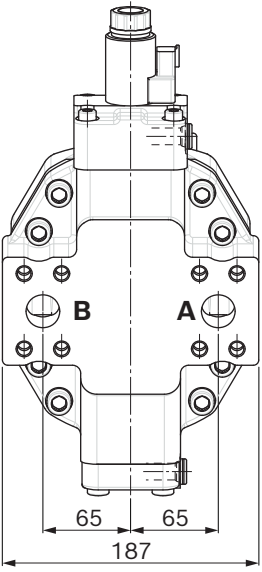
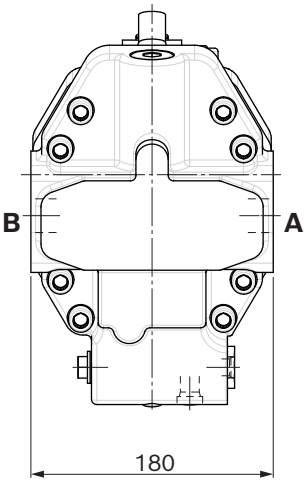
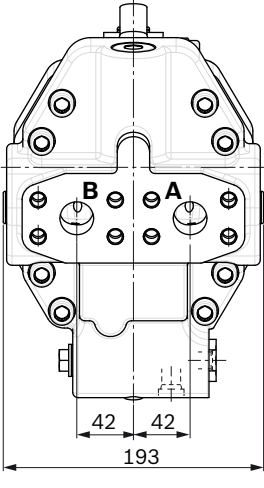
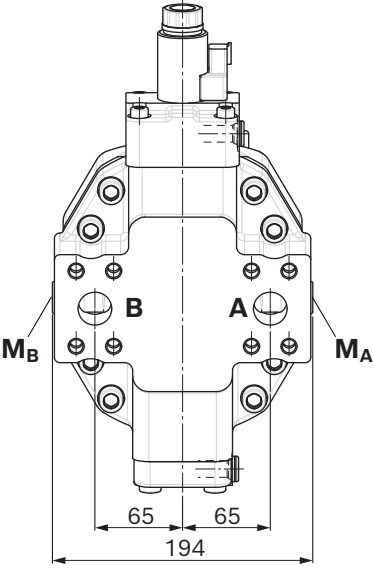
▼ Circuit diagram HA1 Size 28 to 215



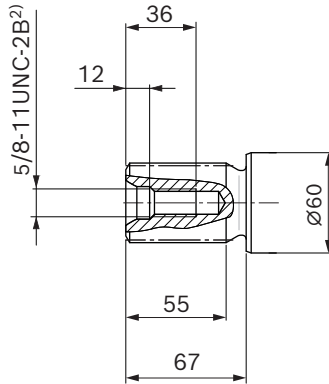
▼ Circuit diagram HA1 Size 280



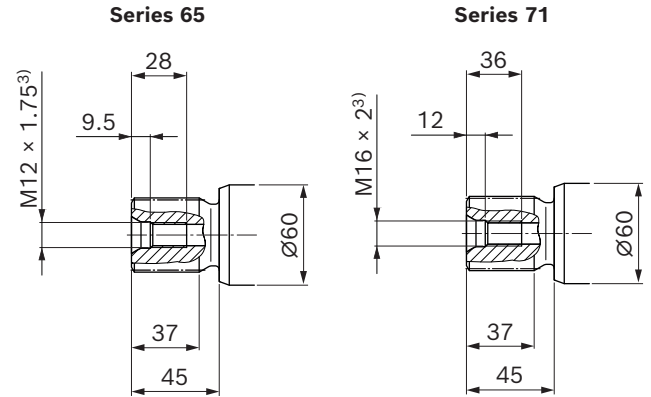
▼ **Location of working ports on the port plates** (View Z)

2 SAE working ports A and B lateral, opposite 	1 SAE working ports A and B at rear 	2 SAE working ports A and B lateral, opposite only HZ7, EZ7/8 	1 SAE working ports A and B at rear, only HZ7, EZ7/8 
4 SAE working ports A and B at rear, with lateral measuring ports 			

