RE 92714/2021-03-18
Replaces: 08.2015

Axial piston variable pump A10VSO Series 32

- Optimized medium pressure pump for high power machines
- Sizes 45 to 180
- Nominal pressure 280 bar
- Maximum pressure 350 bar
- For industrial applications
- Open circuit

Features

- Variable displacement pump with axial piston rotary group of swashplate design for hydrostatic drives in open circuit
- Flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- Hydrostatically unloaded cradle bearing
- Port for measurement sensor on the high-pressure port
- Low noise level
- Low pressure pulsation
- High efficiency
- High resistance to cavitation, suction pressure drops and housing pressure peaks
- Universal through drive

Content

Type code

01	02	03	04		05	06		07	08	09	10	11	12	13
A10VS	**O**			**/**	**32**		**–**			**B**				

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10VS**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, see "Technical data" on page 8	**045**	**071**	**100**	**140**	**180**

Control device

						045	071	100	140	180	
04	Two-point control, direct operated					●	●	●	●	●	**DG**
	Pressure controller	hydraulic				●	●	●	●	●	**DR**
	with flow controller	hydraulic	X-T open			●	●	●	●	●	**DRF**
			X-T plugged			●	●	●	●	●	**DRS**
	Pressure cut-off	hydraulic	remote controlled			●	●	●	●	●	**DRG**
		electric	negative control		*U* = 24 V	●	●	●	●	●	**ED72**
		electric	positive control		*U* = 24 V	●	●	●	●	●	**ER72**
	Power controller with										
	Pressure cut-off	hydraulic	Beginning of control	to	50 bar	●	●	●	●	●	**LA5D**
				from	51 to 90 bar	●	●	●	●	●	**LA6D**
					91 to 160 bar	●	●	●	●	●	**LA7D**
					161 to 240 bar	●	●	●	●	●	**LA8D**
				above	240 bar	●	●	●	●	●	**LA9D**
	Pressure cut-off and flow control	hydraulic	Beginning of control	see LA.D		●	●	●	●	●	**LA.DS**
	Remotely controlled pressure cut-off	hydraulic	Beginning of control	see LA.D		●	●	●	●	●	**LA.DG**
	separate flow control	hydraulic	Beginning of control	see LA.D		●	●	●	●	●	**LA.S**

Series

05	Series 3, index 2	**32**

Direction of rotation

06	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Sealing material

		045	071	100	140	180	
07	FKM (fluorocarbon rubber)	●	●	●	●	●	**V**
	NBR (nitrile rubber) only with use of HFA, HFB, HFC hydraulic fluid	–	–	–	●	–	**C**

Type code

01	02	03	04		05	06		07	08	09	10	11	12	13
A10VS	**O**			**/**	**32**		**–**			**B**				

Drive shaft

			045	071	100	140	180	
08	Parallel keyed shaft DIN 6885, limited suitability for through drive (see the table of values, page 10)		●	●	●	●	●	**P**
	Splined shaft	Standard shaft	●	●	●	●	●	**S**
	ISO 3019-1	same as shaft "S", but for higher torque	●	●	–	–	–	**R**

Mounting flange

09	ISO 3019-2; 4-hole	**B**

Port

			045	071	100	140	180	
10	SAE flange ports fastening thread, metric (port plate and through drive assignment see position 11).	top, bottom, opposite	–	–	–	●	–	**12**
		top, bottom, opposite, with universal through drive **without** pulsation damping	●	●	●	●	●	**22**
		top, bottom, opposite, with universal through drive **with** pulsation damping	●	●	●	●	●	**32**

Through drive (for mounting options, see page 47)

	For Flange **ISO 3019-2**[1)] Diameter	Mounting[4)]	Hub for splined shaft[2)] Diameter		045	071	100	140	180	
11	**Only for port plate 12**				045	071	100	140	180	
	without through drive[5)]				–	–	–	●	–	**N00**
	ISO 80, 2-hole		3/4 in	11T 16/32DP	–	–	–	●	–	**KB2**
	ISO 100, 2-hole		7/8 in	13T 16/32DP	–	–	–	●	–	**KB3**
			1 in	15T 16/32DP	–	–	–	●	–	**KB4**
	ISO 125, 2-hole		1 1/4 in	14T 12/24DP	–	–	–	●	–	**KB5**
			1 1/2 in	17T 12/24DP	–	–	–	●	–	**KB6**
	ISO 180, 4-hole		1 3/4 in	13T 8/16DP	–	–	–	●	–	**KB7**
	Only for port plate 22 and 32				045	071	100	140	180	
	without through drive[3)]				●	●	●	●	●	**U00**
	ISO 80, 2-hole		3/4 in	11T 16/32DP	●	●	●	●	●	**UB2**
	ISO 100, 2-hole		7/8 in	13T 16/32DP	●	●	●	●	●	**UB3**
	ISO 125, 4-hole		1 in	15T 16/32DP	●	●	●	●	●	**UE1**
	ISO 160, 4-hole		1 1/4 in	14T 12/24DP	–	●	●	●	●	**UB8**
	ISO 180, 4-hole		1 1/2 in	17T 24/24DP	–	–	●	●	●	**UB9**
			1 3/4 in	13T 8/16DP	–	–	–	●	●	**UB7**

1) 2-hole: Attachment pump series 31
4-hole: Attachment pump series 32
2) According to ANSI B92.1a (splined shaft according to ISO 3019-1)
3) With through-drive shaft, without hub, without intermediate flange, closed on a functionally reliable basis with cover. For mounting kits, see data sheet 95581.
4) Mounting holes pattern viewed on through drive with control at top
5) Version "N00" with V_g limitation.

Type code

01	02	03	04		05	06		07	08	09	10	11	12	13
A10VS	**O**			**/**	**32**		**–**	**V**		**B**				

Through drive (for mounting options see page 41)

11	For Flange **ISO 3019-1** Diameter	Mounting[3]	Hub for splined shaft[1] Diameter		045	071	100	140	180	
	Only for port plate 12				**045**	**071**	**100**	**140**	**180**	
	without through drive				–	–	–	●	–	**N00**
	82-2 (A)	8, ∘°, ∘∘	5/8 in	9T 16/32DP	–	–	–	●	–	**K01**
		8, ∘°, ∘∘	3/4 in	11T 16/32DP	–	–	–	●	–	**K52**
	101-2 (B)	8, ∘°, ∘∘	7/8 in	13T 16/32DP	–	–	–	●	–	**K68**
		8, ∘°, ∘∘	1 in	15T 16/32DP	–	–	–	●	–	**K04**
	127-2 (C)	∘°, ∘∘	1 1/4 in	14T 12/24DP	–	–	–	●	–	**K07**
	127-2 (C)	∘°, ∘∘	1 1/2 in	17T12/24DP	–	–	–	●	–	**K24**
	Only for port plate 22 and 32				**045**	**071**	**100**	**140**	**180**	
	without through drive[2]				●	●	●	●	●	**U00**
	82-2 (A)	8, ∘°, ∘∘	5/8 in	9T 16/32DP	●	●	●	●	●	**U01**
		8, ∘°, ∘∘	3/4 in	11T 16/32DP	●	●	●	●	●	**U52**
	101-2 (B)	8, ∘°, ∘∘	7/8 in	13T 16/32DP	●	●	●	●	●	**U68**
		8, ∘°, ∘∘	1 in	15T 16/32DP	●	●	●	●	●	**U04**
	127-2 (C)	8, ∘°, ∘∘	1 1/4 in	14T 12/24DP	–	●	●	●	●	**U07**
	127-2 (C)	8, ∘°, ∘∘	1 1/2 in	17T12/24DP	–	–	●	●	●	**U24**

Rotary group version

12		045	071	100	140	180	
	Standard rotary group (noise-optimized for n= 1500/1800 rpm)	●	●	●	●	●	**E**
	High-speed; with port plate version 22U	●	●	●	●	–	**S**
	High-speed; with port plate version 32U	●	●	○	○	–	

Connector for solenoids

13		
	Without connector (without solenoid, only for hydraulic controls, without signs)	
	HIRSCHMANN connector – without suppressor diode	**H**

● = Available ○ = On request – = Not available

Notice
- Note the project planning notes on page 52.
- In addition to the type code, please specify the relevant technical data.

1) According to ANSI B92.1a (splined shaft according to ISO 3019-1)
2) With through-drive shaft, without hub, without intermediate flange, closed on a functionally reliable basis with cover. For mounting kits, see data sheet 95581.
3) Mounting holes pattern viewed on through drive with control at top

Hydraulic fluids

The A10VSO variable pump is designed for operation with HLP mineral oil according to DIN 51524.
See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: HFD hydraulic fluids (for permissible technical data, see data sheet 90225)
- 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 provided in the following technical data sheet:

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

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

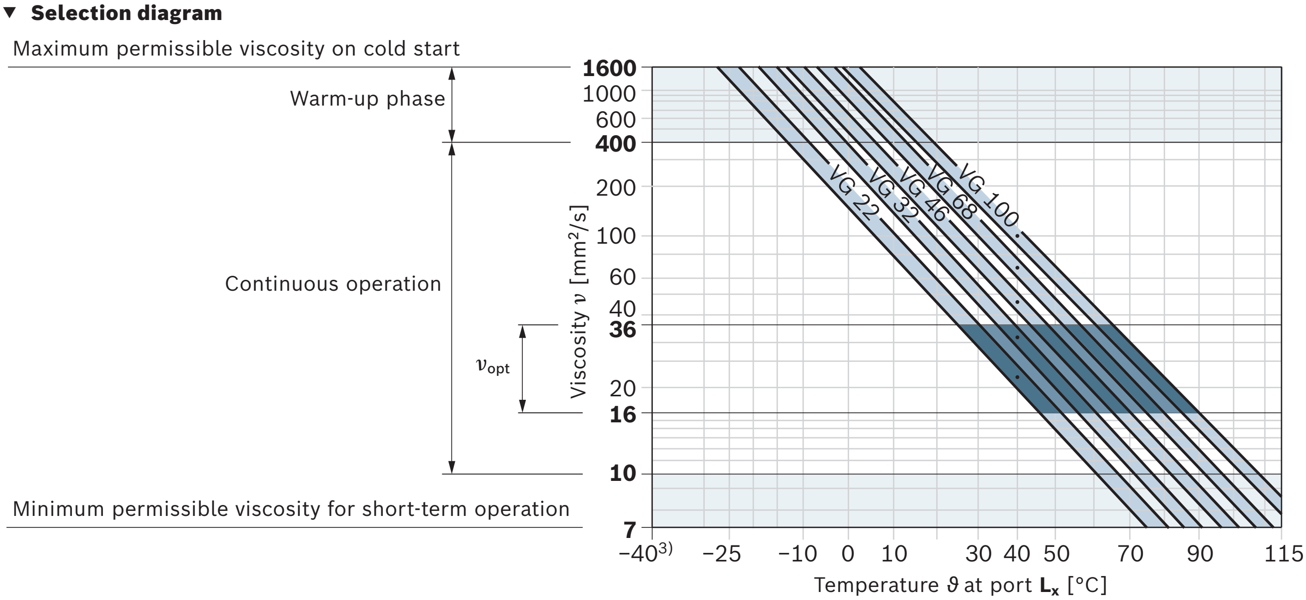
Notice

- Size 140 is suitable for operation with water-containing HF hydraulic fluids. See version "C".

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[2]	Remarks
Cold start	ν_{max} ≤ 1600 mm²/s	FKM	ϑ_{St} ≥ −25 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	ν = 1600 ... 400 mm²/s			t ≤ 15 min, $p \le 0.7 \times p_{nom}$ and $n \le 0.5 \times n_{nom}$
Continuous operation	ν = 400 ... 10 mm²/s[1]	FKM	ϑ ≤ +110°C	Measured at port $\mathbf{L_x}$
	ν_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range
Short-term operation	ν_{min} = 10 ... 7 mm²/s	FKM	ϑ ≤ +110°C	t ≤ 3 min, $p \le 0.3 \times p_{nom}$, measured at port $\mathbf{L_X}$

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +4 °C to +85 °C (see selection diagram)
2) If the temperature at extreme operating parameters cannot be adhered to, please contact us.
3) For applications in the low-temperature range, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of theaxial 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), at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.

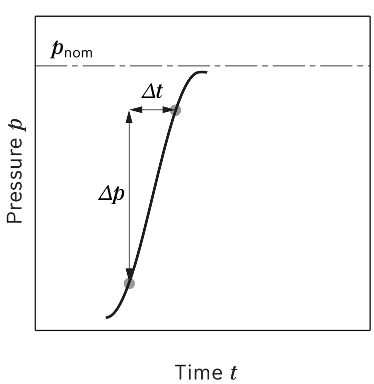
For example, viscosity corresponds to 10 mm²/s at:

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

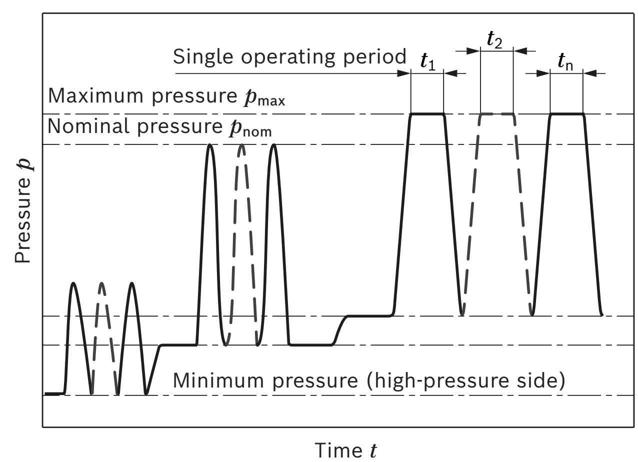
Working pressure range

Pressure at working port B			Definition
Nominal pressure p_{nom}		280 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}		350 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.
Single operating period		2.5 ms	
Total operating period		300 h	
Minimum pressure (high-pressure side)		10 bar[1]	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$		16000 bar/s	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)			
Minimum pressure $p_{S\ min}$	Standard	0.8 bar absolute	Minimum pressure at suction port **S** (inlet) which is required to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
	High-Speed	1.0 bar absolute	
Maximum pressure $p_{S\ max}$		10 bar[2]	
Case pressure at port L_1, L_2			
Maximum pressure $p_{L\ max}$		2 bar absolute	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.
Pilot pressure port X with external high pressure			
Maximum pressure p_{max}	350 bar		When designing all control lines with external high pressure, the values for the rate of pressure change, maximum single operating period and total operating period applicable to port **B** must not be exceeded.

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



▼ **Pressure definition**



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

Notice
Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

1) Lower pressure is time-dependent, please contact us
2) Other values on request

Technical data

Rotary group – version "E"

Size		NG		45	71	100	140	180
Geometric displacement, per revolution		$V_{g\ max}$	cm³	45	71	100	140	180
Maximum rotational speed[1]	at $V_{g\ max}$	n_{nom}	rpm	1800[2]	1800[2]	1800[2]	1800[3]	1800[3]
Flow	at n_{nom} and $V_{g\ max}$	q_v	l/min	81	128	180	252	324
	at n_E = 1500 rpm	q_{vE}	l/min	67.5	106.7	150	210	270
Power	at n_{nom}, $V_{g\ max}$ and Δp = 280 bar	P	kW	38	59.7	84	118	151
	at n_E = 1500 rpm	P_E	kW	31	50	70	98	125
Torque	at $V_{g\ max}$ and Δp = 280 bar	M	Nm	200	317	446	624	802
	at $V_{g\ max}$ and Δp = 100 bar	M	Nm	72	113	159	223	286
Rotary stiffness Drive shaft	P	c	Nm/rad	34587	80627	132335	188406	213022
	S	c	Nm/rad	29497	71884	121142	169537	171107
	R	c	Nm/rad	41025	76545	–	–	–
Moment of inertia of the rotary group		J_{TW}	kgm²	0.0035	0.0087	0.0185	0.0276	0.033
Maximum angular acceleration[4]		α	rad/s²	4000	2900	2400	2000	2000
Case volume		V	L	1.0	1.6	2.2	3.0	2.7
Weight (12N00 without through drive) approx.		m	kg	–	–	–	70.5	–
Weight (12Kxx) approx.		m	kg	–	–	–	79.5	–
Weight (22Uxx/32Uxx) approx.		m	kg	32.6	51.8	76	90.2	89.4

Determination of the characteristics			
Flow	q_v	$= \dfrac{V_g \times n \times \eta_v}{1000}$	[l/min]
Torque	M	$= \dfrac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
Power	P	$= \dfrac{2\,\pi \times M \times n}{60000} = \dfrac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

Key

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

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. Bosch Rexroth recommend testing the load by means of experiment or calculation/simulation and comparison with the permissible values.

1) The values are applicable:
– for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
– with hydraulic fluid on the basis of mineral oils
– with HF hydraulic fluids (observe technical data on page 9 and data sheet 90225)
2) The values are applicable at an absolute pressure of p_{abs} = 0.8 bar at suction port **S**
3) The values apply at absolute pressure p_{abs} = 1.0 bar at suction port **S**
4) The data are valid for values between the minimum required and maximum permissible rotational speed. Valid for external excitation (e.g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

Technical data

High-speed rotary group – version "S"

Size		NG		45	71	100	140
Geometric displacement, per revolution		$V_{g\,max}$	cm³	45	71	100	140
Maximum rotational speed[1]	at $V_{g\,max}$	n_{nom}	rpm	3000[2]	2550[2]	2300[2]	2200[2]
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	135	181	230	308
	at n_E = 1500 rpm	q_{vE}	l/min	67.5	106.7	150	210
Power	at n_{nom}, $V_{g\,max}$ and Δp = 280 bar	P	kW	62.8	85	107	144
	at n_E = 1500 rpm	P_E	kW	31	50	70	98
Torque	at $V_{g\,max}$ and Δp = 280 bar	M	Nm	200	317	446	624
	at $V_{g\,max}$ and Δp = 100 bar	M	Nm	72	113	159	223
Rotary stiffness	Drive shaft P	c	Nm/rad	34587	80627	132335	188406
	Drive shaft S	c	Nm/rad	29497	71884	121142	169537
	Drive shaft R	c	Nm/rad	41025	76545	–	–
Moment of inertia of the rotary group		J_{TW}	kgm²	0.0035	0.0087	0.0185	0.0276
Maximum angular acceleration[3]		α	rad/s²	4000	2900	2400	2000
Case volume		V	L	1.0	1.6	2.2	3.0
Weight (approx.)		m	kg	see technical data – version "E" on page 8			

Determination of the characteristics				
Flow	q_v	=	$\frac{V_g \times n \times \eta_v}{1000}$	[l/min]
Torque	M	=	$\frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
Power	P	=	$\frac{2\,\pi \times M \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

Key

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

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. Bosch Rexroth recommend testing the load by means of experiment or calculation/simulation and comparison with the permissible values.

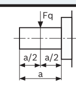
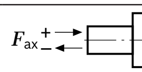
Technical data, HF hydraulic fluids

Maximum rotational speed

Hydraulic fluid[4] Version "C"	Size		NG	140 [rpm]
HFA	at nominal pressure p_N	140 bar	n_{nom}	1350
	at maximum pressure p_{max}	160 bar		
HFB	at nominal pressure p_N	140 bar	n_{nom}	1450
	at maximum pressure p_{max}	160 bar		
HFC	at nominal pressure p_N	175 bar	n_{nom}	1450
	at maximum pressure p_{max}	210 bar		
Technical data, HFD hydraulic fluids				
HFDR, HFDU polyalkylene glycol	at nominal pressure p_N	280 bar	n_{nom}	1450
HFDU polyol ester	at nominal pressure p_N	280 bar		1800

1) The values are applicable:
– for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
– with hydraulic fluid on the basis of mineral oils
2) The values apply at absolute pressure p_{abs} = 1.0 bar at suction port **S**
3) The data are valid for values between the minimum required and maximum permissible rotational speed. Valid for external excitation (e.g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.
4) For HF hydraulic fluids, see additional technical data in data sheet 90225).

Permissible radial and axial loading of the drive shaft

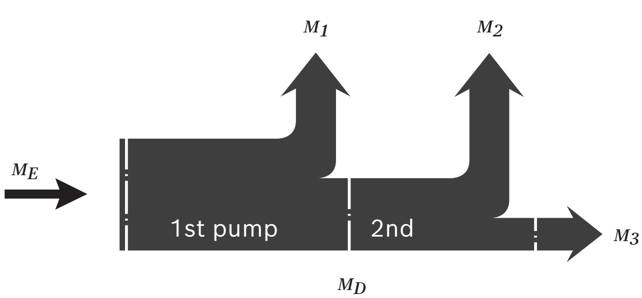
Size		NG		45	71	100	140	180
Maximum radial force at a/2		$F_{q\ max}$	N	1500	1900	2300	2800	2300
Maximum axial force		$\pm F_{ax\ max}$	N	1500	2400	4000	4800	800

Notice
The values given are maximum values and do not apply to continuous operation. All loads of the drive shaft reduce the bearing service life!
For drives with radial loading (pinion, V-belt), please contact us.