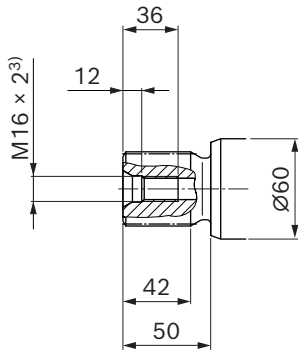
▼ Splined shaft SAE J744

T1 – 1 3/4 in 13T 8/16DP¹⁾

▼ Splined shaft DIN 5480

Z9 – W40×2×18×9g

▼ Splined shaft DIN 5480

A1 – W45×2×21×9g

Ports		Standard	Size	$p_{\max}$ [bar] ⁴⁾	State ⁸⁾
A, B	Working port Fastening thread A/B	SAE J518 ⁵⁾ DIN 13	1 in M12 × 1.75; 17 deep	530	O
T₁	Drain port	ISO 6149 ⁷⁾	M27 × 2; 19 deep	3	X ⁶⁾
T₂	Drain port	ISO 6149 ⁷⁾	M33 × 2; 19 deep	3	O ⁶⁾
G	Synchronous control	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	530	X
U	Bearing flushing port	ISO 6149 ⁷⁾	M18 × 1.5; 14.5 deep	3	X
X	Pilot pressure port (HP, HZ, HA1T/HA2T)	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	100	O
X	Pilot pressure port (HA1, HA2)	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	3	X
X₁, X₂	Pilot pressure port (DA0)	ISO 8434-1	SDSC-L8×M12-F	40	O
X₁	Pilot pressure port (DA1, DA2)	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	40	O
X₃	Pilot pressure port (DA0, DA1, DA2)	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	40	X
M₁	Measuring port, control pressure	ISO 6149 ⁷⁾	M14 × 1.5; 11.5 deep	530	X
M_A, M_B	Measuring port, pressure A, B	ISO 6149 ⁷⁾	M18 × 1.5; 14.5 deep	530	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to ASME B1.1

3) Center bore according to DIN 332 (thread according to DIN 13)

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

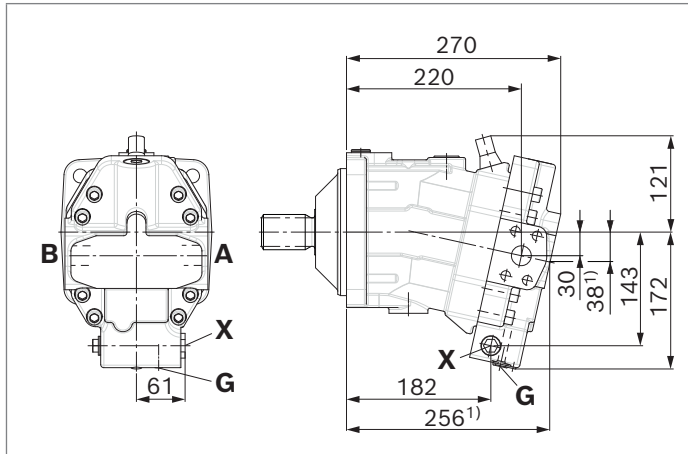
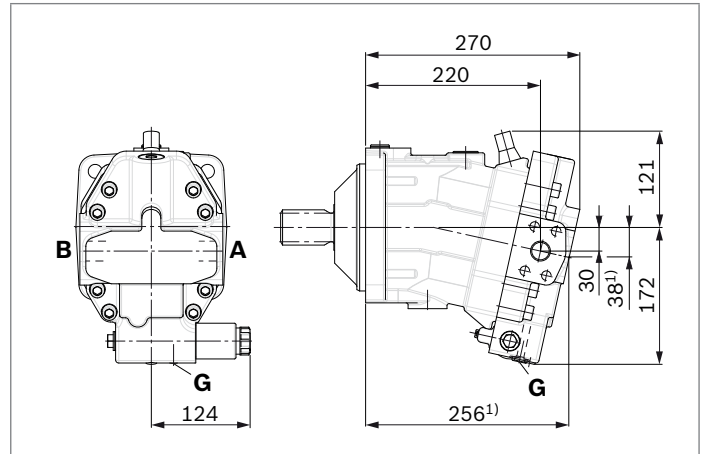
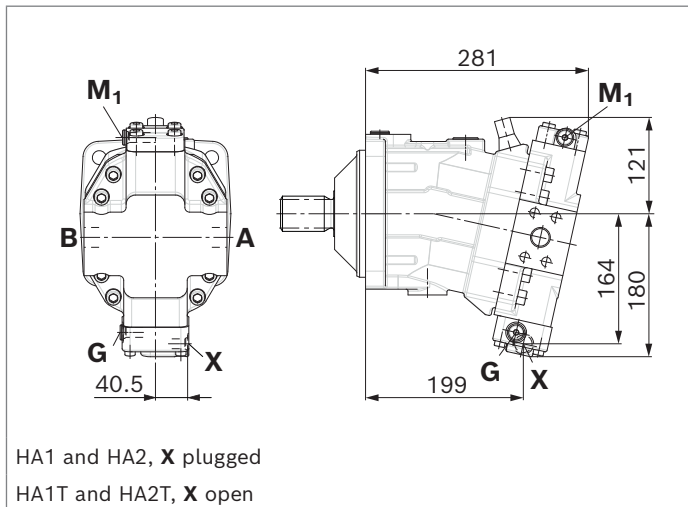
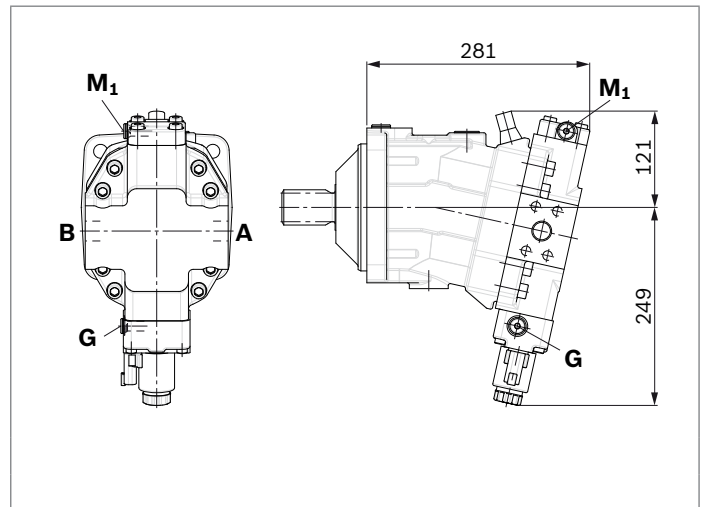
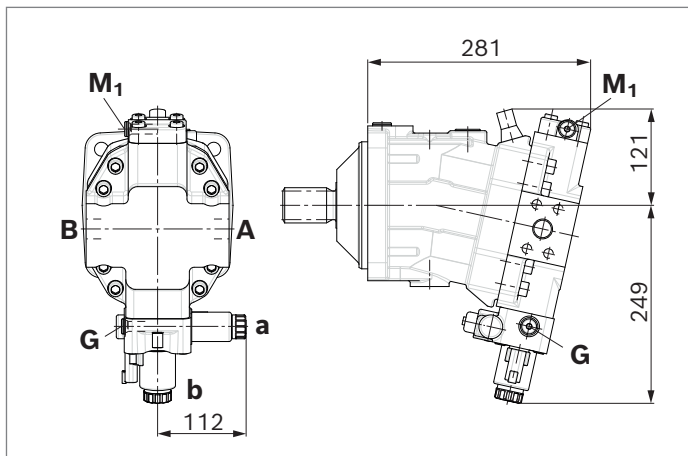
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard

6) Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 100).

7) The countersink may be deeper than specified in the standard.

8) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

▼ **HZ7** – Two-point control, hydraulic, negative control

▼ **EZ7, EZ8** – Two-point control, electric, negative control

▼ **HA1, HA2 / HA1T3, HA2T3** – Automatic high-pressure related control, positive control, with hydraulic override, remote controlled, proportional

▼ **HA1U1, HA2U2** – Automatic high-pressure related control, positive control, with electric override, two-point

▼ **HA1R1, HA2R2** – Automatic high-pressure related control, positive control, with electric override and electric travel direction valve

¹⁾ Port plate 1 – SAE working ports **A** and **B** at rear

Flushing and boost-pressure valve

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

In a closed circuit, it is used for flushing the housing and safeguarding the minimum boost pressure.

Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.