Permissible inlet and through-drive torques

Size				45	71	100	140	180
Torque at $V_{g\,max}$ and Δp = 280 bar[1]		M_{max}	Nm	200	316	446	624	802
Max. input torque on drive shaft[2]								
	P	$M_{E\,max}$	Nm	200	439	857	1206	1243
		Ø	mm	25	32	40	45	45
	S	$M_{E\,max}$	Nm	319	626	1104	1620	1834
		Ø	in	1	1 1/4	1 1/2	1 3/4	1 3/4
	R	$M_{E\,max}$	Nm	400	644	–	–	–
		Ø	in	1	1 1/4	–	–	–
Maximum through-drive torque								
	P	$M_{D\,max}$	Nm	200	439	778	1206	1243
	S	$M_{D\,max}$	Nm	319	492	778	1266	1266
	R	$M_{D\,max}$	Nm	365	548	–	–	–

▼ **Distribution of torques**



Torque at 1st pump	M_1		
Torque at 2nd pump	M_2		
Torque at 3rd pump	M_3		
Input torque	M_E	=	$M_1 + M_2 + M_3$
	M_E	<	$M_{E\,max}$
Through-drive torque	M_D	=	$M_2 + M_3$
	M_D	<	$M_{D\,max}$

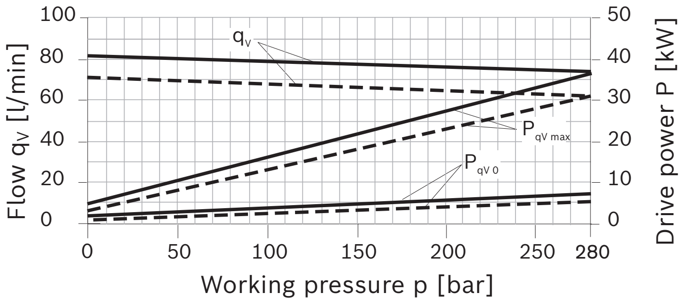
1) Efficiency not considered
2) For drive shafts with no radial force

Drive power and flow

Size 45

---- n= 1500 rpm

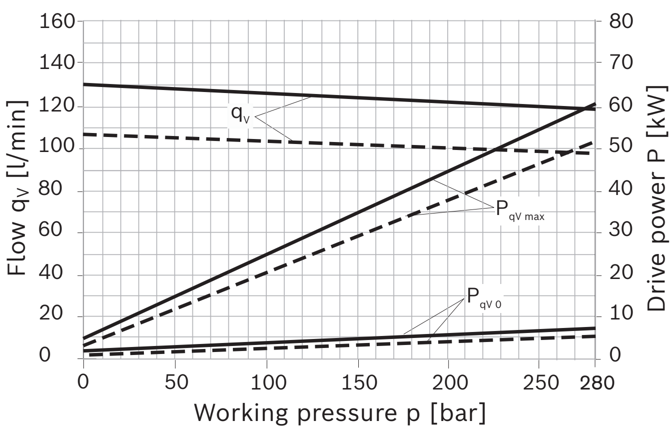
—— n= 1800 rpm



Size 71

---- n= 1500 rpm

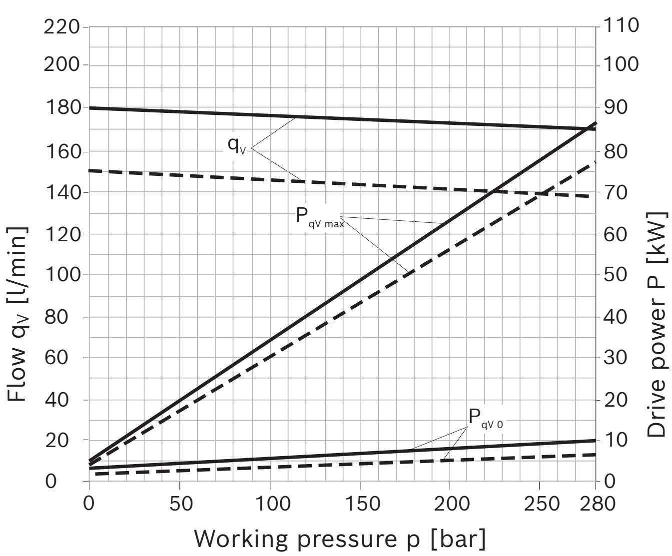
—— n= 1800 rpm



Size 100

---- n= 1500 rpm

—— n= 1800 rpm



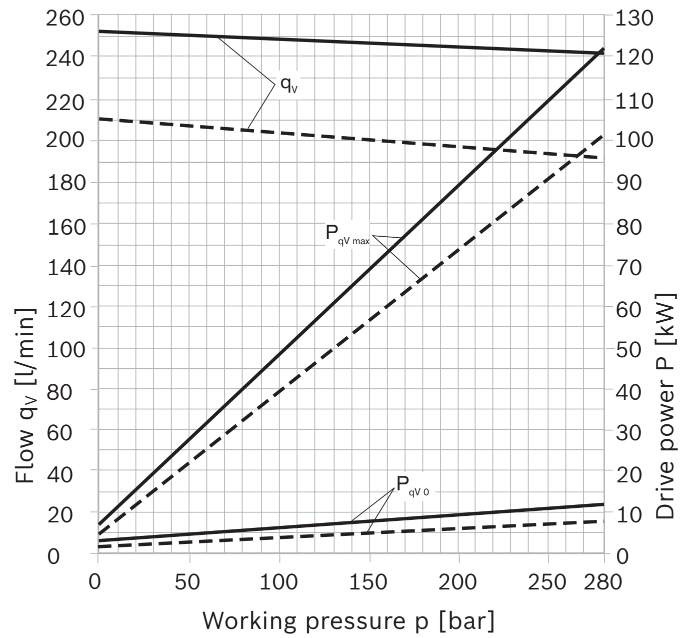
Notice

▶ Characteristic curves measured using ISO VG 46 DIN 51519 hydraulic fluid and θ=50 °C

Size 140

---- n= 1500 rpm

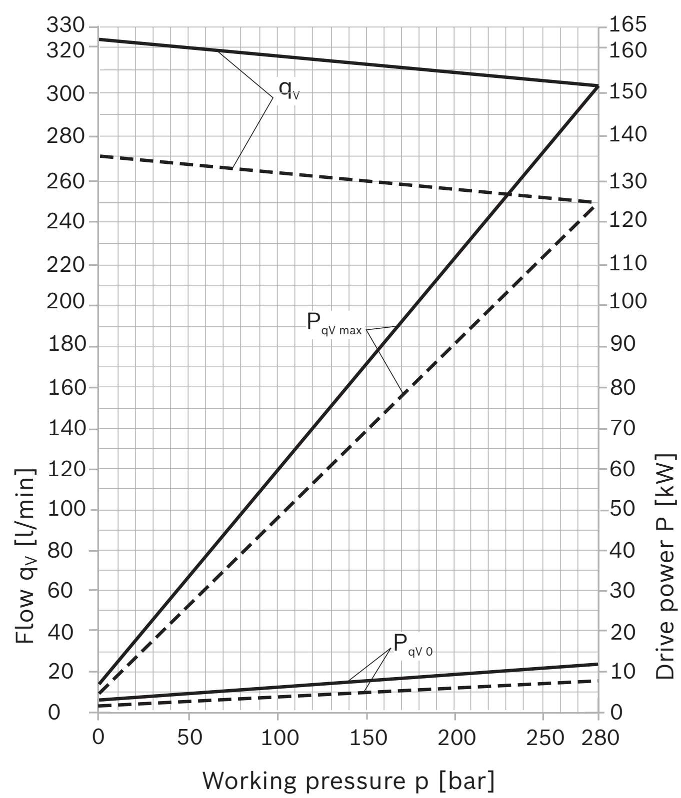
—— n= 1800 rpm



Size 180

---- n= 1500 rpm

—— n= 1800 rpm

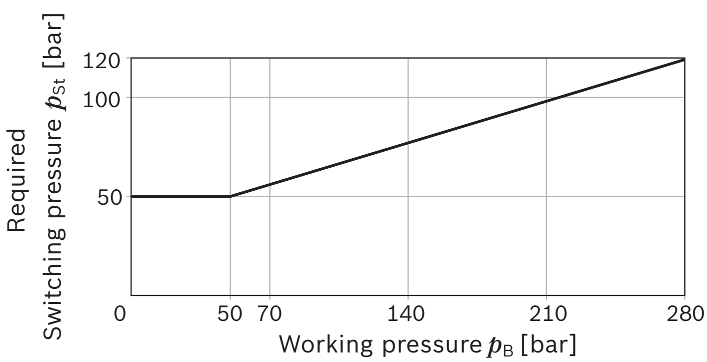


DG – Two-point control, directly operated

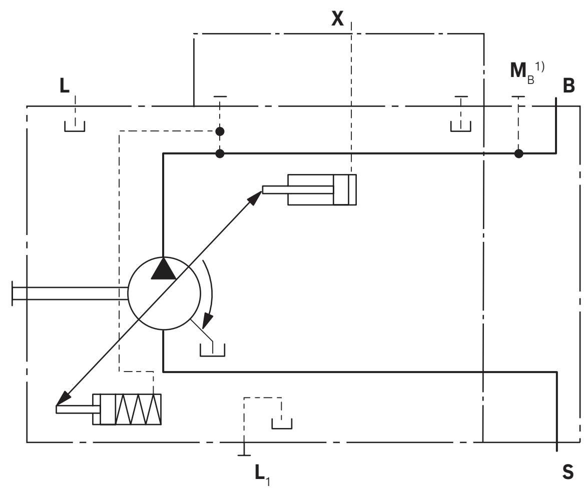
The variable pump can be set to a minimum swivel angle by connecting an external switching pressure to port **X.**
This will supply control fluid directly to the stroking piston; a minimum pressure of p_{St} ≥ 50 bar is required.
The variable pump can only be switched between $V_{g\,min}$ and $V_{g\,max}$.
Please note that the required switching pressure at port **X** is directly dependent on the actual operating pressure p_B at port **B**. (see switching pressure characteristic curve).
The maximum permissible switching pressure is 280 bar.

- Switching pressure p_{ST} in X= 0 bar ≙ $V_{g\,max}$
- Switching pressure p_{ST} in X≥ 50 bar ≙ $V_{g\,min}$

▼ **Switching pressure characteristic curve**



▼ **Circuit diagram DG**



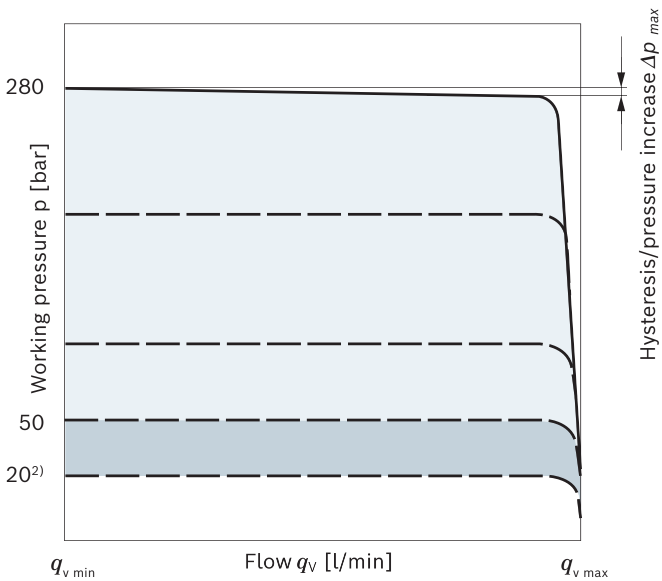
1) Only with port plates 22 and 32

DR – Pressure controller

The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pressure valve, the pump will regulate to a smaller displacement to reduce the control differential.

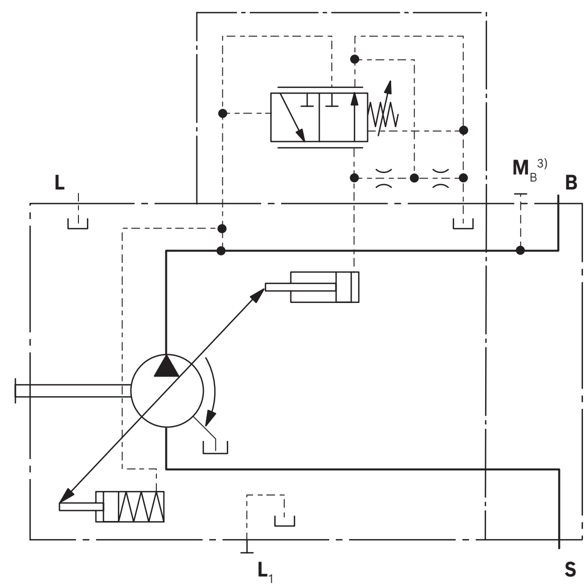
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 50 to 280 bar. Standard is 280 bar.

▼ **Characteristic curve DR**



Characteristic curve valid for n_1 = 1500 rpm and t_{fluid} = 50 °C.

▼ **Circuit diagram DR**



Controller data

NG		45	71	100	140	180
Pressure increase, maximum	Δp [bar]	6	8	10	12	14
Hysteresis and repeatability	Δp [bar]	maximum 3				
Pilot fluid consumption	l/min	maximum approx. 3				

Flow loss at q_{Vmax} see page 11.

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) For settings below 50 bar, please use the SO275 special pressure controller (setting range: 20 to 100 bar).
3) Only with port plates 22 and 32

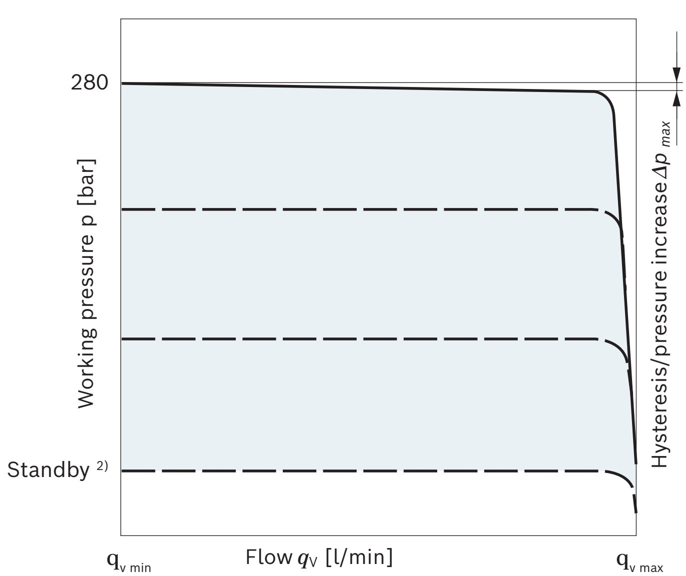
DRG – Pressure controller, remotely controlled

For the remote-controlled pressure controller, the pressure limitation is performed using a separately arranged pressure relief valve. Therefore, any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 13.
A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control.
A differential pressure of 20 bar Δp (standard setting) results in a pilot oil flow of approx. 1.5 l/min at port **X**.
If another setting is required (range from 10-22 bar) please state in plain text.
As a separate pressure relief valve (**1**) we recommend:

- A direct operated, hydraulic or electric proportional one, suitable for the quantity of pilot fluid mentioned above. The maximum line length should not exceed 2 m.
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] for pressure control 50 to 280 bar (**3**). Standard is 280 bar.
- Setting range for differential pressure 10 – 22 bar (**2**). Standard is 20 bar.

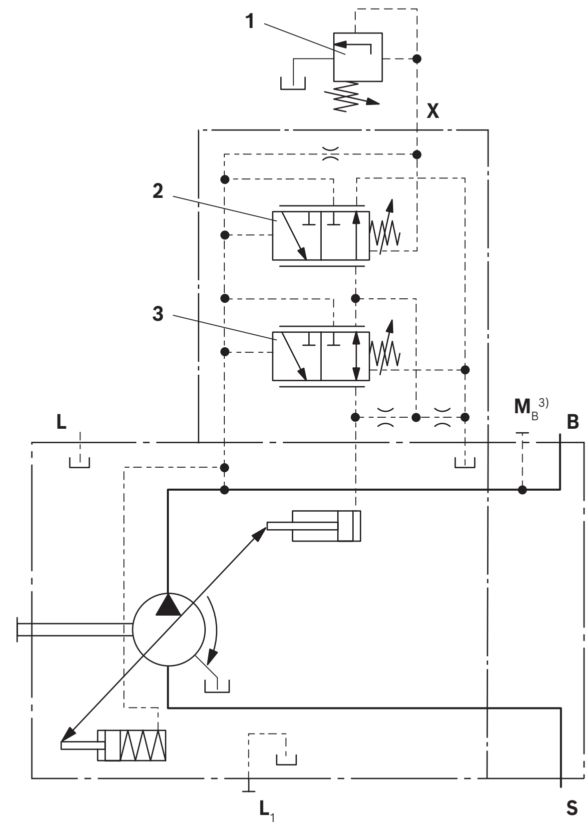
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar higher than the defined differential pressure Δp, however system influences are not taken into account.

▼ **Characteristic curve DRG**



Characteristic curve valid for n_1 = 1500 rpm and t_{fluid} = 50 °C.

▼ **Circuit diagram DRG**



1 The separate pressure relief valve and the line are not included in the scope of delivery.
2 Remote controlled pressure cut-off (**G**)
3 Pressure controller (**DR**)

Controller data

NG		45	71	100	140	180
Pressure increase, maximum	Δp [bar]	6	8	10	12	14
Hysteresis and Repeat accuracy	Δp [bar]	maximum 3				
Pilot fluid consumption	l/min	maximum approx. 4.5				

Flow loss at q_{Vmax} see page 11.

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke from pressure setting Δp on controller (**2**)
3) Only with port plates 22 and 32

DRF/DRS – Pressure and flow controller

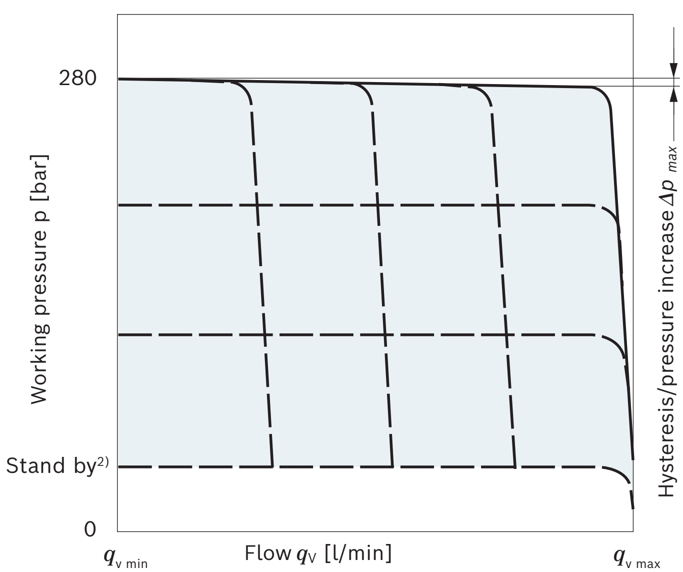
In addition to the pressure controller function (see page 13), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the V_g reduction has priority.

- Basic position in depressurized state: $V_{g\ max}$.
- Setting range[1] to 280 bar
  Standard is 280 bar.
- For pressure controller data, see page 13

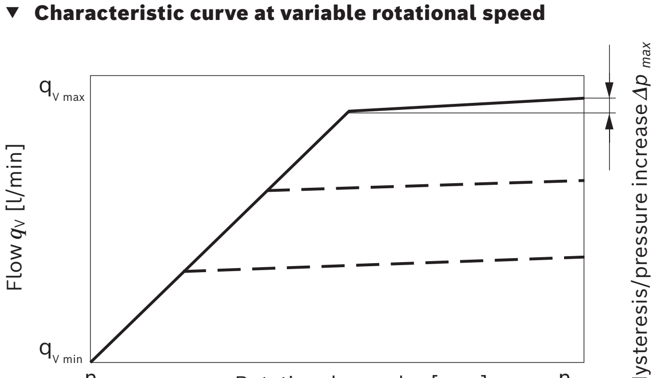
Notice

- The DRS version has no unloading between **X** and the reservoir. The LS must thus be unloaded in the system. Because of the flushing function of the flow controller in the DRS control valve, sufficient unloading of the **X** line must also be ensured.

▼ **Characteristic curve DRF/DRS**

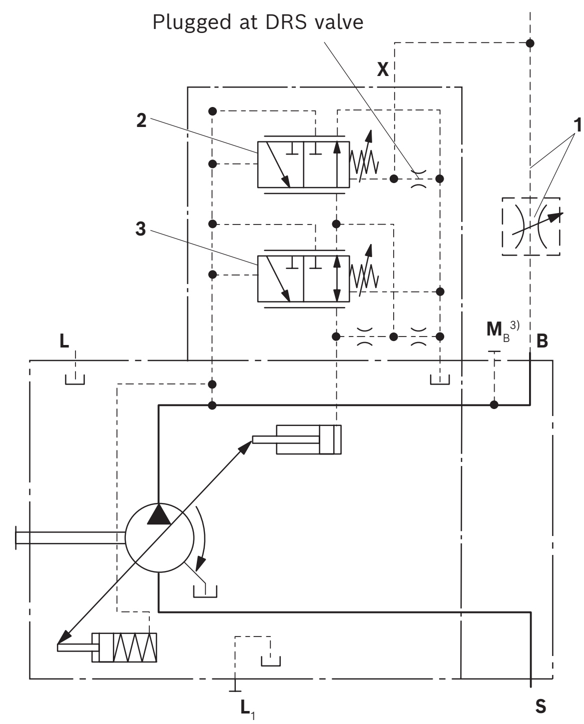


▼ **Characteristic curve at variable rotational speed**



Characteristic curves valid at n_1 = 1500 rpm and t_{fluid} = 50°C.