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

Cracking pressure of pressure retention valve

(observe when setting the primary valve)

- ▶ Size 28 to 215, fixed setting 16 bar
- ▶ Size 280, adjustable 15 to 35 bar

Switching pressure, flushing spool Δp

- ▶ Size 28 to 115 (small flushing valve) 8 ± 1 bar
- ▶ Size 107 to 215 (medium and large flushing valve) 17.5 ± 1.5 bar
- ▶ Size 280 8 ± 1 bar

Flushing flow q_v

Orifices can be used to adjust the flushing flows as required. The following parameters are based on:

$$\Delta p_{ND} = p_{ND} - p_G = 25 \text{ bar and } v = 10 \text{ mm}^2/\text{s}$$

(p_{ND} = low pressure, p_G = case pressure)

Small flushing valve

Size 28 to 115

Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290106	1.2	3.5	A
R902290107	1.4	5	B
R902290109	1.8	8	C
R902290110	2.0	10	D
R902290112	2.4	14	F ¹⁾
R902290113	3.0	16	H ¹⁾

Medium flushing valve

Size 107 and 115

Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290123	2.8	18	I
R902290124	3.1	21	J
R902290125	3.5	27	K
R902290127	5.0	31	L

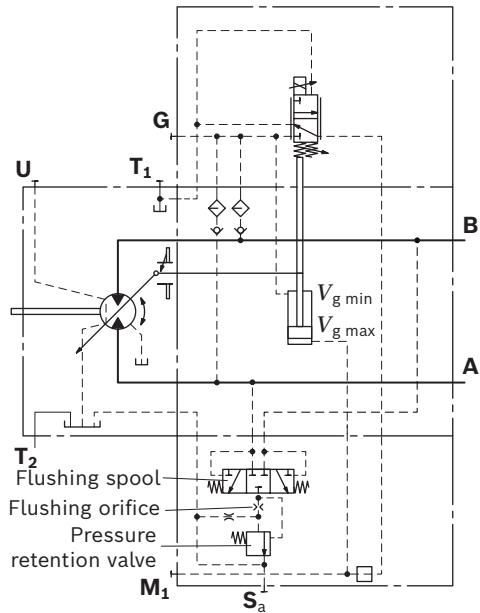
Large flushing valve

Size 140 to 215

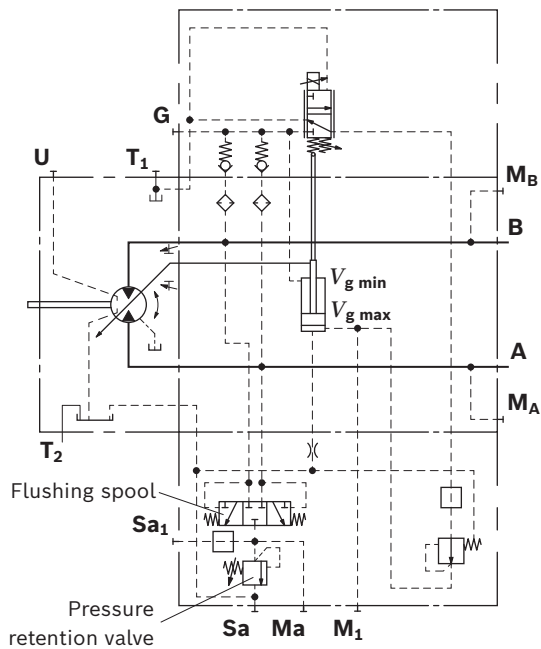
Material number of orifice	Ø [mm]	q_v [l/min]	Code
R902290118	1.8	8	C
R902290119	2.0	10	D
R902290121	2.5	15	G
R902290123	2.8	18	I
R902290124	3.1	21	J
R902290125	3.5	27	K
R902290126	4.0	31	L
R902290127	5.0	37	M