▼ **Circuit diagram DRF**



1 The metering orifice (control block) and the line are not included in the scope of delivery.
2 Flow controller (**FR**).
3 Pressure controller (**DR**)

For further information see page 16

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting Δp on controller (**2**)
3) Only with port plates 22 and 32

Differential pressure Δp

- Standard setting: 14 bar
  If another setting is required, please state in the plain text.
- Setting range: 14 bar to 22 bar

Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar higher than the defined differential pressure Δp, however system influences are not taken into account.

Controller data

DR pressure controller data see page 13

Maximum flow deviation measured at drive speed n = 1500 rpm.

NG		45	71	100	140	180
Pressure increase, maximum	Δp [bar]	6	8	10	12	14
Hysteresis and Repeat accuracy	Δp [bar]	maximum 3				
Pilot fluid consumption	l/min	maximum approx. 4.5				
Flow deviation	$\Delta q_{V\,max}$ [l/min]	1.8	2.8	4.0	6.0	8.0

LA... – Pressure, flow and power controller

Pressure controller equipped as DR(G), see page 13 (14).
Equipment of the flow controller like DRS, see page 15.
In order to achieve a constant drive torque with varying working pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant. Flow control is possible below the power control curve. When ordering please state the power characteristics to be set at the factory in plain text, e.g. 20 kW at 1500 rpm.

Controller data

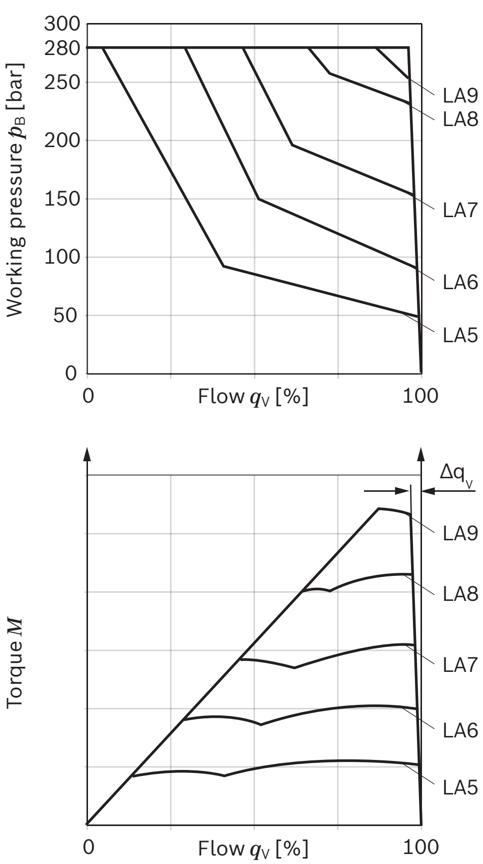
For technical data of pressure controller DR see page 13.
For technical data of flow controller FR see page 15.
Pilot fluid consumption max. approx. 5.5 l/min.

	Torque M [Nm] for size					
Beginning of control	**45**	**71**	**100**	**140**	**180**	**Type code**
up to 50 bar	to 42.0	to 67.0	to 94.0	to 132.0	to 167.0	**LA5**
51 to 90 bar	42.1 - 76.0	67.1 - 121.0	94.1 - 169.0	132.1 - 237.0	167.1 - 302.0	**LA6**
91 to 160 bar	76.1 - 134.0	121.1 - 213.0	169.1 - 299.0	237.1 - 418.0	302.1 - 540.0	**LA7**
161 to 240 bar	134.1 - 202.0	213.1 - 319.0	299.1 - 449.0	418.1 - 629.0	540.1 - 810.0	**LA8**
over 240 bar	over 202.1	over 319.1	over 449.1	over 629.1	over 810.1	**LA9**

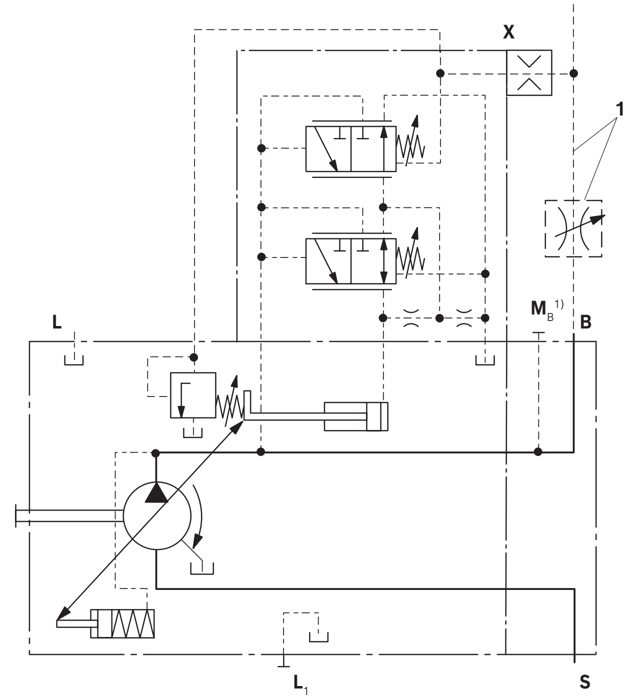
Conversion of the torque values in power [kW]

$P = \frac{M}{6.4}$ [kW] (At 1500 rpm) or $P = \frac{2\pi \times M \times n}{60000}$ [kW] (For rotational speeds see table on page 8)

▼ **Characteristic curve LA.DS**



▼ **Circuit diagram LA.DS**
((for further combination options with LA.. see page 18)

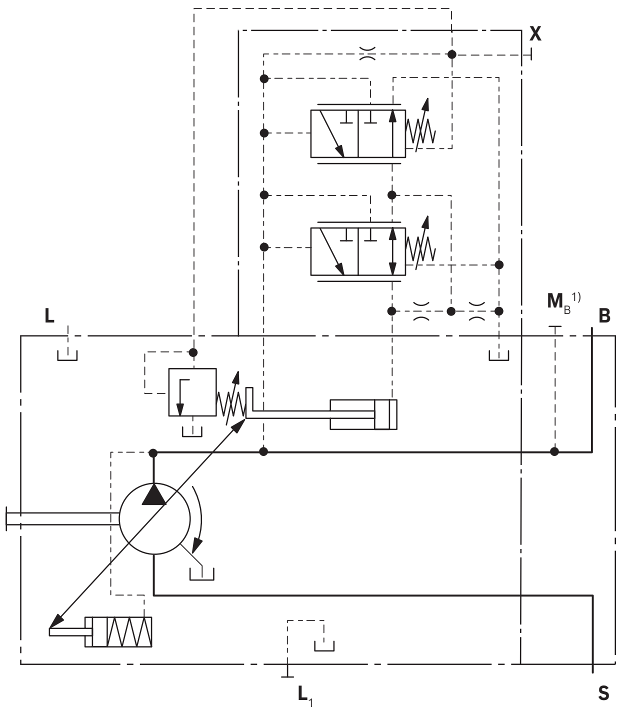


1 Metering orifice
is not included in the scope of delivery.

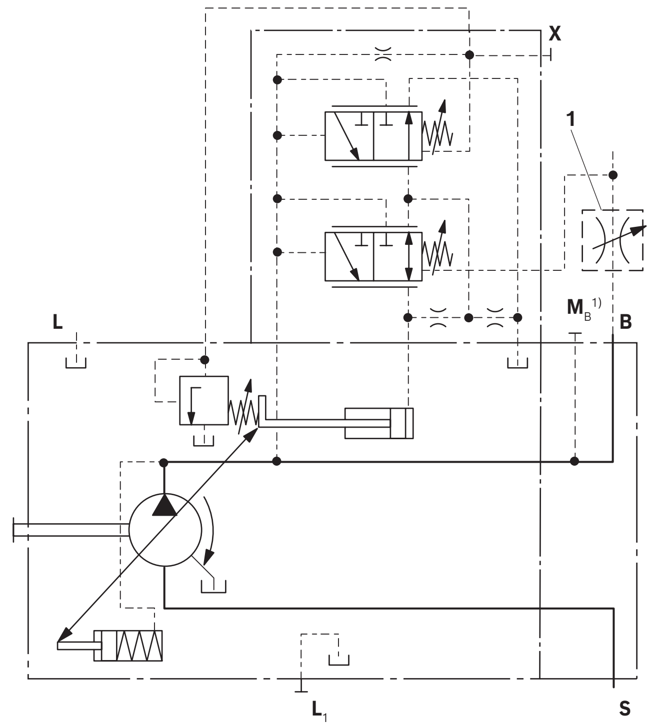
1) Only with port plates 22 and 32

LA... – Variations

▼ **Circuit diagram LA.D** with pressure cut-off

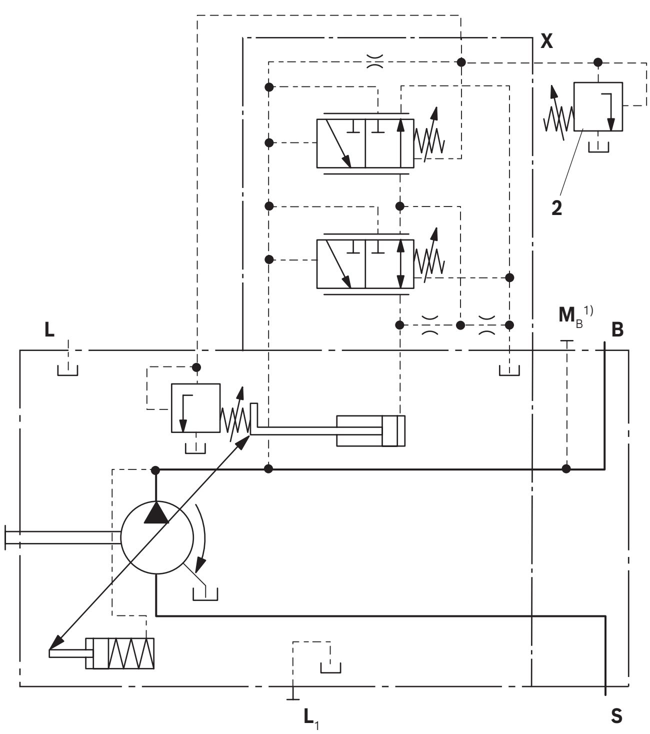


▼ **Circuit diagram LA.S** with separate flow control



1 The metering orifice is not included in the scope of delivery.

▼ **Circuit diagram LA.DG** with pressure cut-off, remotely controlled



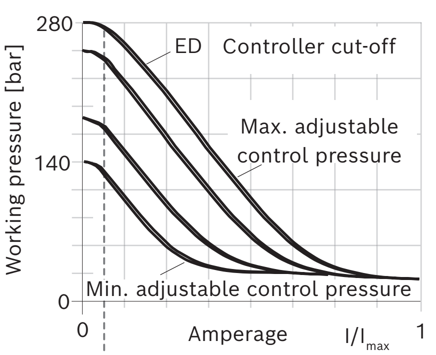
2 The pressure relief valve is not included in the scope of delivery.

1) Only with port plates 22 and 32

ED – Electrohydraulic pressure control

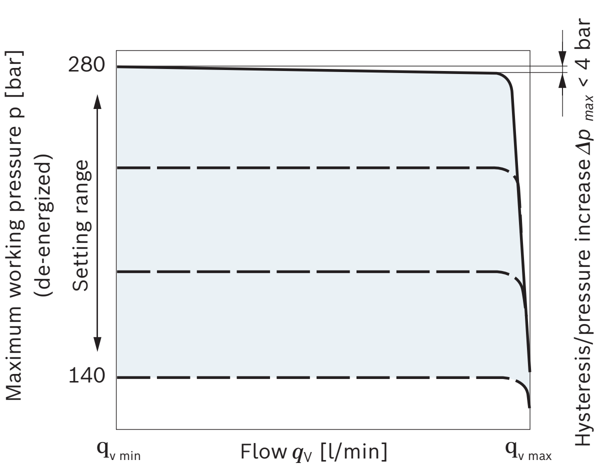
The ED valve is set to a certain pressure by a specified variable solenoid current.
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
The pump thus only delivers as much hydraulic fluid as the actuators can take. The desired pressure level can be set steplessly by varying the solenoid current.
As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of power failure, e.g. for fan speed control). The swivel time characteristic of the ED control was optimized for the use as a fan drive system.
When ordering, specify the type of application in plain text.

▼ **Current/pressure characteristic curve ED**
(negative characteristic curve)



Hysteresis static current-pressure characteristic curve < 3 bar.

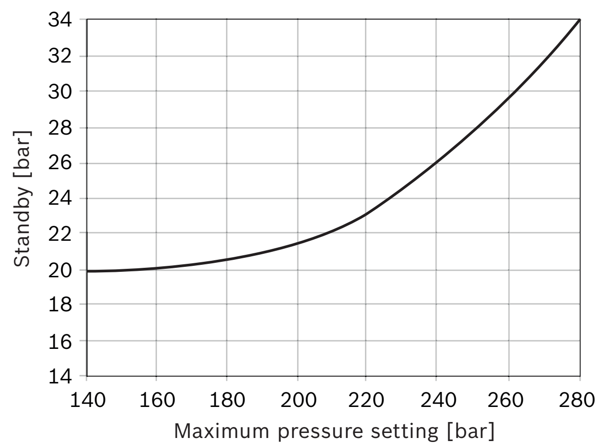
▼ **Flow-pressure characteristic curve**



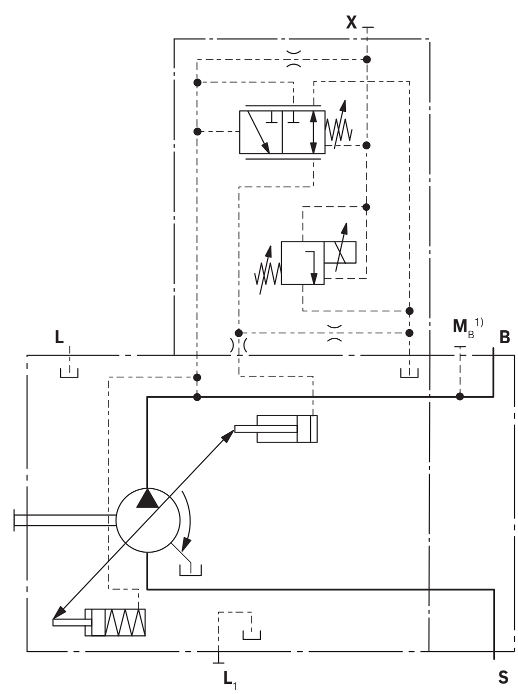
Characteristic curves valid at n_1 = 1500 rpm and t_{fluid} = 50°C.

- Pilot fluid consumption: 3 to 4.5 l/min.
- For standby standard setting, see the following diagram; other values on request.

▼ **Influence of the pressure setting on standby (maximum energization)**



▼ **Circuit diagram ED72**



1) Only with port plates 22 and 32

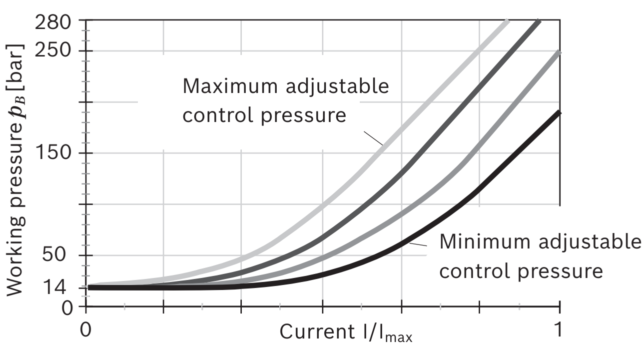
Technical data, solenoids	**ED72**
Voltage	24 V (±20%)
Control current	
Start of control at p_{max}	50 mA
Start of control at p_{min}	600 mA
Current limit	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Recommended amplitude Peak to peak	120 mA
Duty cycle	100%
Type of protection: see connector version page 49	
Operating temperature range at valve -20 °C to +115 °C	

Notice!
With **ED72**, de-energized operating condition (jump from 50 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar.

ER – Electrohydraulic pressure control

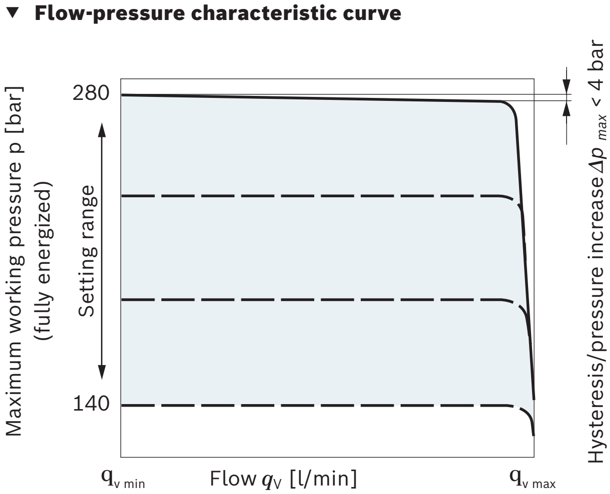
The ER valve is set to a certain pressure by a specified variable solenoid current.
In the case of changes to the actuator (load pressure), the pump swivel angle (flow) increases or decreases until the electrically specified set pressure has been reached again. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
If the solenoid current drops towards zero, the pressure will be limited to p_{min}
(standby) by an adjustable hydraulic pressure cut off.
Observe project planning note.

▼ **Current/pressure characteristic curve ED**
(positive characteristic curve)



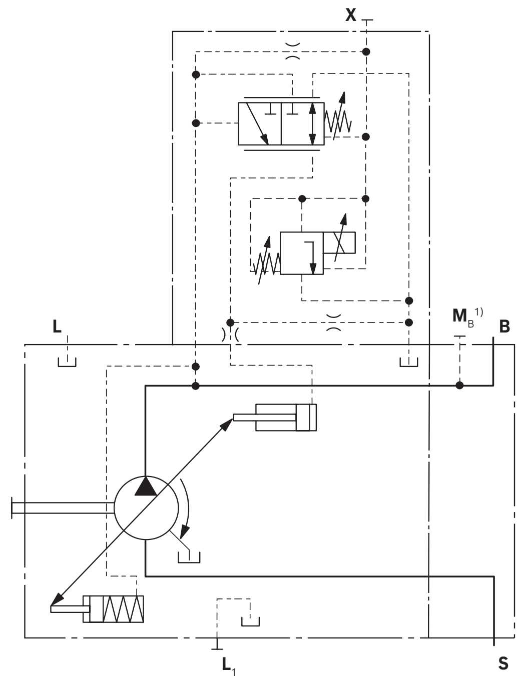
Hysteresis static current-pressure characteristic curve < 3 bar.
Influence of pressure setting on standby ± 2 bar.

▼ **Flow-pressure characteristic curve**



Characteristic curves valid at n_1 = 1500 rpm and t_{fluid} = 50°C.
Pilot fluid consumption: 3 to 4.5 l/min.
Standby standard 14 bar. Other values on request.

▼ **Circuit diagram ER72**



Technical data, solenoids	ER72
Voltage	24 V (±20%)
Control current	
Start of control at p_{min}	50 mA
End of control at p_{max}	600 mA
Current limit	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Recommended amplitude Peak to peak	120 mA
Duty cycle	100%
Type of protection: see connector version page 49	

Operating temperature range at valve -20 °C to +115 °C

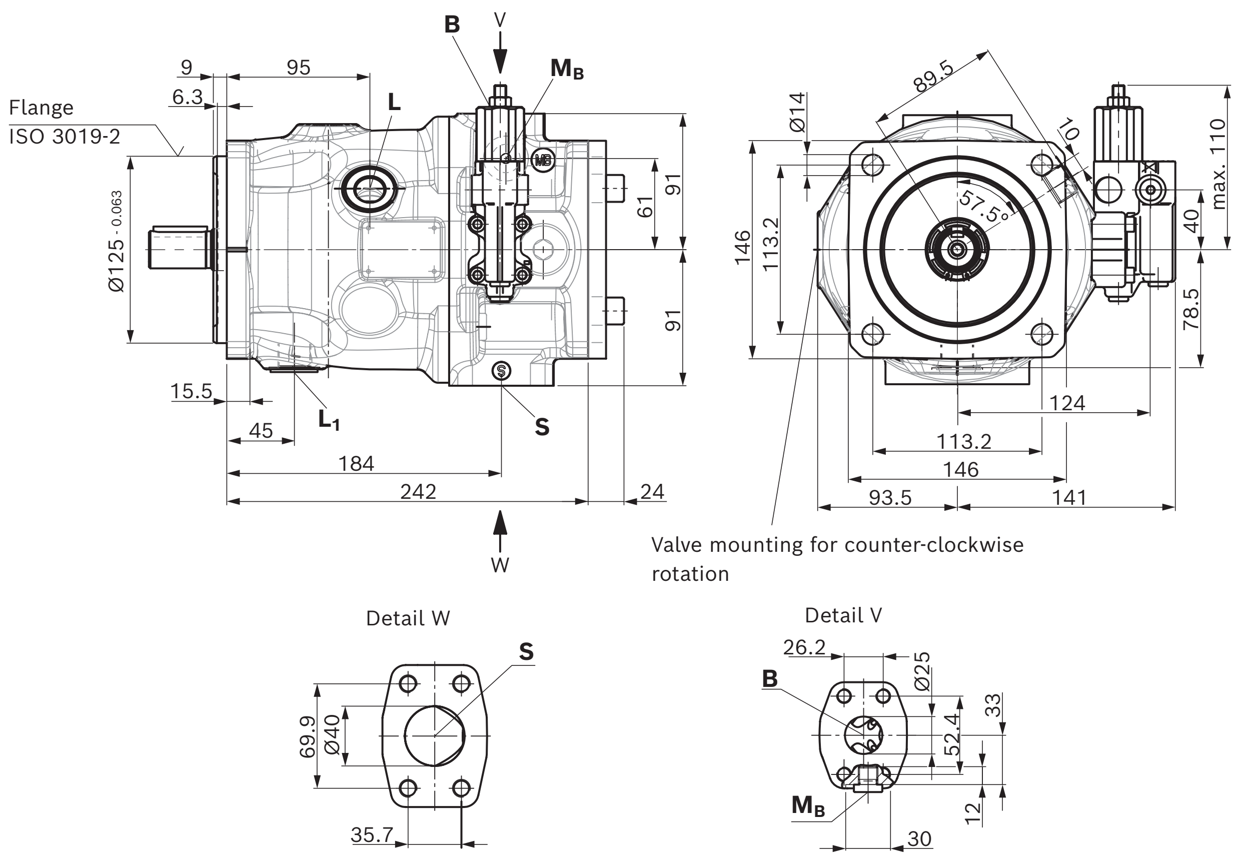
Project planning note!
Over-current (I > 600 mA at 24 V) to the ER solenoid can result in pressure increases leading to pump or system damage. Therefore:
- Use I_{max} current limiter solenoids.
- An intermediate plate pressure controller can be used to protect the pump in the event of overflow.

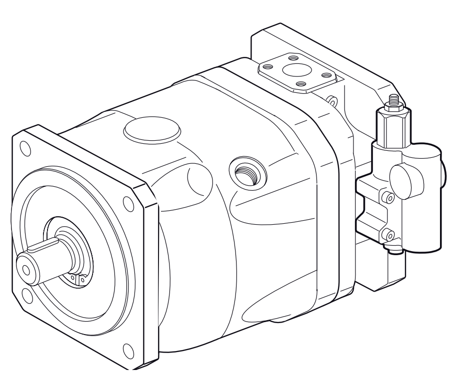
An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

1) Only with port plates 22 and 32

Dimensions, size 45

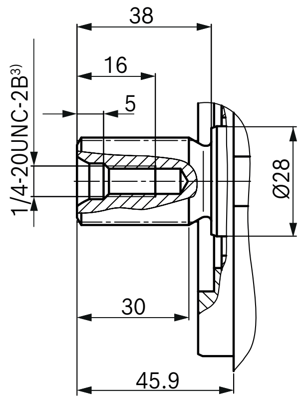
DR – Pressure controller





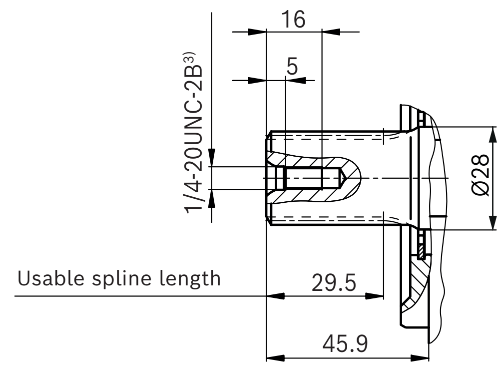
▼ **Splined shaft 1 in (25-4, ISO 3019-1)**

S – 15T 16/32DP[1)]



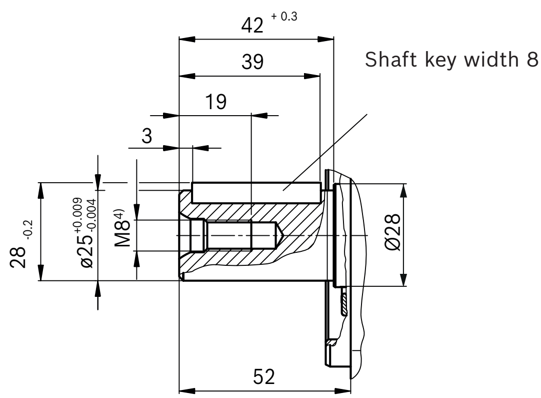
▼ **Splined shaft 1 in (similar to ISO 3019-1)**

R – 15T 16/32DP[1)2)]



▼ **Parallel keyed shaft DIN 6885**

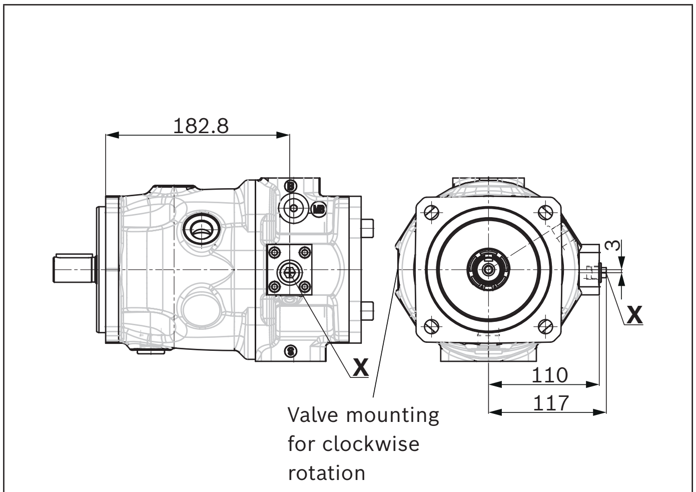
P – A8x7x36



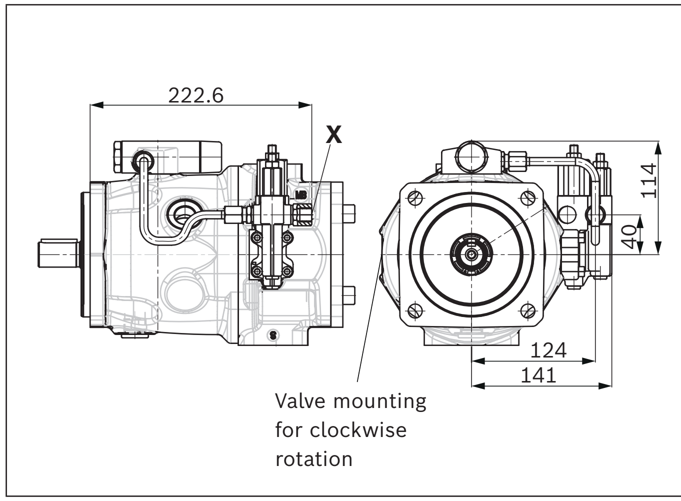
Ports		Standard	Size	p_{max} [bar][5)]	State[8)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10x1.5; 17 deep	350	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/2 in M12 x 1.75; 20 deep	10	O
L	Drain port	DIN 3852[6)]	M22 x 1.5; 14 deep	2	O[7)]
$\mathbf{L_1}$	Drain port	DIN 3852[6)]	M22 x 1.5; 14 deep	2	X[7)]
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Pilot pressure (with DG-control)	DIN 3852-2	G 1/4 in; 12 deep	280	O
$\mathbf{M_B}$	Measuring pressure **B**	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Center bore according to DIN 332 (thread according to DIN 13)
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 50).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

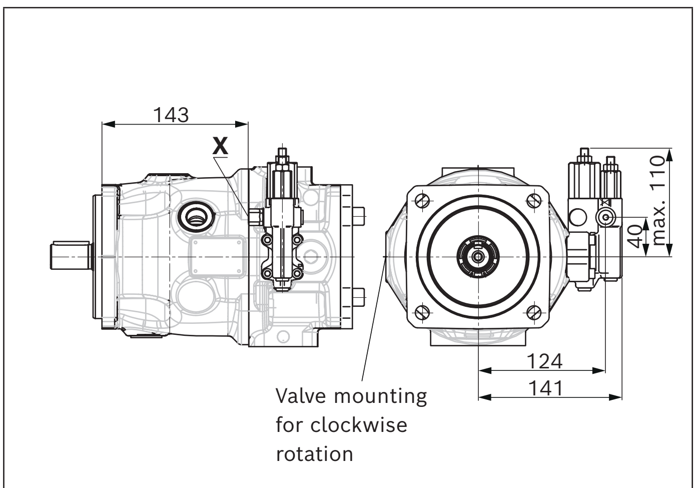
▼ **DG – Two-point control, direct operated**



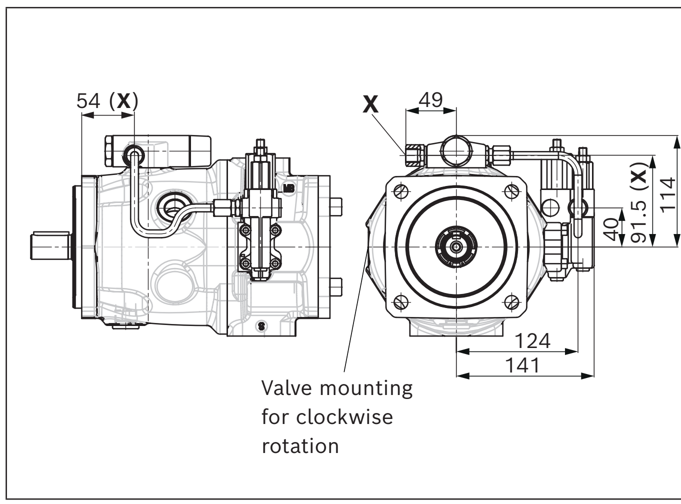
▼ **LA.DS – Pressure, flow and power controller**



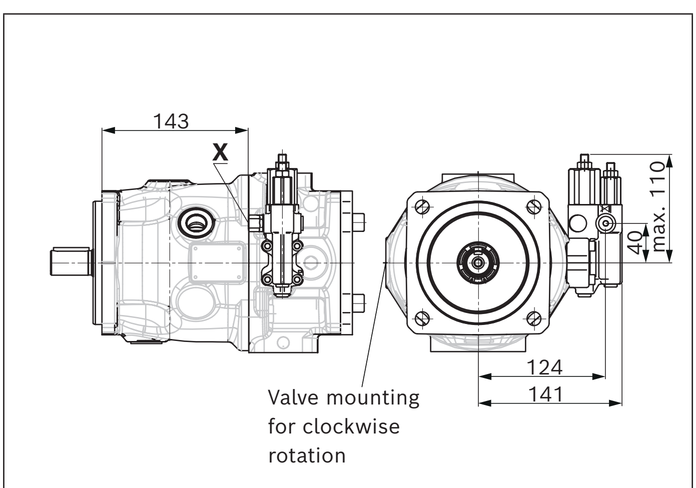
▼ **DRG – Pressure controller, remotely controlled**



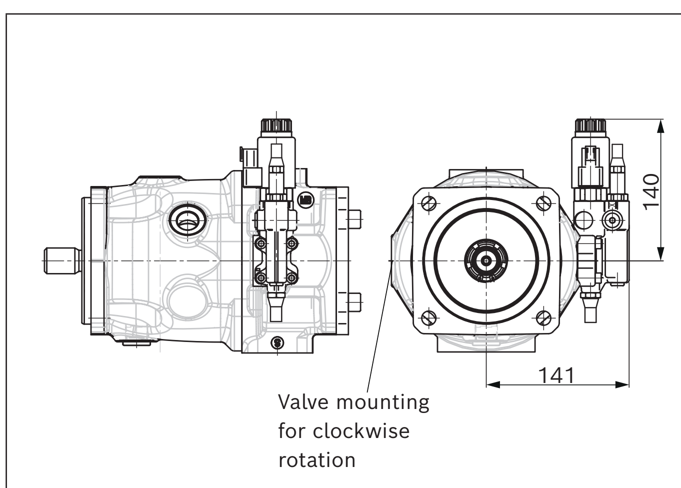
▼ **LA.DG – Power controller with pressure cut off, remote controlled**



▼ **DRF/DRS – Pressure, flow controller**

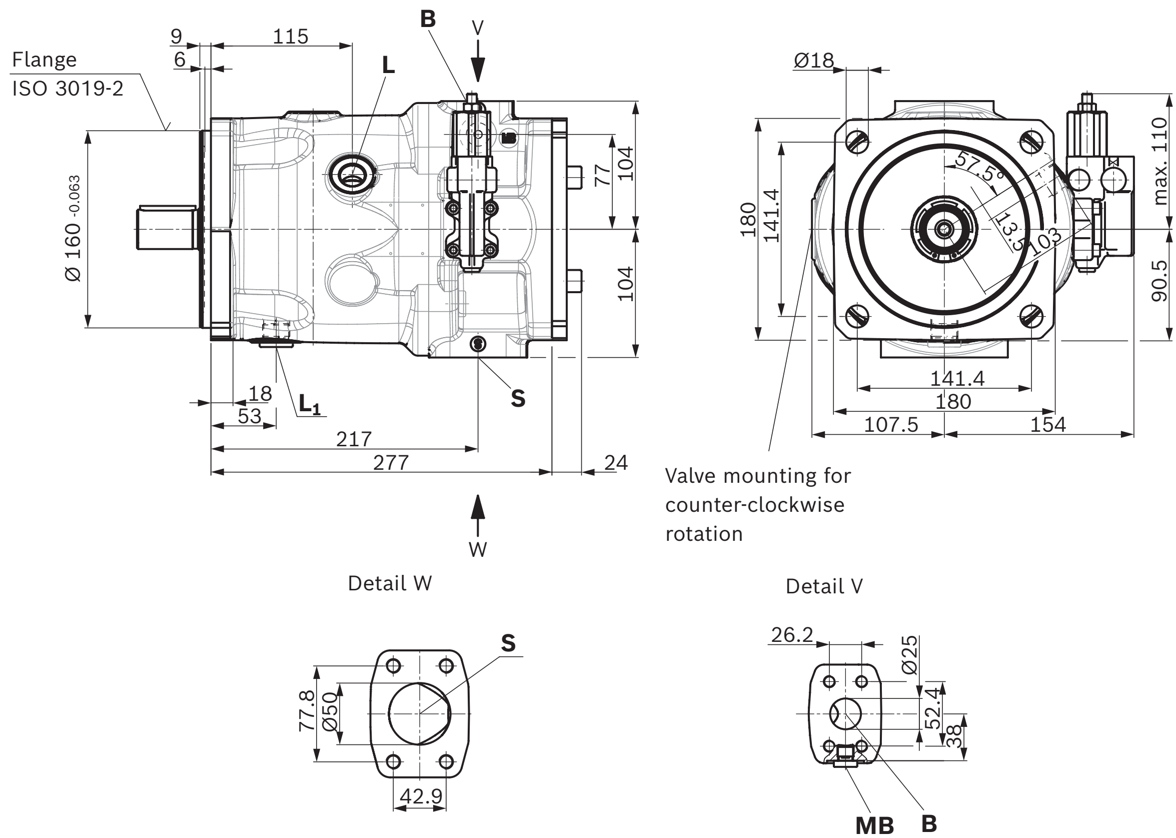


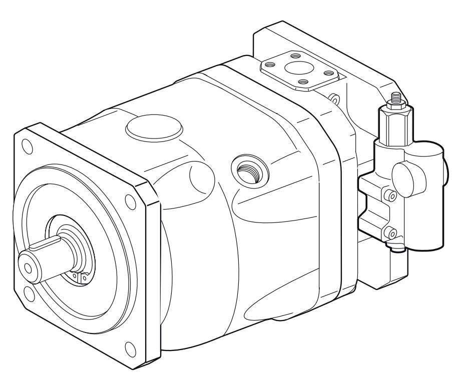
▼ **ED7./ER7. – Pressure controller, electric**



Dimensions, size 71

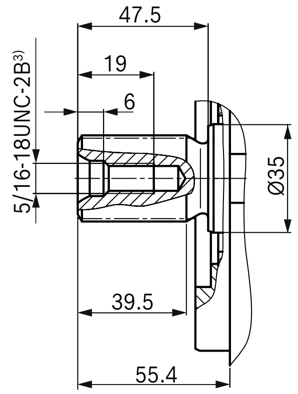
DR – Pressure controller





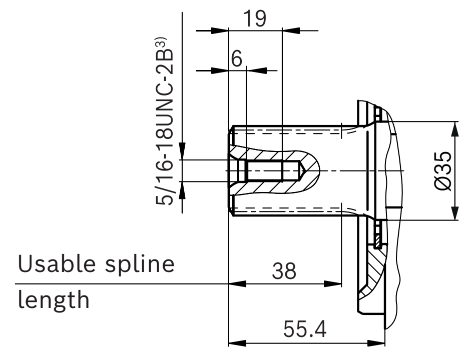
▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)**

S – 14T 12/24DP[1)]



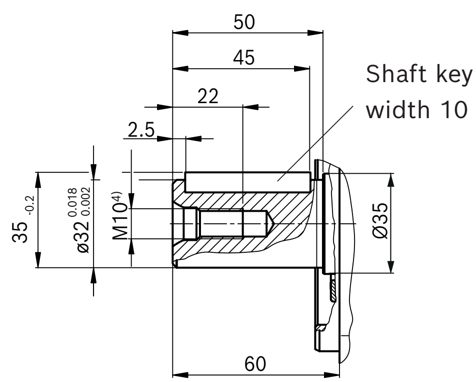
▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)**

R – 14T 12/24DP[1)2)]



▼ **Parallel keyed shaft DIN 6885**

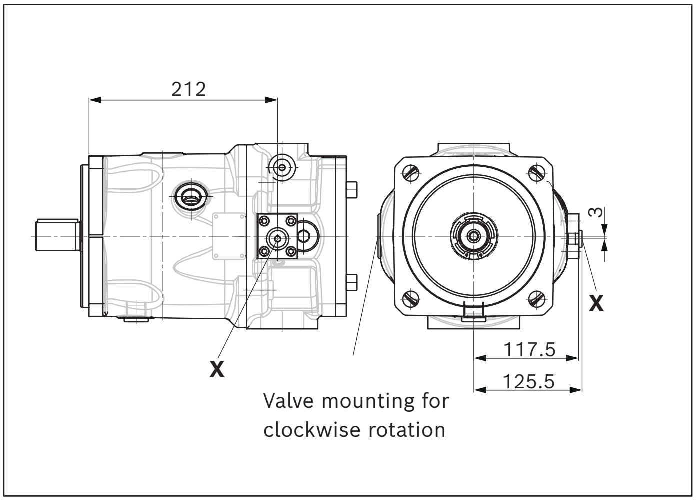
P – A10x8x45



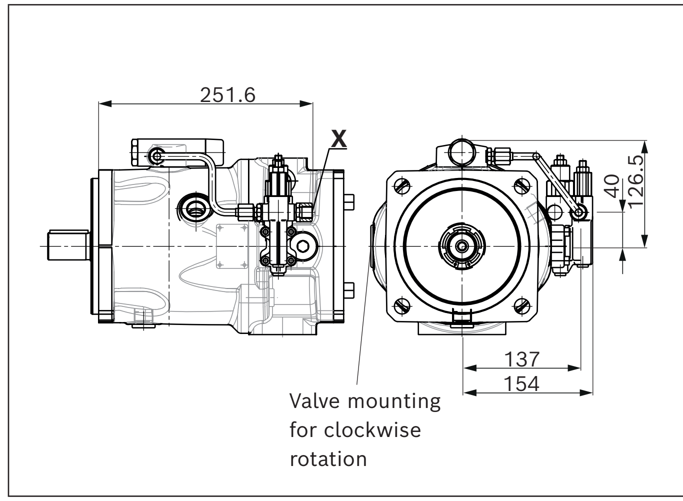
Ports		Standard	Size	p_{max} **[bar]**[5)]	State[8)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10x1.5; 17 deep	350	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 in M12 x 1.75; 20 deep	10	O
L	Drain port	DIN 3852[6)]	M22 x 1.5; 14 deep	2	O[7)]
$\mathbf{L_1}$	Drain port	DIN 3852[6)]	M22 x 1.5; 14 deep	2	X[7)]
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Pilot pressure (with DG-control)	DIN 3852-2	G 1/4 in; 12 deep	280	O
$\mathbf{M_B}$	Measuring pressure **B**	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Center bore according to DIN 332 (thread according to DIN 13)
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page 50).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

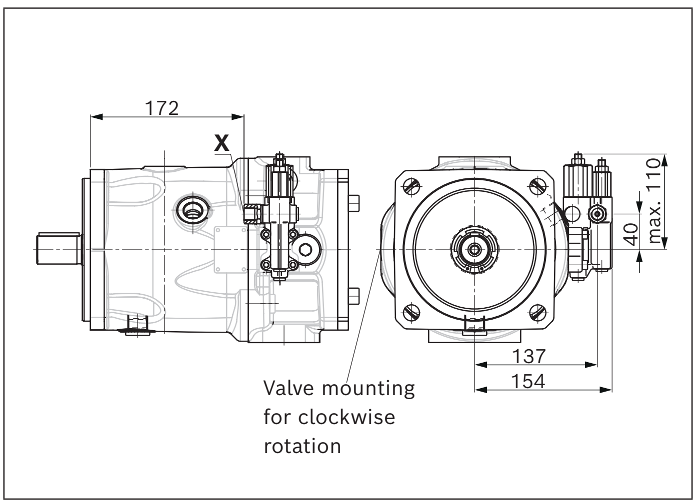
▼ **DG – Two-point control, direct operated**