1) Not available for size 28

▼ **Circuit diagram EP**
Size 28 to 215



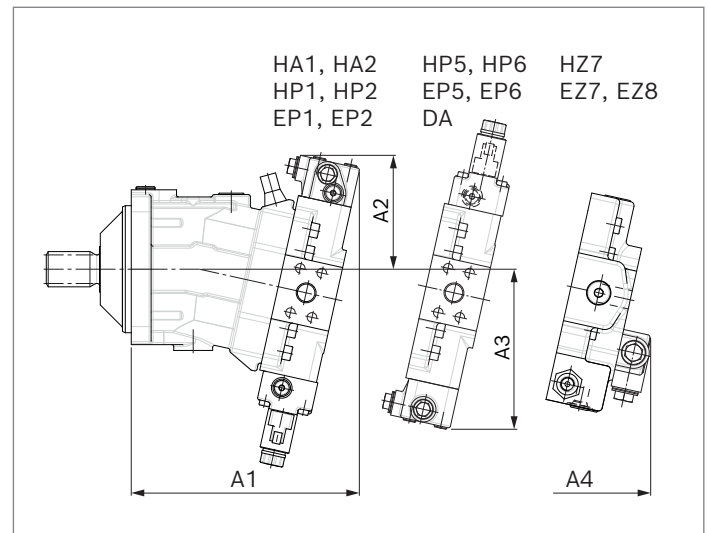
▼ **Circuit diagram EP**
Size 280



Notice

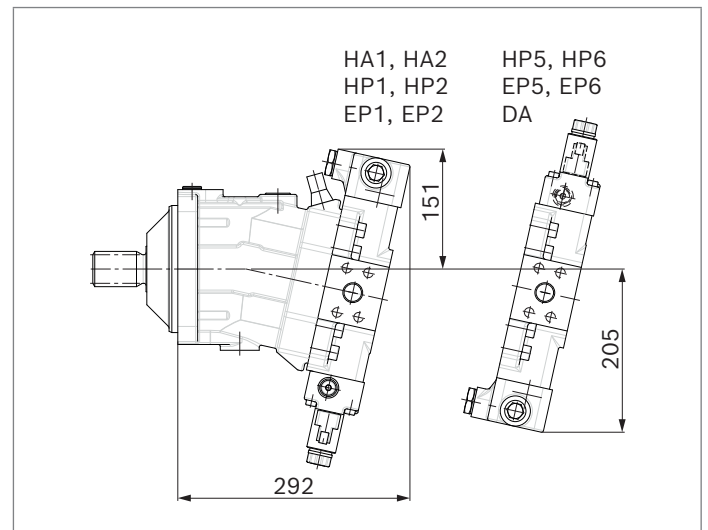
- ▶ Port **S_a** only for size 140 to 280
- ▶ From a flushing flow of 35 l/min¹⁾, it is recommended that port **S_a** be connected in order to prevent an increase in case pressure. An increased case pressure reduces the flushing flow.