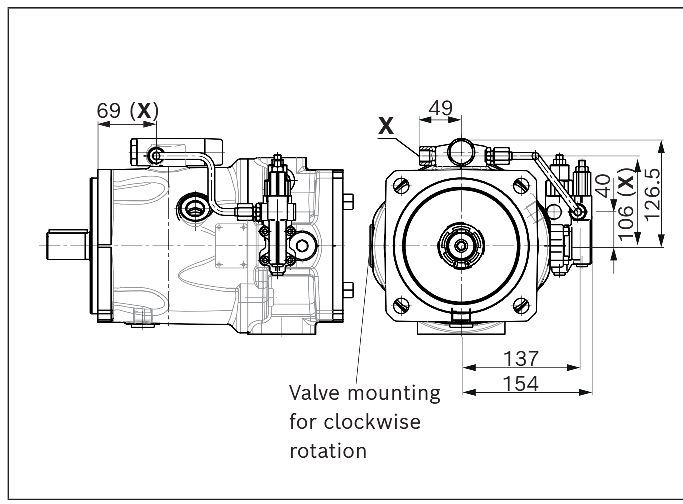
▼ **LA.DS – Pressure, flow and power controller**



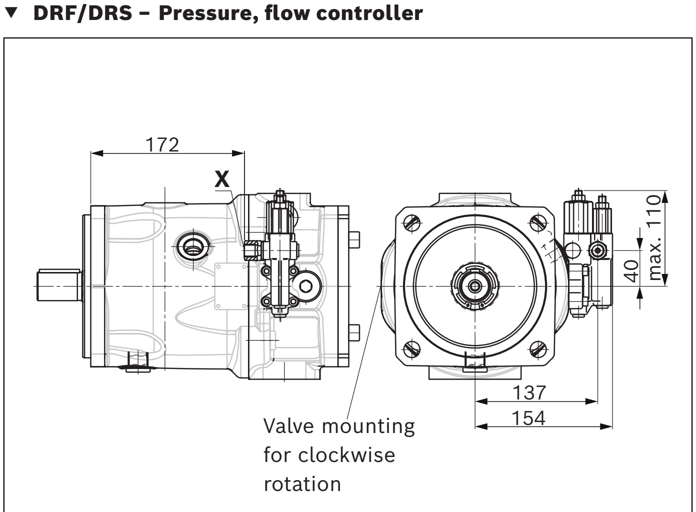
▼ **DRG – Pressure controller, remotely controlled**



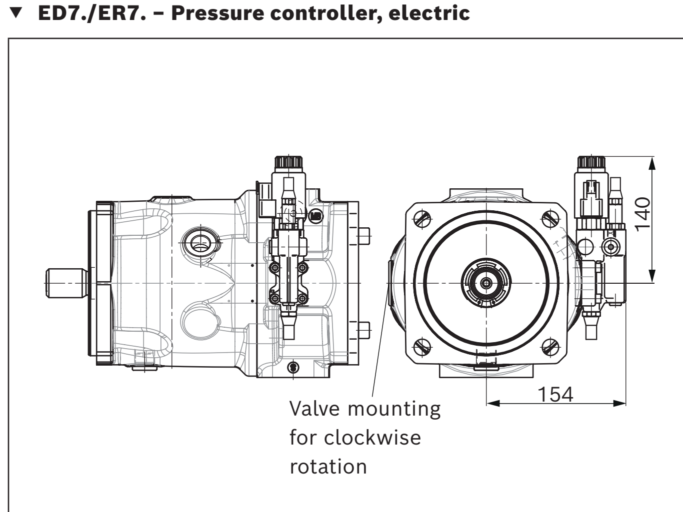
▼ **LA.DG – Power controller with pressure cut off, remote controlled**



▼ **DRF/DRS – Pressure, flow controller**

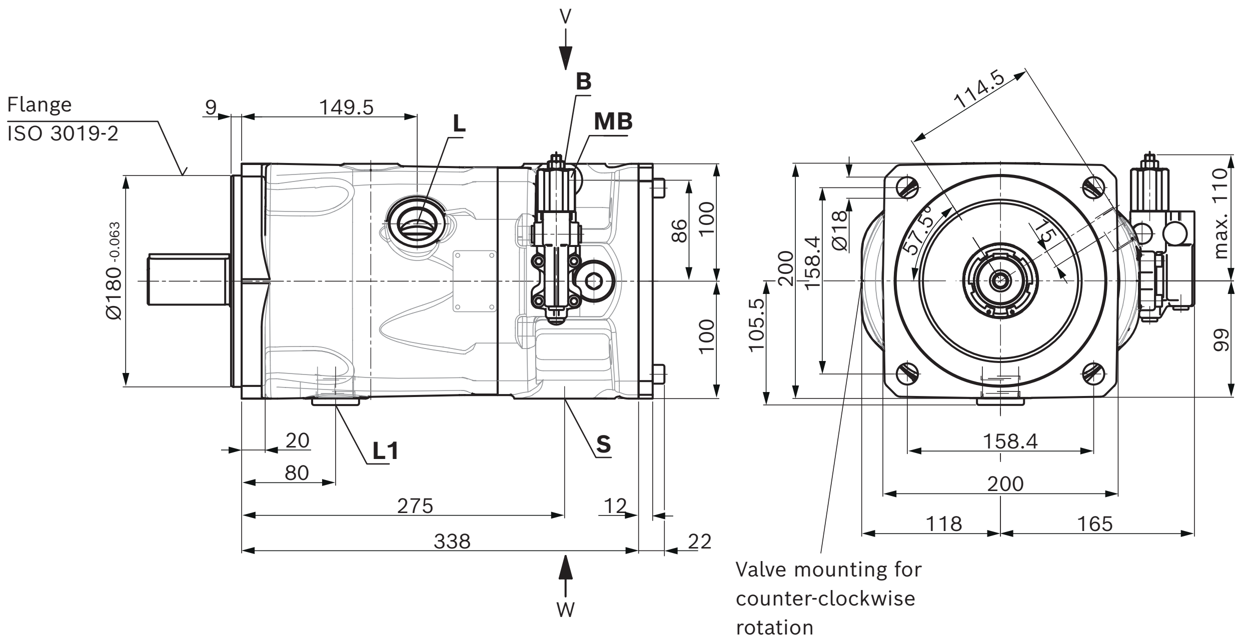


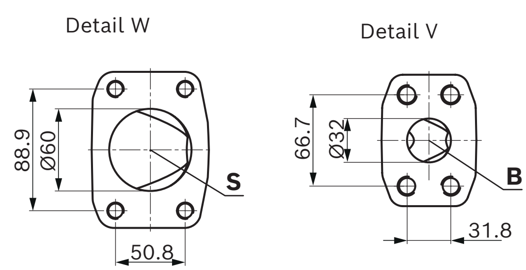
▼ **ED7./ER7. – Pressure controller, electric**

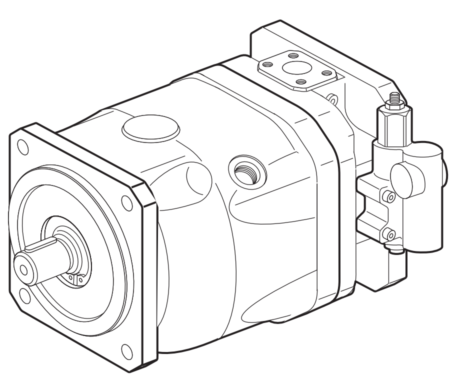


Dimensions, size 100

DR – Pressure controller

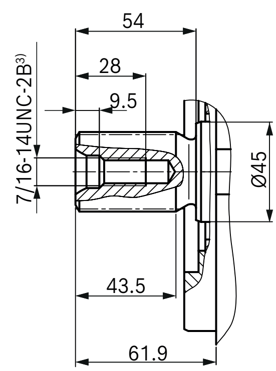






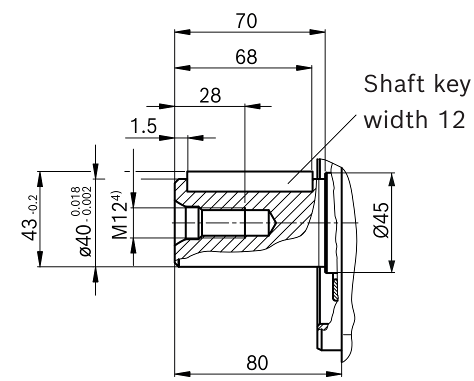
▼ Splined shaft 1 1/2 in (38-4, ISO 3019-1)

S – 17T 12/24DP[1)]



▼ Parallel keyed shaft DIN 6885

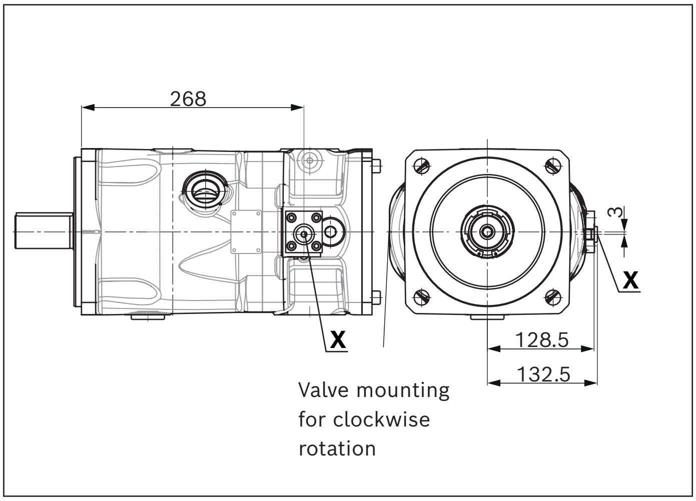
P – A12x8x68



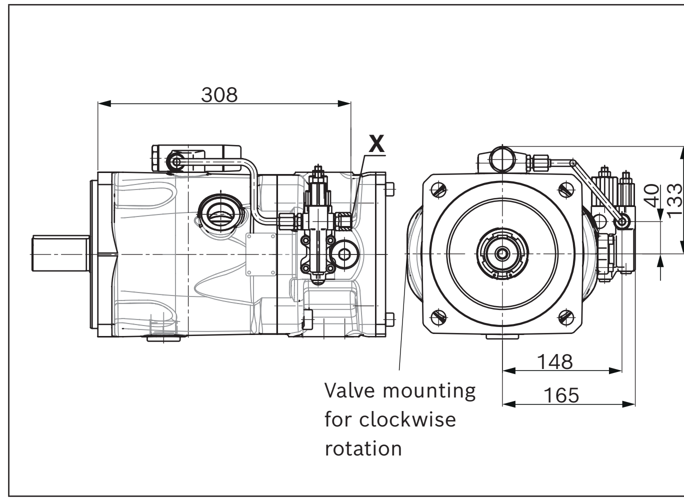
Ports		Standard	Size	p_{max} [bar][5)]	State[8)]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	DIN 3852[6)]	M33 x 2; 16 deep	2	O[7)]
$\mathbf{L_1}$	Drain port	DIN 3852[6)]	M33 x 2; 16 deep	2	X[7)]
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Pilot pressure (with DG-control)	DIN 3852-2	G 1/4 in; 12 deep	280	O
$\mathbf{M_B}$	Measuring pressure **B**	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Center bore according to DIN 332 (thread according to DIN 13)
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page 50).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

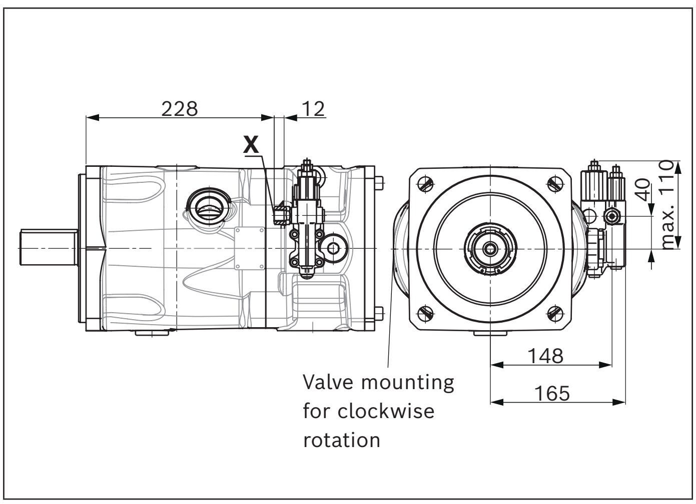
▼ DG – Two-point control, direct operated



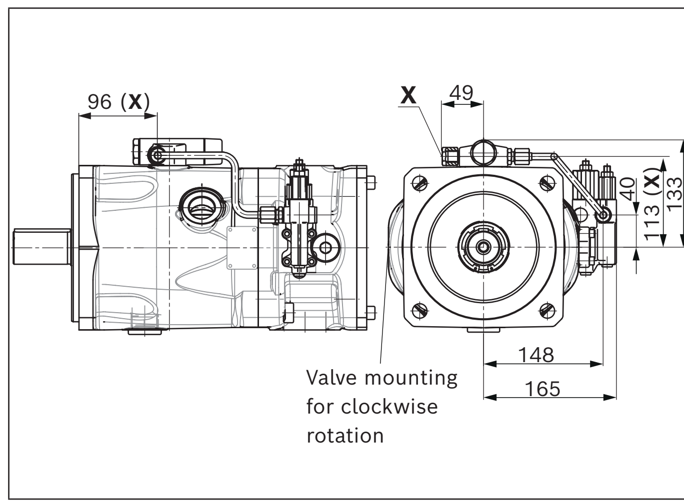
▼ LA.DS – Pressure, flow and power controller



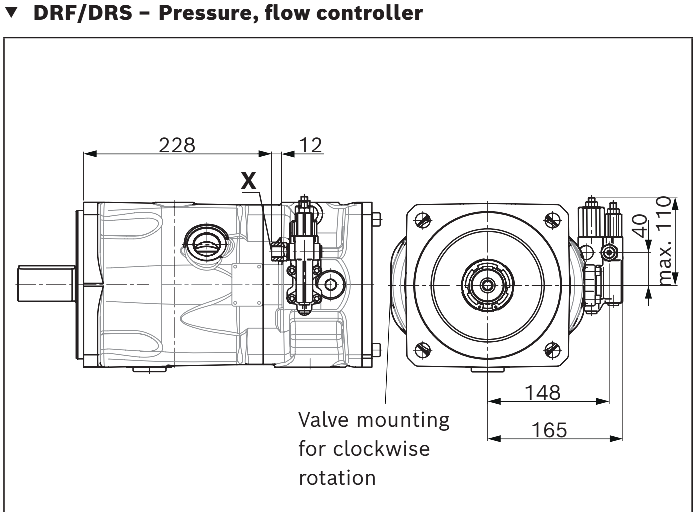
▼ DRG – Pressure controller, remotely controlled



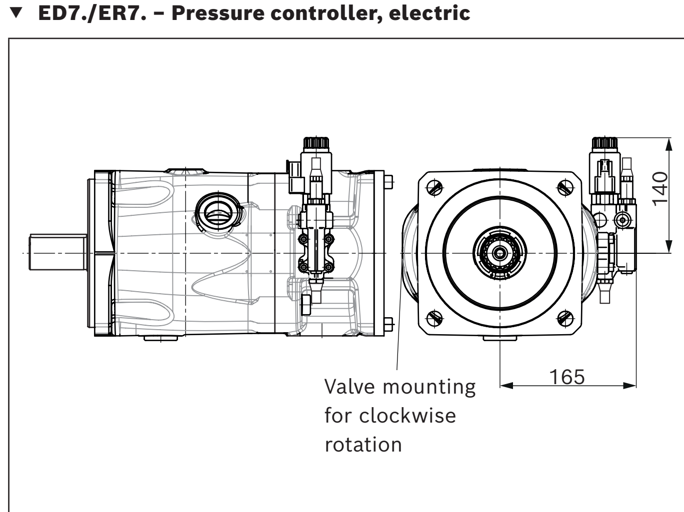
▼ LA.DG – Power controller with pressure cut off, remote controlled



▼ DRF/DRS – Pressure, flow controller

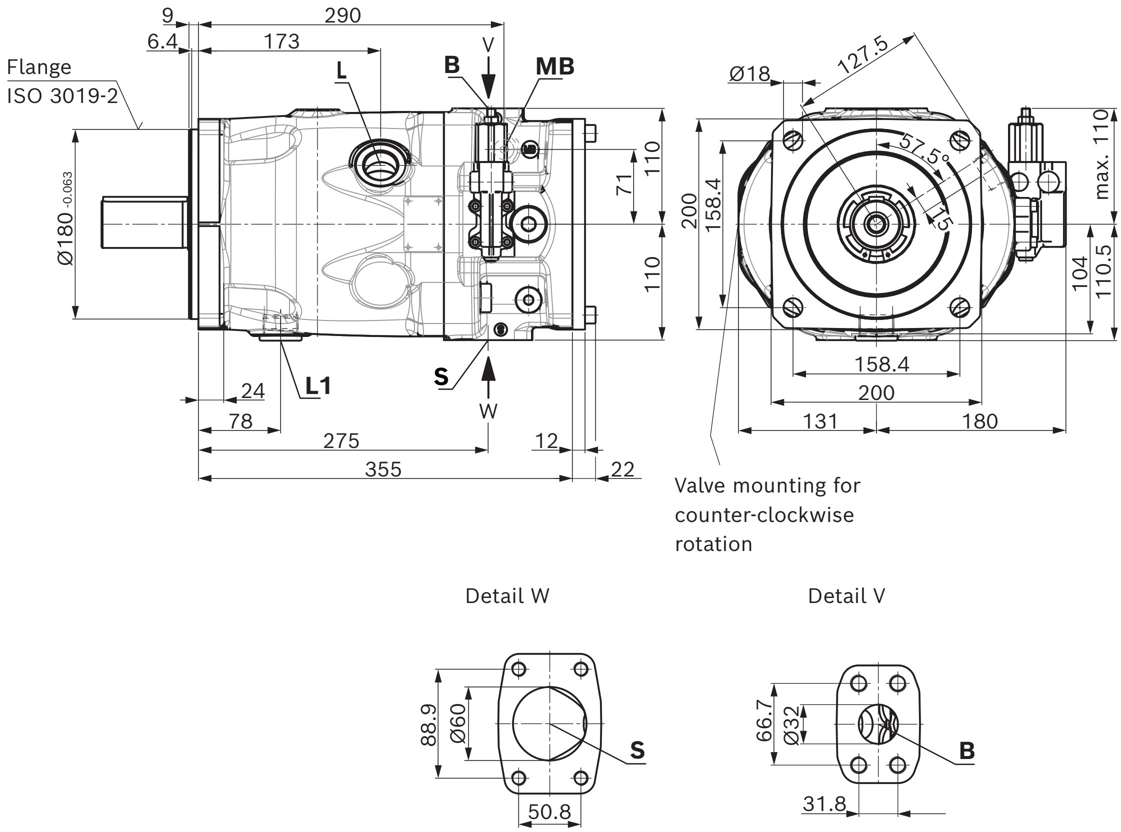


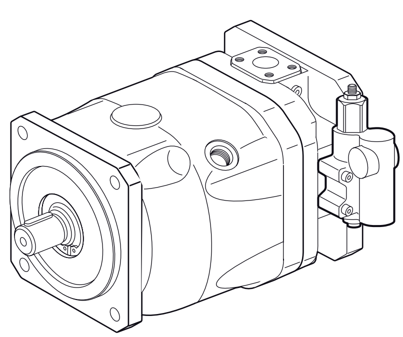
▼ ED7./ER7. – Pressure controller, electric



Dimensions, size 140

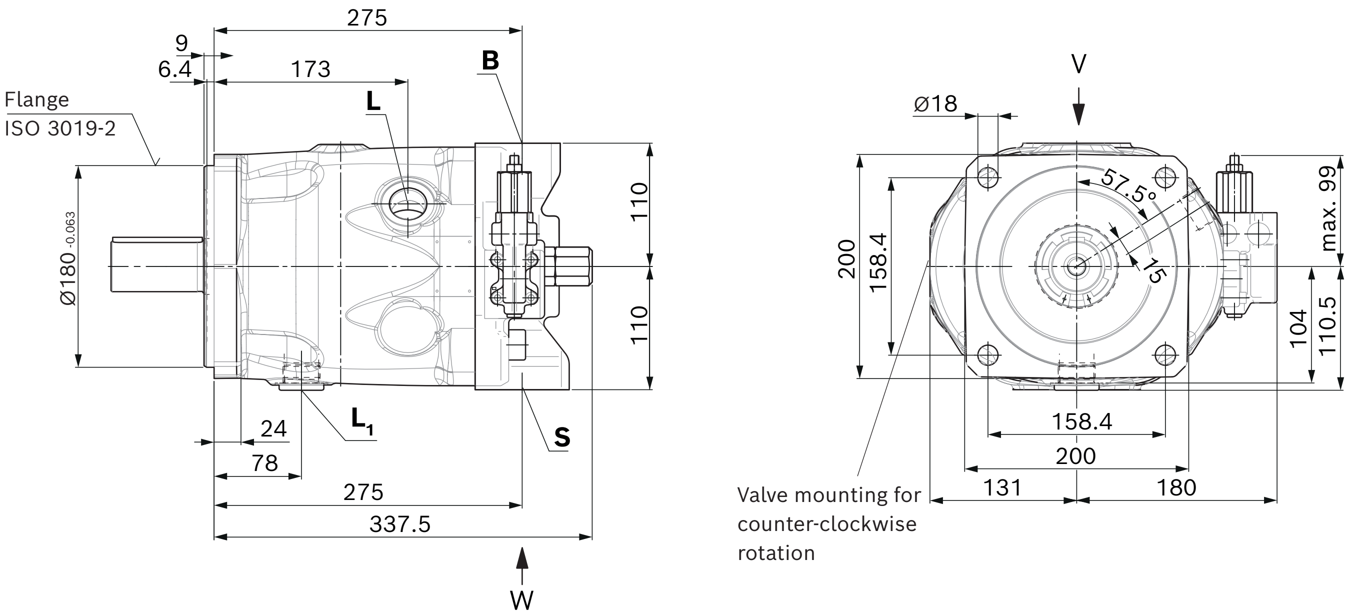
DR – Pressure controller, with port plate 22/32

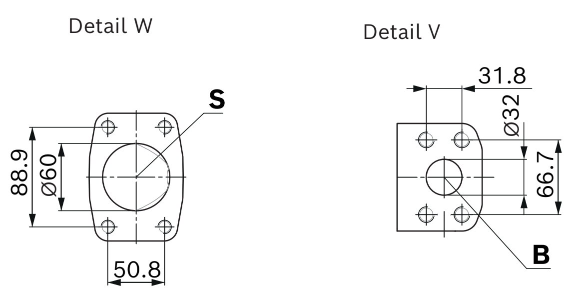




Dimensions, size 140

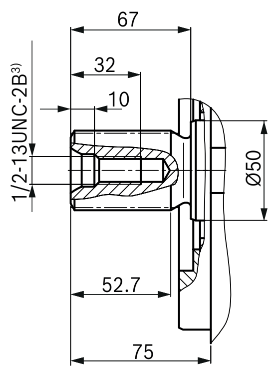
DR – Pressure controller, with port plate 12





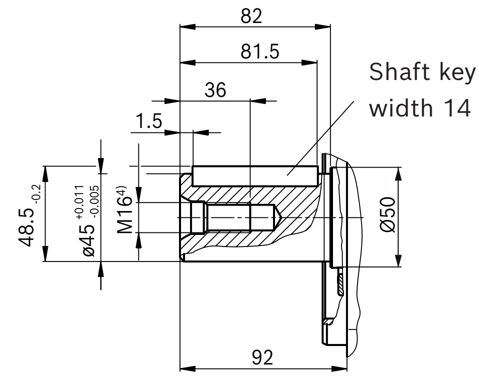
▼ **Splined shaft 1 3/4 in (44-4, ISO 3019-1)**

S – 13T 8/16DP[1)]



▼ **Parallel keyed shaft DIN 6885**

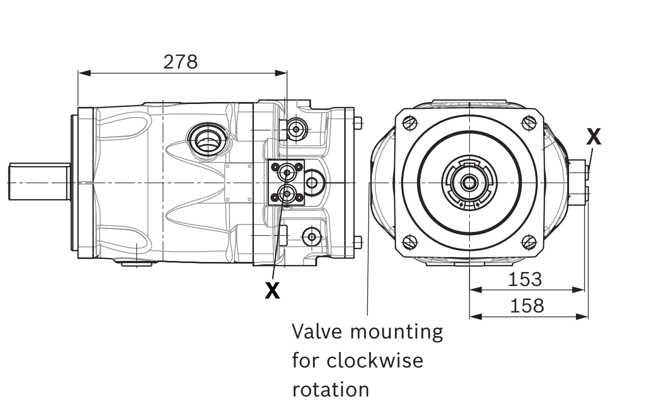
P – A12x8x68



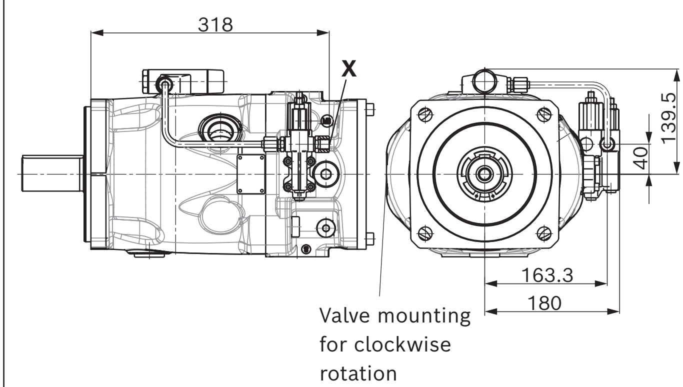
Ports		Standard	Size	p_{max} [bar][5)]	State[8)]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	DIN 3852[6)]	M33 x 2; 16 deep	2	O[7)]
$\mathbf{L_1}$	Drain port	DIN 3852[6)]	M33 x 2; 16 deep	2	X[7)]
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Pilot pressure (with DG-control)	DIN 3852-2	G 1/4 in; 12 deep	280	O
$\mathbf{M_B}$	Measuring pressure **B**[9)]	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Center bore according to DIN 332 (thread according to DIN 13)
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page 50).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
9) Only for port plate 22 and 32.

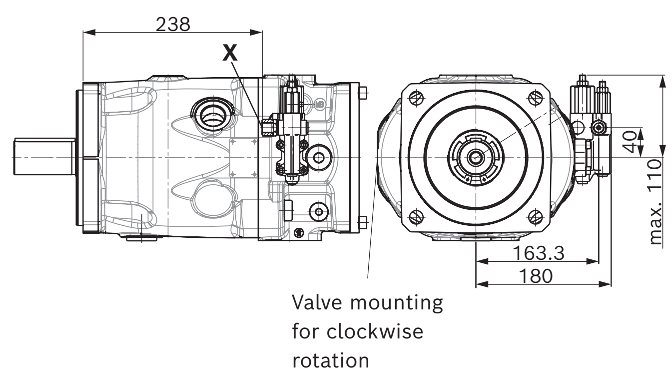
▼ **DG – Two-point control, direct operated, port plate 22/32**



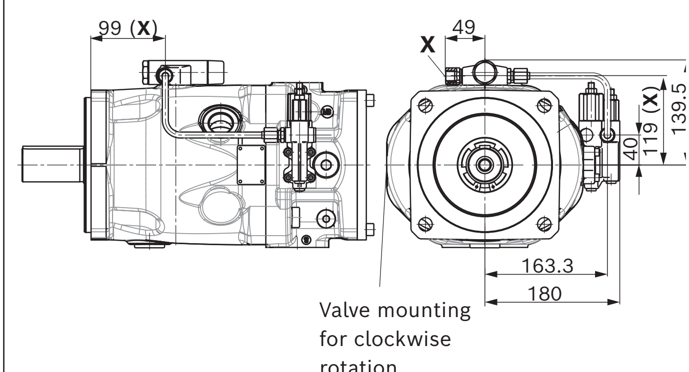
▼ **LA.DS – Pressure, flow and power controller, port plate 22/32**



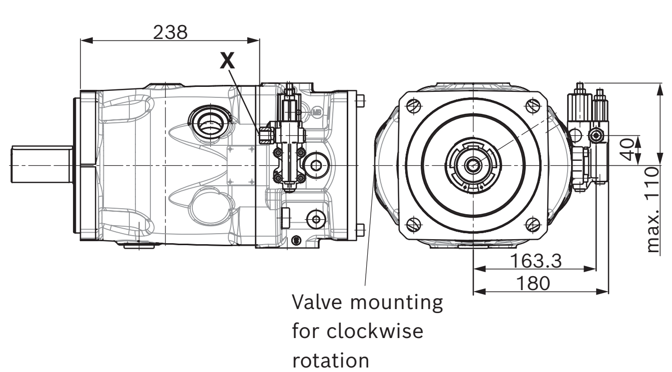
▼ **DRG – Pressure controller, remote controlled, port plate 22/32**



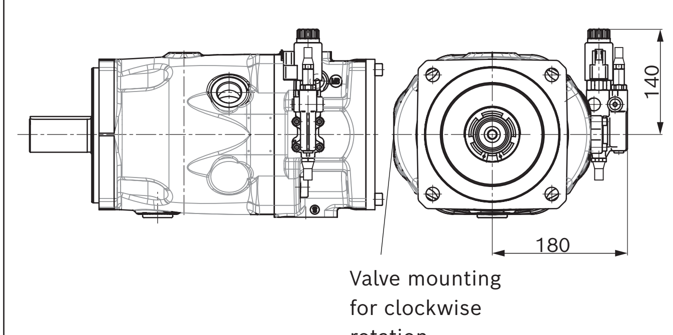
▼ **LA.DG – Power controller with pressure cut off, remote controlled, port plate 22/32**



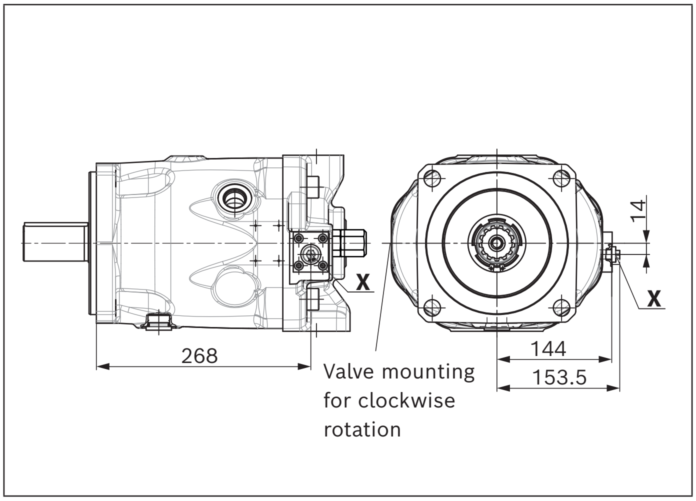
▼ **DRF/DRS – Pressure, flow controller, port plate 22/32**



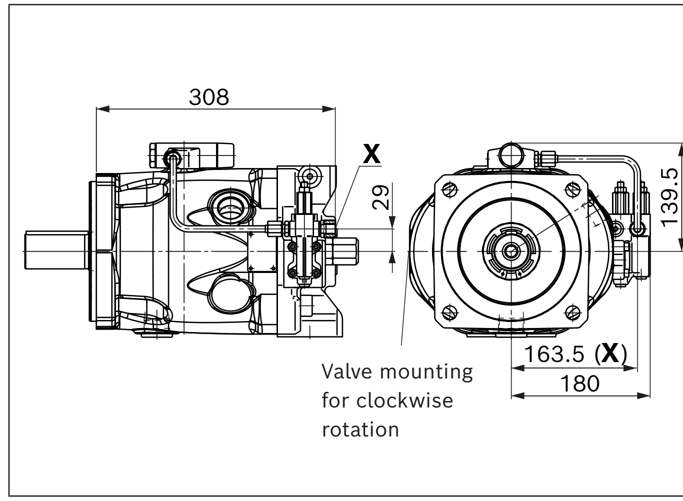
▼ **ED7./ER7. – Pressure controller, electric, port plate 22/32**



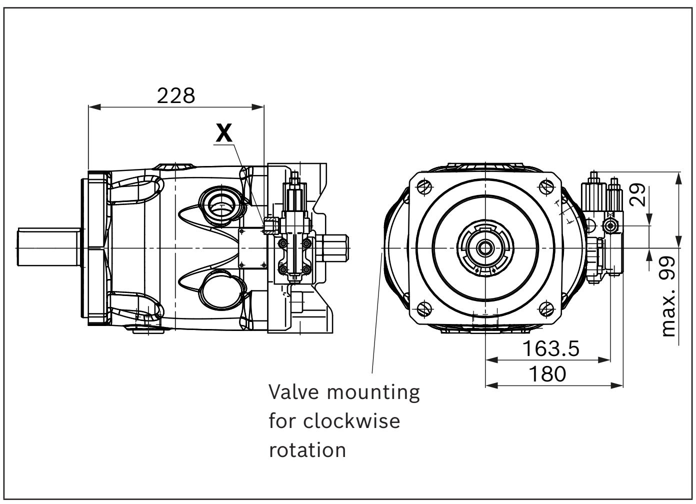
▼ **DG – Two-point control, direct operated, Port plate 12**



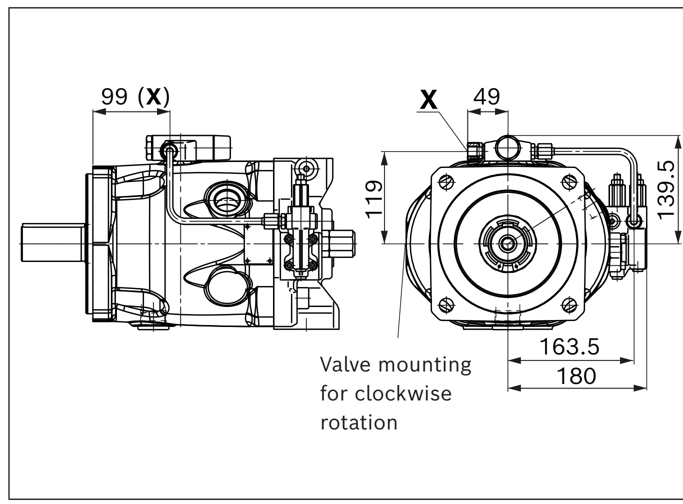
▼ **LA.DS – Pressure, flow and power controller, Port plate 12**



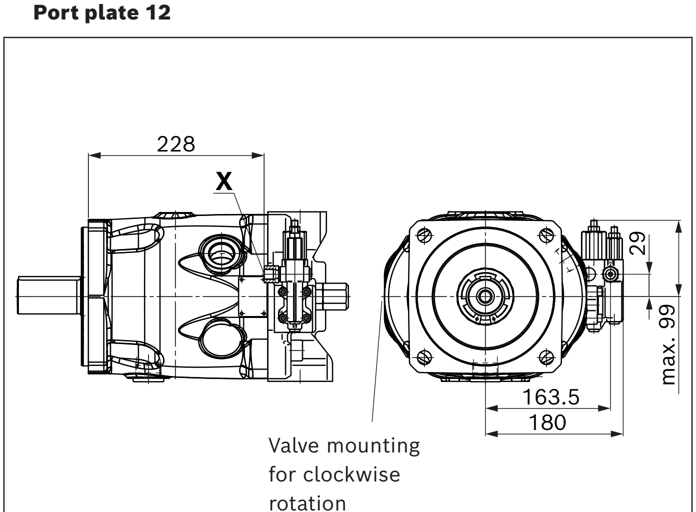
▼ **DRG – Pressure controller, remote controlled, Port plate 12**



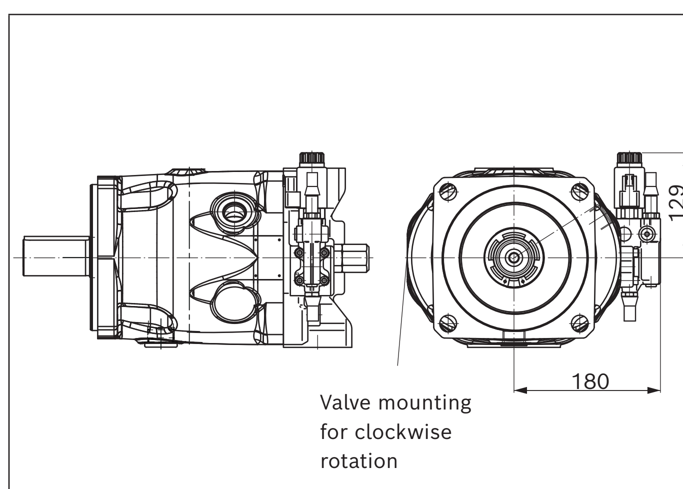
▼ **LA.DG – Power controller with pressure cut off, remote controlled Port plate 12**



▼ **DRF/DRS – Pressure, flow controller, Port plate 12**

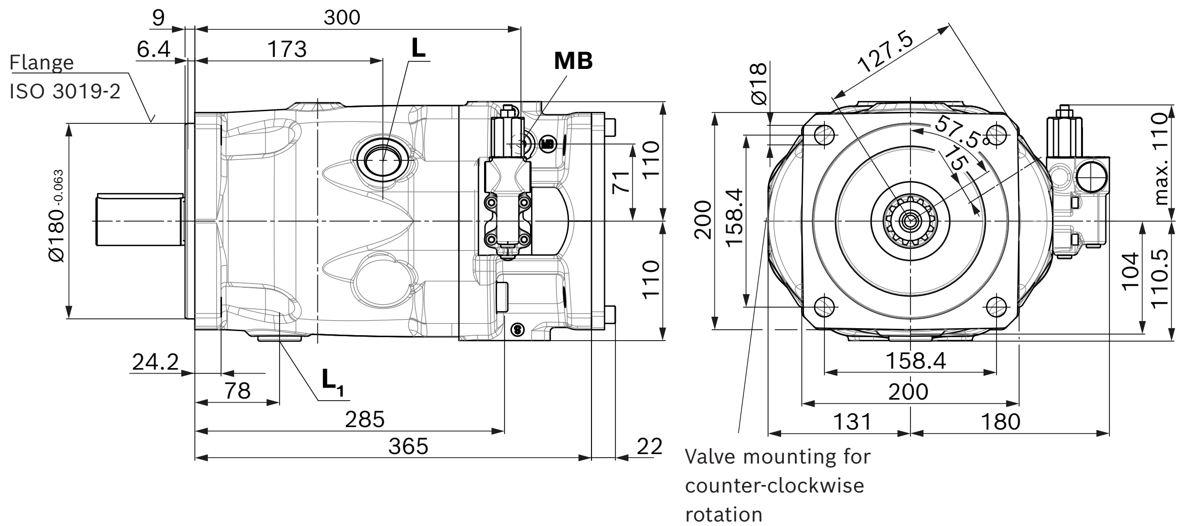


▼ **ED7./ER7. – Pressure controller, electric, Port plate 12**

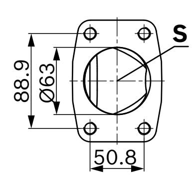


Dimensions, size 180

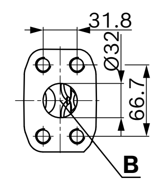
DR – Pressure controller

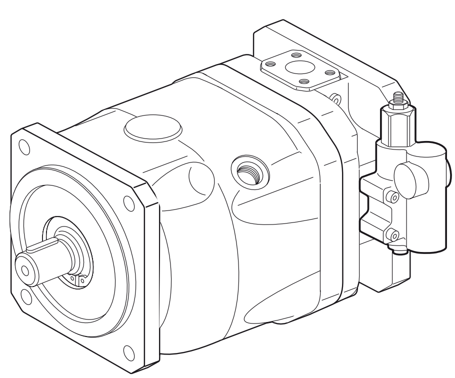


Detail W



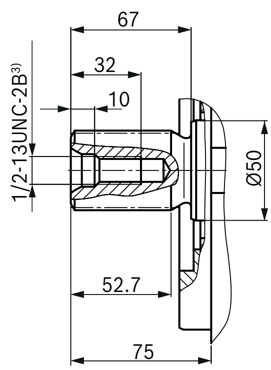
Detail V





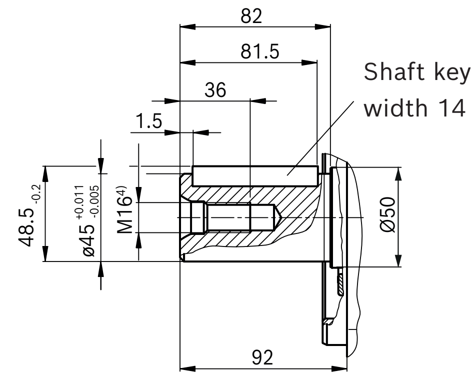
▼ **Splined shaft 1 3/4 in (44-4, ISO 3019-1)**

S – 13T 8/16DP[1]