▼ **Dimensions (small flushing valve)**
Size 28 to 115



NG	A1	A2	A3	A4
28	214	125	161	–
55, 60	245	137	183	236
80, 85	273	142	194	254
107, 115	287	143	202	269

▼ Dimensions (medium flushing valve)
Size 107 and 115



1) Please contact us concerning size 280

Setting range for displacement series 71

	60				85				115				150			
	$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)		$V_{g \max}$ (cm ³ /rev)		$V_{g \min}$ (cm ³ /rev)	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
A	62.0	62.0	0.0	15.0	85.2	85.2	0.0	9.0	115.6	115.6	0.0	24.0	152.1	152.1	0.0	44.0
	Without screw		M10 × 60 R909154690		Without screw		M12 × 60 R909083530		Without screw		M12 × 70 R909085976		Without screw		M12 × 80 R909153075	
B	62.0	62.0	> 15.0	30.5	85.2	85.2	> 9.0	28.0	115.6	115.6	> 24.0	47.5	152.1	152.1	> 44.0	69.0
	Without screw		M10 × 70 R909153779		Without screw		M12 × 70 R909085976		Without screw		M12 × 80 R909153075		Without screw		M12 × 90 R909154041	
C	62.0	62.0	> 30.5	43.0	85.2	85.2	> 28.0	47.0	115.6	115.6	> 47.5	71.0	152.1	152.1	> 69.0	99.0
	Without screw		M10 × 80 R909154058		Without screw		M12 × 80 R909153075		Without screw		M12 × 90 R909154041		Without screw		M12 × 100 R909153975	
D	x		x		85.2	85.2	> 47.0	59.0	115.6	115.6	> 71.0	80.0	152.1	152.1	> 99.0	106.0
					Without screw		M12 × 90 R909154041		Without screw		M12 × 100 R909153975		Without screw		M12 × 110 R909154212	
E	< 62.0	47.5	0.0	15.0	< 85.2	77.0	0.0	9.0	< 115.6	93.5	0.0	24.0	< 152.1	111.0	0.0	44.0
	M10 × 60 R909154690		M10 × 60 R909154690		M12 × 60 R909083530		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075	
F	< 62.0	47.5	> 15.0	30.5	< 85.2	77.0	> 9.0	28.0	< 115.6	93.5	> 24.0	47.5	< 152.1	111.0	> 44.0	69.0
	M10 × 60 R909154690		M10 × 70 R909153779		M12 × 60 R909083530		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041	
G	< 62.0	47.5	> 30.5	43.0	< 85.2	77.0	> 28.0	47.0	< 115.6	93.5	> 47.5	71	< 152.1	111.0	> 69.0	99.0
	M10 × 60 R909154690		M10 × 80 R909154058		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975	
H	x		x		< 85.2	77.0	> 47.0	59.0	< 115.6	93.5	> 71.0	80.0	< 152.1	111.0	> 99.0	106.0
					M12 × 60 R909083530		M12 × 90 R909154041		M12 × 70 R909085976		M12 × 100 R909153975		M12 × 80 R909153075		M12 × 110 R909154212	
J	< 47.5	33.0	0.0	15.0	< 77.0	58.0	0.0	9.0	< 93.5	71.0	0.0	24.0	< 111.0	87.0	0.0	44.0
	M10 × 70 R909153779		M10 × 60 R909154690		M12 × 70 R909085976		M12 × 60 R909083530		M12 × 80 R909153075		M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075	
K	< 47.5	33.0	> 15.0	30.5	< 77.0	58.0	> 9.0	28.0	< 93.5	71.0	> 24.0	47.5	< 111.0	87.0	> 44.0	69.0
	M10 × 70 R909153779		M10 × 70 R909153779		M12 × 70 R909085976		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 90 R909154041	
L	< 47.5	33.0	> 30.5	43.0	< 77.0	58.0	> 28.0	47.0	< 93.5	71.0	> 47.5	71.0	< 111.0	87.0	> 69.0	99.0
	M10 × 70 R909153779		M10 × 80 R909154058		M12 × 70 R909085976		M12 × 80 R909153075		M12 × 80 R909153075		M12 × 90 R909154041		M12 × 90 R909154041		M12 × 100 R909153975	
M	x		x		< 77.0	58.0	> 47.0	59.0	< 93.5	71.0	> 71.0	80.0	< 111.0	87.0	> 99.0	106.0
					M12 × 70 R909085976		M12 × 90 R909154041		M12 × 80 R909153075		M12 × 100 R909153975		M12 × 90 R909154041		M12 × 110 R909154212	

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 e.g. a danger of dry running. The leakage in the housing area must be directed to the reservoir via the highest drain port (**T₁**, **T₂**). If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary. To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts). Under all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Installation position

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

Notice

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

Notice

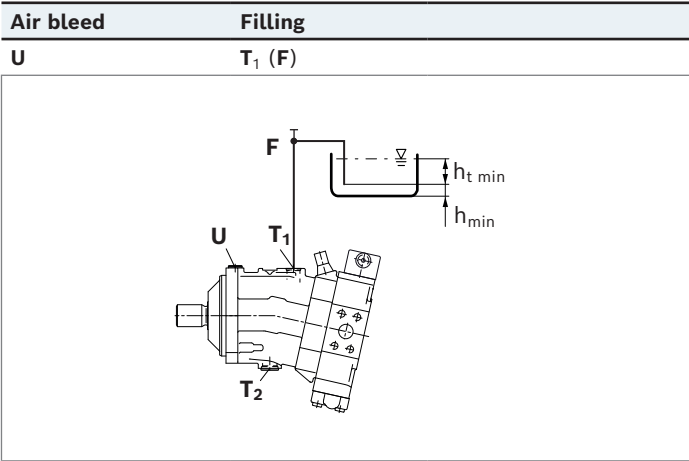
In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in actuating time.

Key	
F	Filling/air bleeding
U	Bearing flushing / air bleed port
T₁, T₂	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

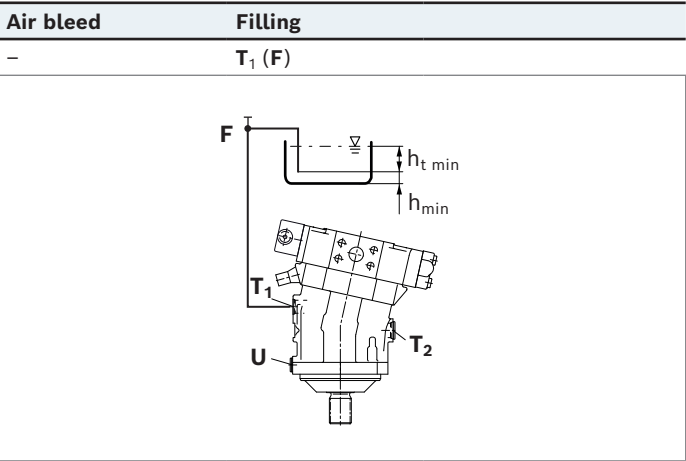
Below-reservoir installation (standard)