▼ **Parallel keyed shaft DIN 6885**

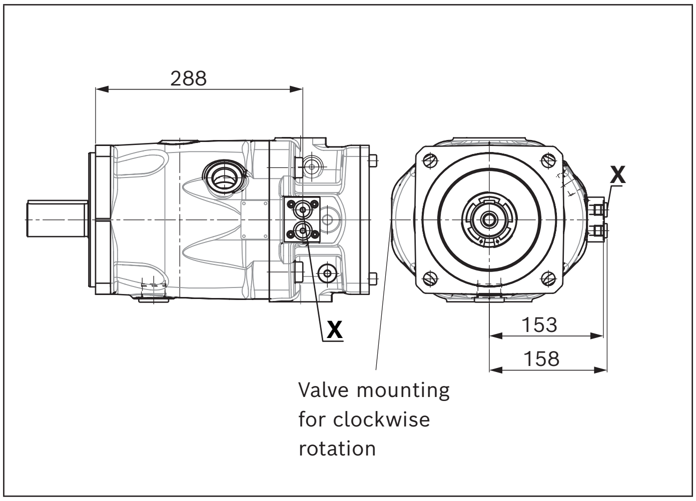
P – A12x8x68



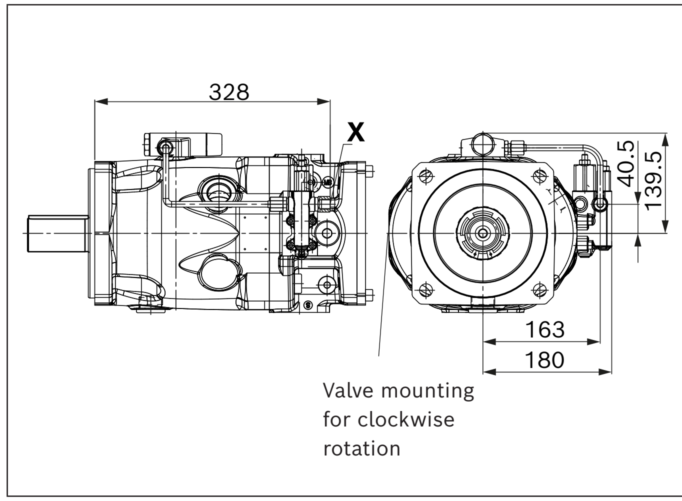
Ports		Standard	Size	p_{max} [bar][5]	State[8]
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	DIN 3852[6]	M33 x 2; 16 deep	2	O[7]
L₁	Drain port	DIN 3852[6]	M33 x 2; 16 deep	2	X[7]
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Pilot pressure (with DG-control)	DIN 3852-2	G 1/4 in; 12 deep	280	O
M$_B$	Measuring pressure **B**	DIN 3852-2[6]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Center bore according to DIN 332 (thread according to DIN 13)
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions on page 50).
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

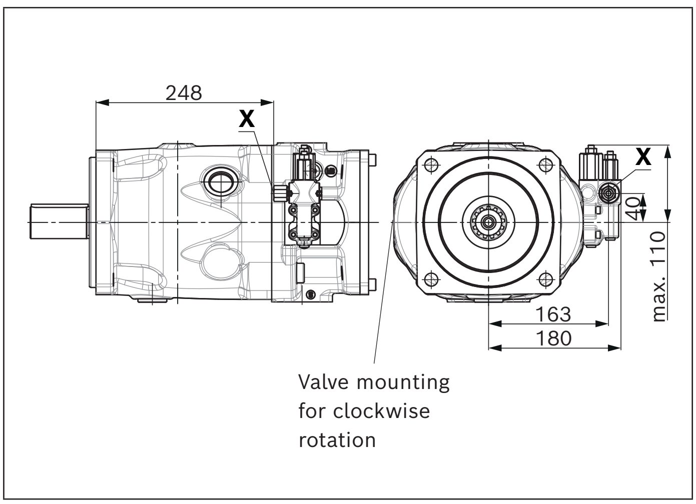
▼ DG – Two-point control, direct operated



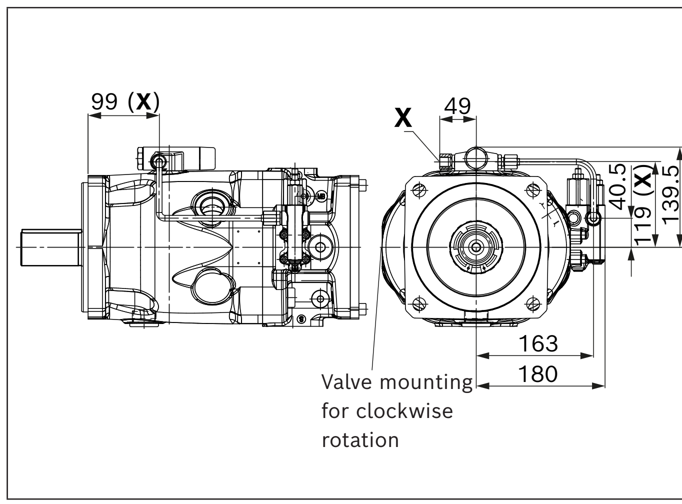
▼ LA.DS – Pressure, flow and power controller



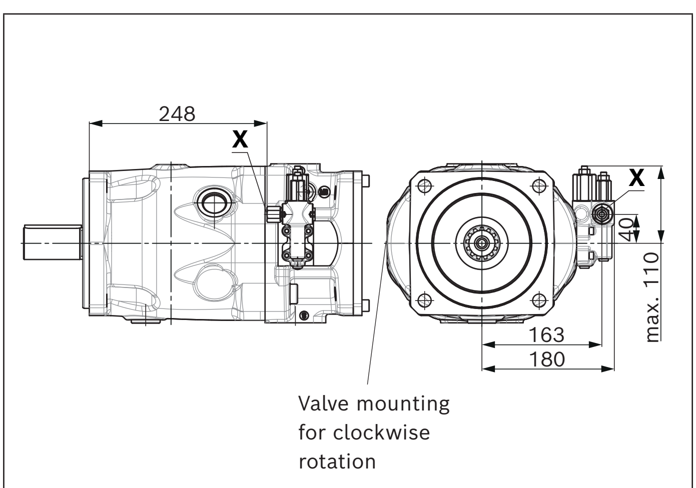
▼ DRG – Pressure controller, remotely controlled



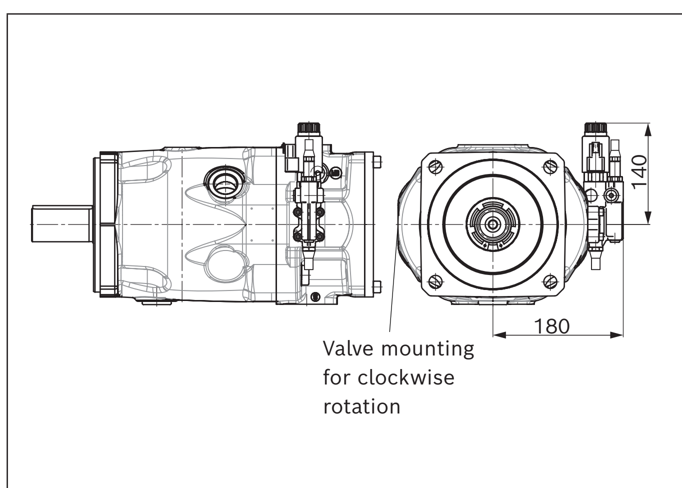
▼ LA.DG – Power controller with pressure cut off, remote controlled



▼ DRF/DRS – Pressure, flow controller



▼ ED7./ER7. – Pressure controller, electric



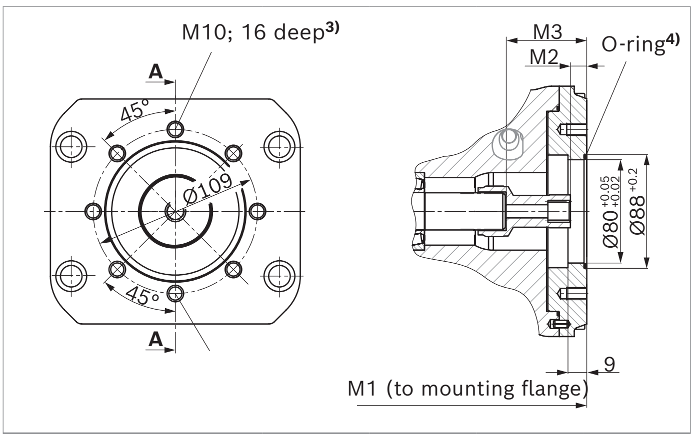
Dimensions, through drive

For flanges and drive shafts according to ISO 3019-2

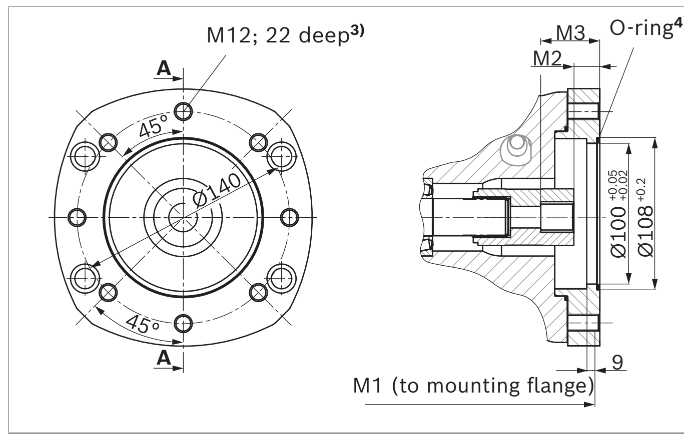
Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
80-2	8, ☍, ⚯	3/4 in	11T 16/32DP	●	●	●	●	●	UB2
	8, ☍			–	–	–	●	–	KB2
100-2	8, ☍, ⚯	7/8 in	13T 16/32DP	●	●	●	●	●	UB3
	☍			–	–	–	●	–	KB3

● = Available ○ = On request

▼ **80-2**

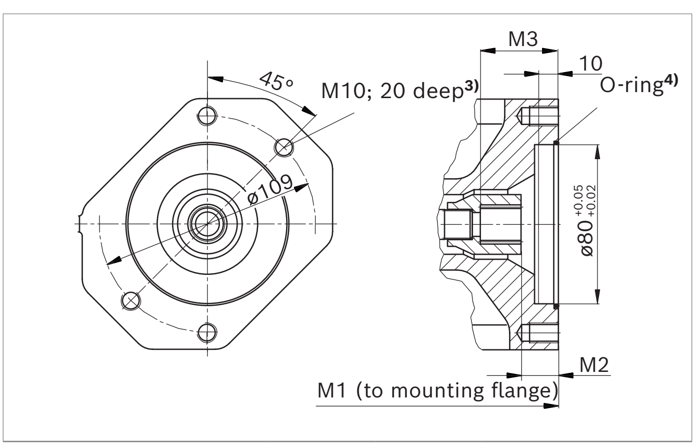


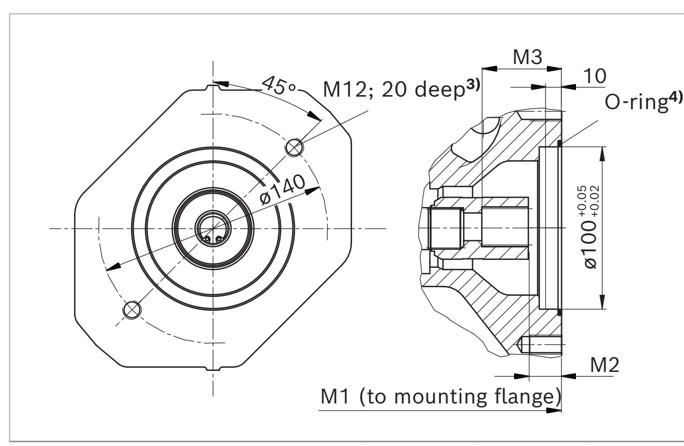
▼ **100-2**



UB2 (19-4 (A-B))	NG	M1	M2[5]	M3[5]
	45	264	19	39.4
	71	299	20.8	41.2
	100	360	19	40
	140	377	18.6	39.6
	180	387	18.9	39.9

UB3 (22-4 (B))	NG	M1	M2[5]	M3[5]
	45	264	18	42.4
	71	299	19.8	44.2
	100	360	18	42.3
	140	377	17.6	41.9
	180	387	17.9	42.2





KB2 (19-4 (A-B))	NG	M1	M2[5]	M3[5]
	140	350	18.4	39.4

KB3 (22-4 (B))	NG	M1	M2[5]	M3[5]
	140	350	17.4	41.7

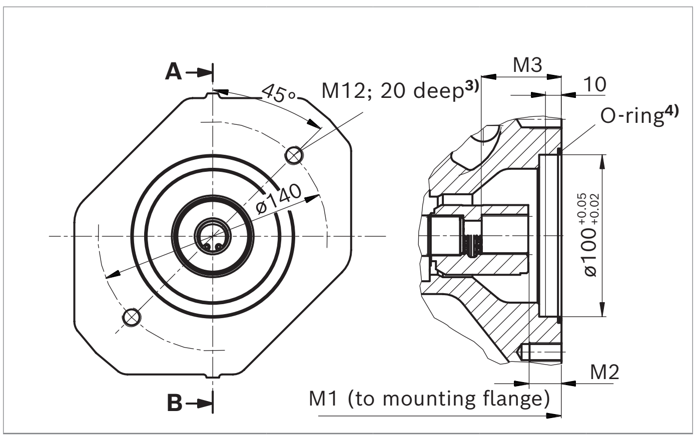
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

For flanges and drive shafts according to ISO 3019-2

Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	**Mounting**[2]	**Diameter**		**45**	**71**	**100**	**140**	**180**	
100-2	o°	1 in	15T 16/32DP	–	–	–	●	–	KB4
125-2	o°, oo	1 1/4 in	14T 12/24DP	–	–	–	●	–	KB5
		1 1/2 in	17T 12/24DP	–	–	–	●	–	KB6

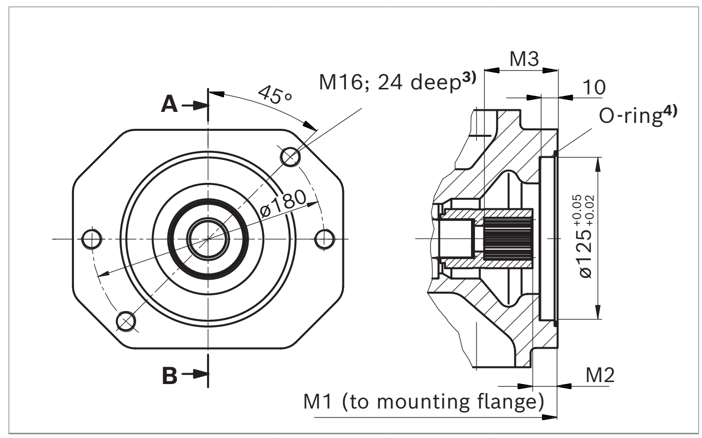
● = Available ○ = On request

▼ **100-2**

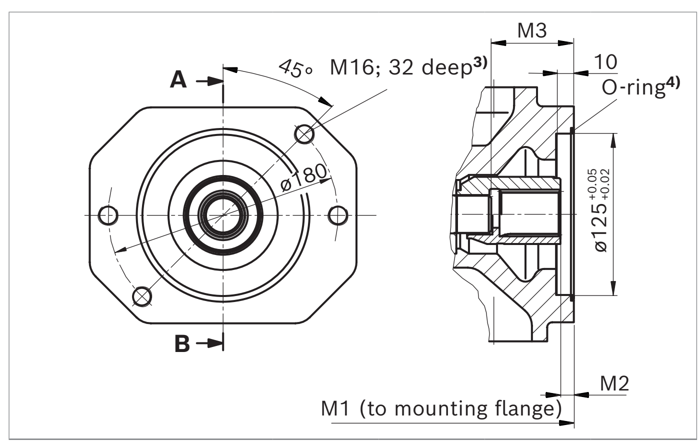


KB4 (25-4 (B-B))	**NG**	**M1**	**M2**[5]	**M3**[5]
	140	350	17.9	47.4

▼ **125-2**



KB5 (32-4 (C))	**NG**	**M1**	**M2**[5]	**M3**[5]
	140	350	18.9	56.2



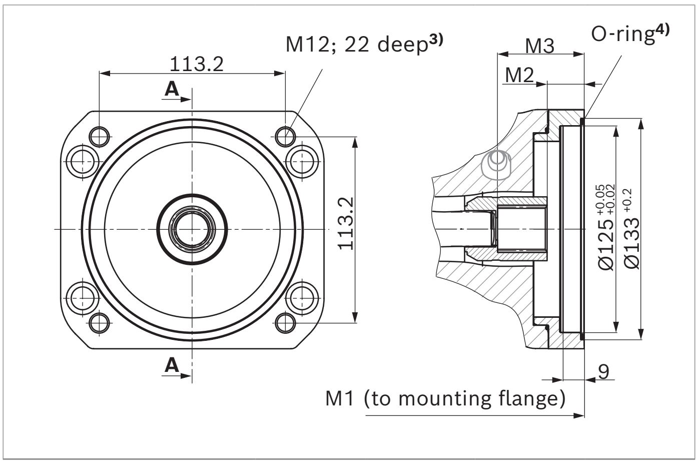
KB6 (38-4 (C-C))	**NG**	**M1**	**M2**[5]	**M3**[5]
	140	350	9.4	68.4

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

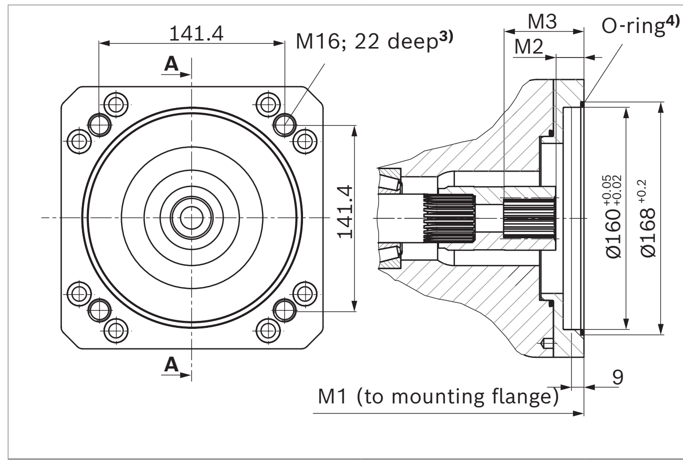
For flanges and drive shafts according to ISO 3019-2

Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
125-4	⌘	1 in	15T 16/32DP	●	●	●	●	●	UE1
160-4	⌘	1 1/4 in	14T 12/24DP	–	●	●	●	●	UB8

▼ **125-4**



▼ **160-4**



UE1 (25-4(B-B))	NG	M1	M2[5)]	M3[5)]
	45	264	18.5	48.0
	71	299	20.3	49.2
	100	360	18.2	47.0
	140	377	18.1	47.6
	180	387	18.4	47.9

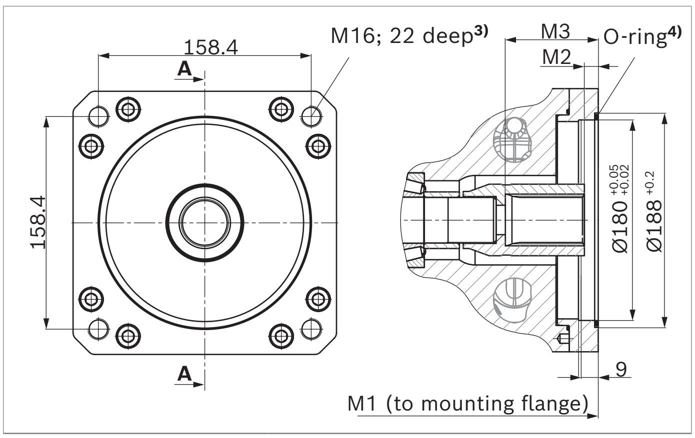
UB8 (32-4 (C))	NG	M1	M2[5)]	M3[5)]
	71	299	20.3	58.3
	100	360	19.5	57.5
	140	377	19.1	56.4
	180	387	19.4	56.7

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

For flanges and drive shafts according to ISO 3019-2

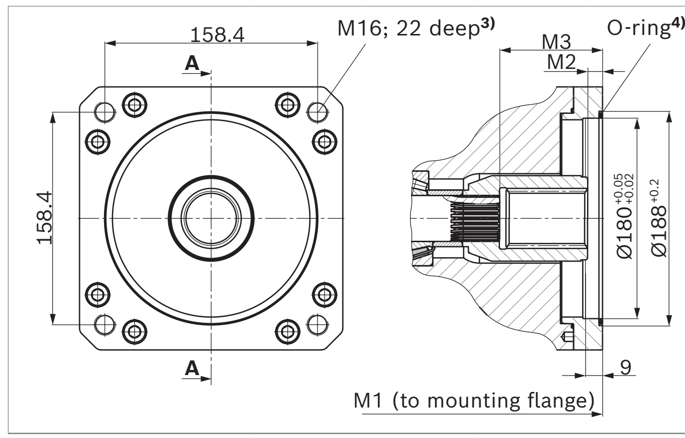
Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
180-4		1 1/2 in	17T 12/24DP	–	–	●	●	●	UB9
		1 3/4 in	13T 8/16DP	–	–	–	●	●	UB7
				–	–	–	●	–	KB7

▼ **180-4**



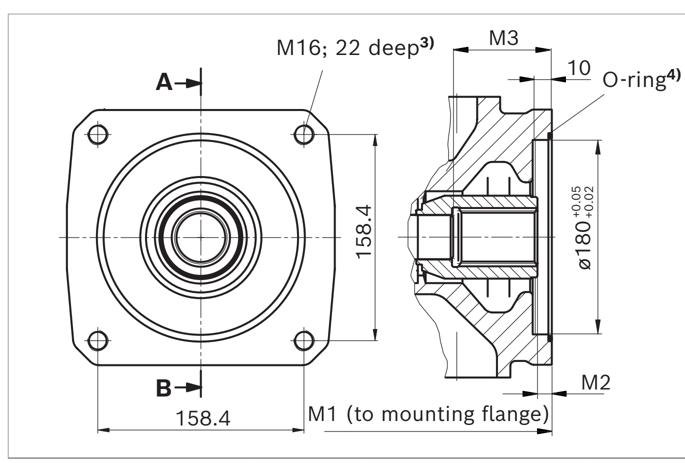
UB9 (38-4 (C-C))	**NG**	**M1**	**M2**[5]	**M3**[5]
	100	360	21	63
	140	377	9.6	68.6
	180	387	9.9	68.9