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

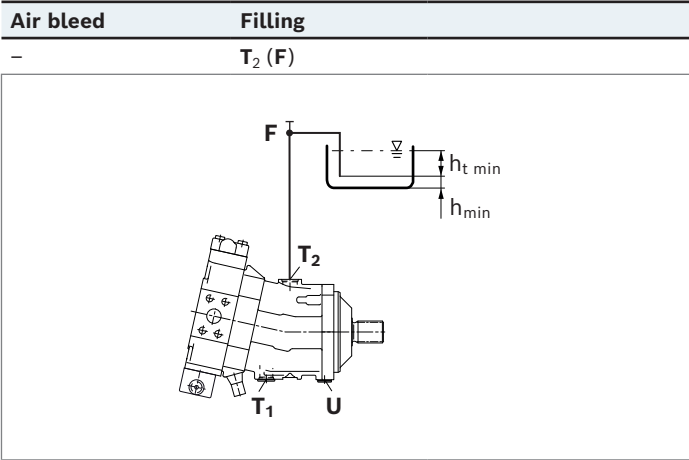
▼ Installation position 1



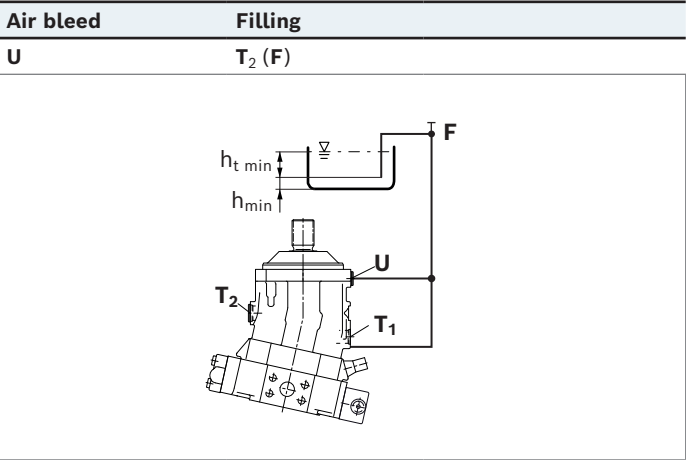
▼ Installation position 3



▼ Installation position 2



▼ Installation position 4



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 0.5 bar) can prevent draining of the housing area.

▼ **Installation position 5**

Air bleed	Filling
U, T ₁ (F)	T ₁ (F)

▼ **Installation position 7**

Air bleed	Filling
T ₁ (F)	T ₁ (F)

▼ **Installation position 6**

Air bleed	Filling
T ₂ (F)	T ₂ (F)

▼ **Installation position 8**

Air bleed	Filling
U, T ₁ (F)	T ₁ (F)

Project planning notes

- ▶ The motor A6VM is intended to be used in open and closed circuits.
- ▶ The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding operating instructions 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 information contained herein must be observed.
- ▶ For safety reasons, controls with beginning of control at $V_{g \min}$ (e.g., HA) are not permissible for winch drives, e.g. anchor winches!
- ▶ Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the operating instructions.
- ▶ Not all configuration 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 a direct current 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 current signal (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.
- ▶ Pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. Therefore, a pressure relief valve must be added to the hydraulic system (integrated into the pump or externally in the system). In this connection, observe the technical limits of the pressure relief valve.
- ▶ Please note that a hydraulic system is an oscillating system. This can lead e.g. 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 7 times (series 65) or 9 times (series 71) the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- ▶ Please note the information regarding the tightening torques of connection threads and other screw connections in the operating instructions.
- ▶ The ports and fastening threads are designed for the $p_{\max}$ permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- ▶ The service ports and function ports are only intended to accommodate hydraulic lines.
- ▶ Please note that the series connection of motors and the operation under summation pressure affect the efficiency of the units.
- ▶ The control behavior of the motor can change slightly due to natural influences, e.g. 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 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.