▼ **180-4**



UB7 (44-4 (D))	**NG**	**M1**	**M2**[5]	**M3**[5]
	140	377	9.3	75.9
	180	387	10.4	76.4

▼ **180-4**



KB7 (44-4 (D))	**NG**	**M1**	**M2**[5]	**M3**[5]
	140	350	9.7	76.3

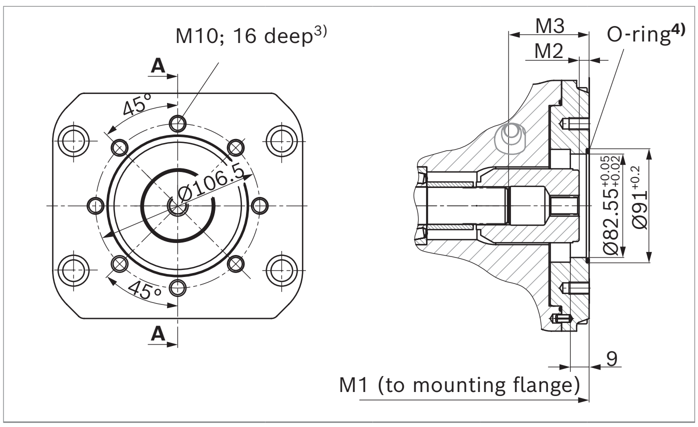
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

For flanges and drive shafts according to ISO 3019-1

Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
82-2 (A)	8, ♂, ⊶	5/8 in	9T 16/32DP	●	●	●	●	●	U01
				–	–	–	●	–	K01
	8, ♂, ⊶	3/4 in	11T 16/32DP	●	●	●	●	●	U52
				–	–	–	●	–	K52

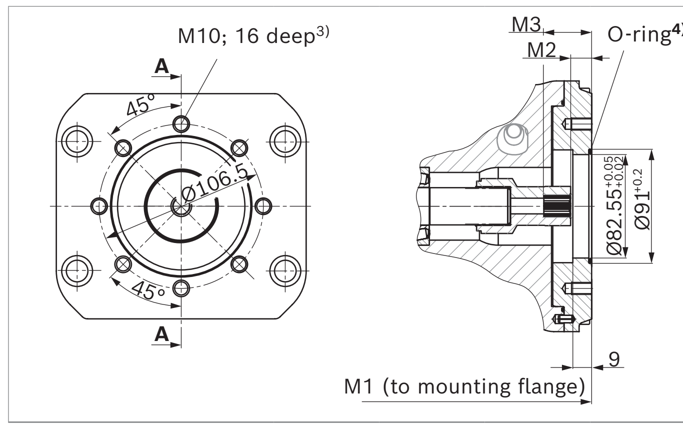
● = Available ○ = On request

▼ **82-2 (A)**



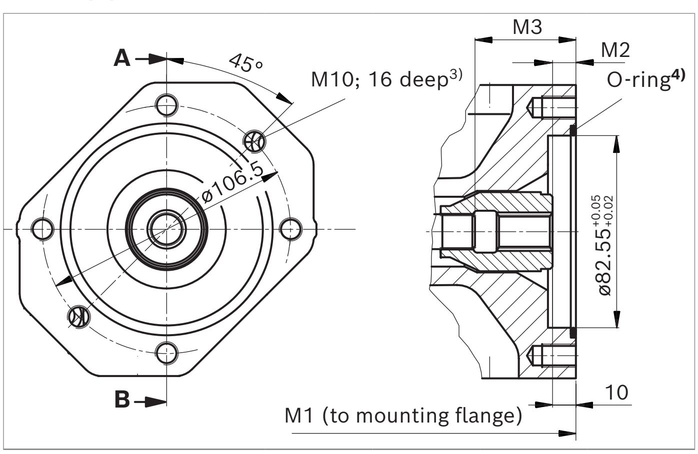
U01 (16-4 (A))	NG	M1	M2[5]	M3[5]
	45	264	21.2	53.3
	71	299	8.4	60.6
	100	360	9.7	64.7
	140	377	9.7	76.8
	180	387	10.8	77.1

▼ **82-2 (A)**



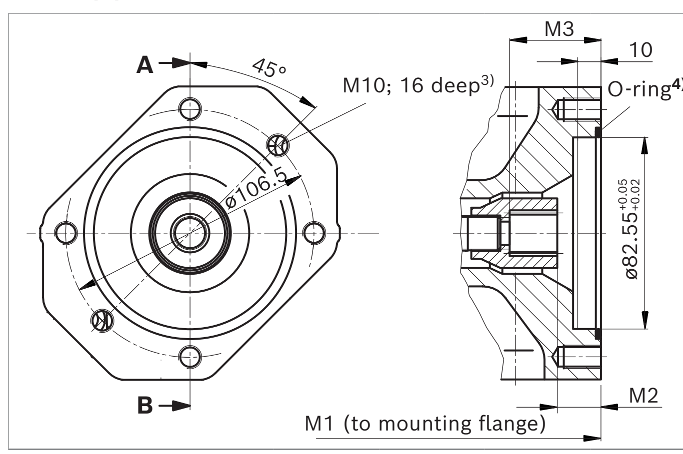
U52 (19-4 (A-B))	NG	M1	M2[5]	M3[5]
	45	264	19	39.4
	71	299	20.8	41.2
	100	360	19	40
	140	377	18.6	39.6
	180	387	18.9	39.9

▼ **82-2 (A)**



K01 (16-4 (A))	NG	M1	M2[5]	M3[5]
	140	350	10.1	76.6

▼ **82-2 (A)**



K52 (19-4 (A-B))	NG	M1	M2[5]	M3[5]
	140	350	18.4	39.4

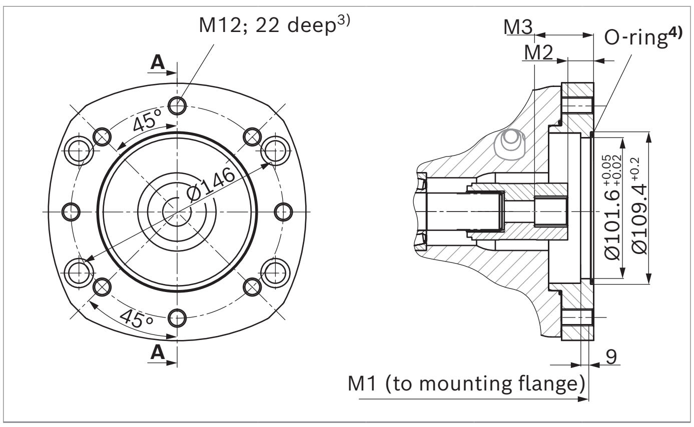
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) Minimum dimension

For flanges and drive shafts according to ISO 3019-1

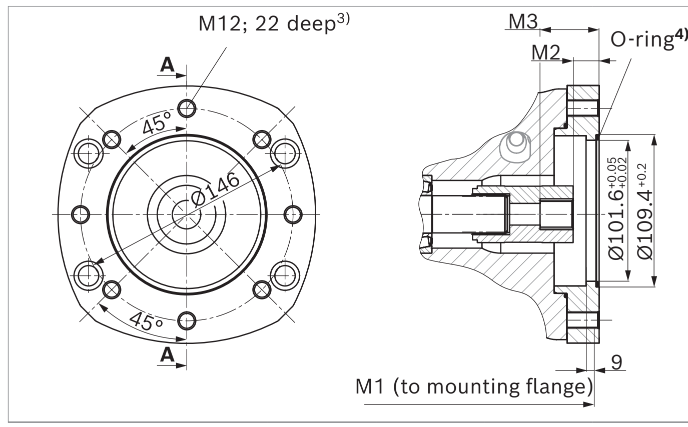
Flange		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
101-2 (B)	8, o°, o-o	7/8 in	13T 16/32DP	●	●	●	●	●	U68
				–	–	–	●	–	K68
	8, o°, o-o	1 in	15T 16/32DP	●	●	●	●	●	U04
				–	–	–	●	–	K04

● = Available ○ = On request

▼ **101-2**



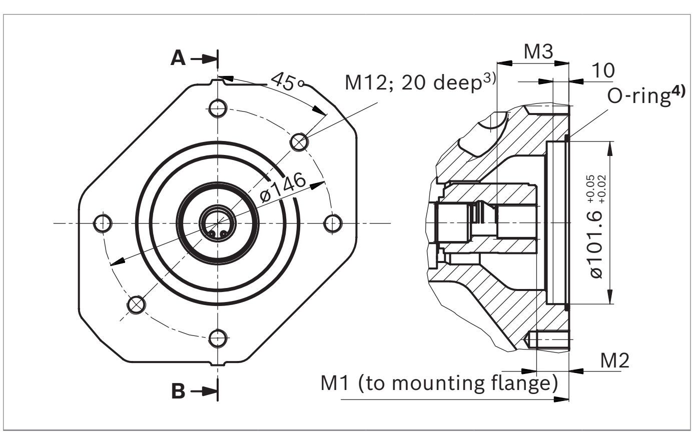
▼ **101-2**



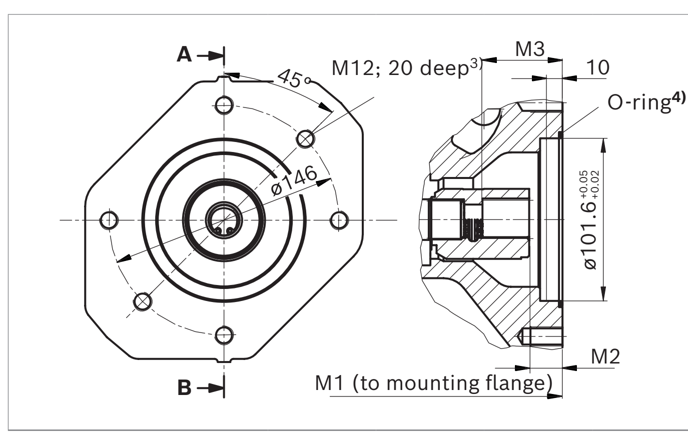
U68 (22-4) (B))	NG	M1	M2[5]	M3[5]
	45	264	18	42.4
	71	299	19.8	44.2
	100	360	18	42.3
	140	377	17.6	41.9
	180	387	17.9	42.2

U04 (25-4 (B-B))	NG	M1	M2[5]	M3[5]
	45	264	18.5	48
	71	299	20.3	49.2
	100	360	18.2	47
	140	377	18.1	47.6
	180	387	18.4	47.9

▼ **101-2**



▼ **101-2**



K68 (22-4) (B))	NG	M1	M2[5]	M3[5]
	140	350	17.4	41.7

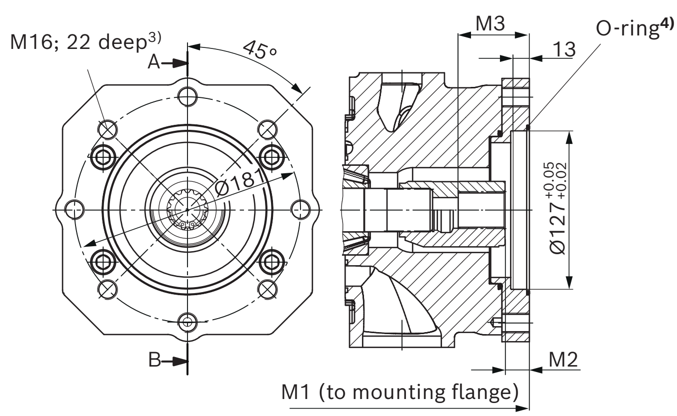
K04 (25-4 (B-B))	NG	M1	M2[5]	M3[5]
	140	350	17.9	47.4

1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

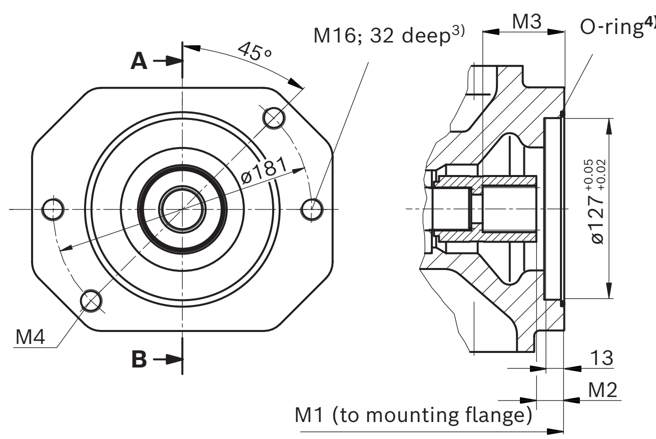
For flanges and drive shafts according to ISO 3019-1

Flange		Splined shaft[1]		Availability across sizes					Code
Diameter	Mounting[2]	Diameter		45	71	100	140	180	
127-2 (C)		1 1/4 in	14T 12/24DP	–	●	●	●	●	U07
		1 1/4 in	14T 12/24DP	–	–	–	●	–	K07

▼ **127-2 (C)**



▼ **127-2 (C)**



U07 (32-4 (C))	NG	M1	M2[5]	M3[5]
	71	299	20.3	58.3
	100	360	19.5	57.5
	140	377	19.1	56.4
	180	387	19.4	56.7

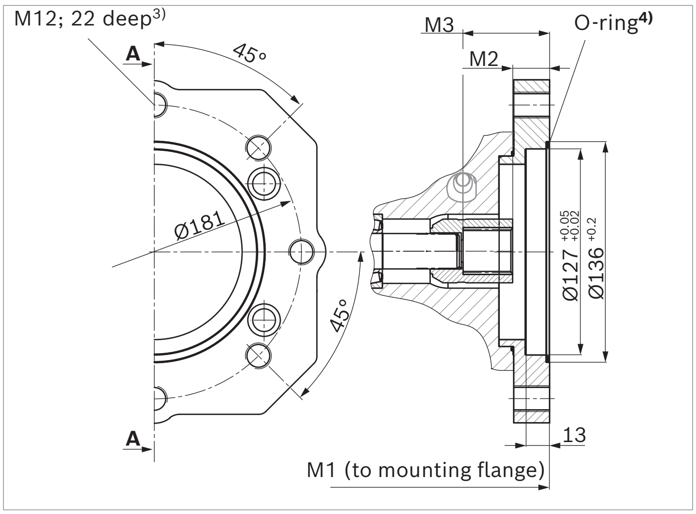
K07 (32-4 (C))	NG	M1	M2[5]	M3[5]
	140	350	18.9	56.2

1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

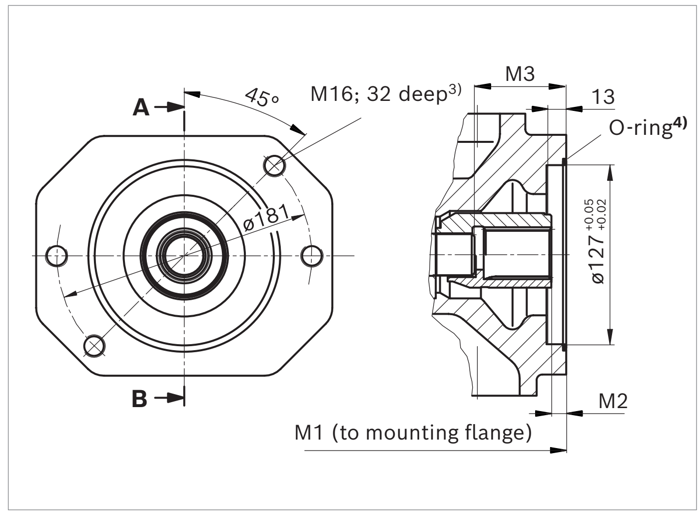
For flanges and drive shafts according to ISO 3019-1

Flange		Splined shaft[1)]		Availability across sizes					Code
Diameter	**Mounting**[2)]	**Diameter**		**45**	**71**	**100**	**140**	**180**	
127-2 (C)	8, o°, oo	1 1/2 in	17T 12/24DP	–	–	●	●	●	U24
127-2 (C)	o°, oo	1 1/2 in	17T 12/24DP	–	–	–	●	–	K24

▼ **127-2 (C)**



▼ **127-2 (C)**



U24 (38-4 (C-C))	**NG**	**M1**	**M2**[5)]	**M3**[5)]
	100	360	21	63
	140	377	9.6	68.6
	180	387	9.9	68.9

K24 (38-4 (C-C))	**NG**	**M1**	**M2**[5)]	**M3**[5)]
	140	350	9.4	68.4

1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) Minimum dimension

Overview of mounting options

Through drive			Mounting options – 2nd pump			
Flange (ISO) ISO 3019-2	**Hub for splined shaft**	**Code**	**A10VSO/32 NG (shaft)**	**A10VSO/31 NG (shaft)**	**A10V(S)O/52 and 53 NG (shaft)**	**Gear/gerotor/vane pump**
80-2	3/4 in	UB2 KB2	–	18 (S, R)	10 (S)	PGZ
100-2	7/8 in	UB3 KB3	– –	28 (S, R)	–	PGZ
	1 in	KB4	–	45 (S, R)	–	–
125-2	1 1/4 in	KB5	–	71 (S, R) 88 (S, R)	–	–
	1 1/2 in	KB6	–	100 (S)	–	–
125-4	1 in	UE1	45 (S, R)	–	–	–
160-4	1 1/4 in	UB8	71 (S, R)	–	–	–
180-4	1 1/2 in	UB9	100 (S)	–	–	–
	1 3/4 in	UB7	140 (S), 180 (S)[3]	–	–	–
		KB7	140 (S)	–	–	–
Flange (SAE) ISO 3019-1	**Hub for splined shaft**	**Code**	**A10VSO/32 NG (shaft)**	**A10VSO/31 NG (shaft)**	**A10V(S)O/52 and 53 NG (shaft)**	**Gear/gerotor/vane pump**
82-2 (A)	5/8 in	U01 K01	– –	– –	10 (U), 18 (U)	AZPF, PGH2, PGH3
	3/4 in	U52 K52	–	–	10 (S), 18 (S, R)	–
101-2 (B)	7/8 in	U68 K68	–	–	28 (S, R), 45 (U, W)	AZPN, AZPG AZPN, AZPG
	1 in	U04 K04	–	–	45 (S, R), 60, 63 (U, W)[1], 72 (U, W)[1]	PGH4
127-2 (C)	1 1/4 in	U07 K07	–	–	60, 63 (S, R) 85 (U), 100(U)[2]	PVV BG 4, 5
	1 1/2 in	U24 K24	–	–	85 (S), 100(S)	PGH5

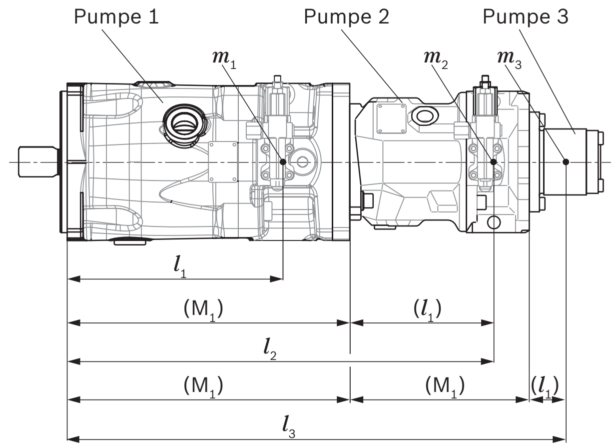
1) Not with NG 45 with U04
2) Not with NG 71 with U07
3) Not with NG 140 with UB7

Combination pumps A10VSO + A10VSO

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of pump 1 and 2 pumps must be linked by a "**+**".

Order example:
A10VSO100DR/32R-VPB32UB8+
A10VSO71DRF/32R-VSB22U00

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s^2).
For combination pumps consisting of more than two pumps, a calculation of the mounting flange regarding the permissible mass torque is required (please contact us).



m_1, m_2, m_3	Weight of pump	[kg]
l_1, l_2, l_3	Distance from center of gravity	[mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ [Nm]}$$

Calculation for multiple pumps		
l_1	=	Front pump distance from center of gravity (values from "Permissible moments of inertia" table)
l_2	=	Dimension "M1" from through drive drawings (page 39 to 46) + l_1 of the 2nd pump
l_3	=	Dimension "M1" from through drive drawings (page 39 to 46) of the 1st pump + "M1" of the 2nd pump + l_1 of the 3rd pump

Through drives are plugged with a **non-pressure-resistant** cover. Therefore, single pumps must be equipped with a pressure-resistant cover before commissioning. Through drives can also be ordered with a pressure-resistant cover, please specify in plain text.
U00 basic through drives (without hub and intermediate flange) are supplied **with a pressure-resistant** cover. This enables the utilization of various through drive options without mechanical machining of the port plate. Details of the necessary assembled parts can be found in data sheet RE 95581.

Notice
With a mounted hub, through drives are delivered with a spacer as transport protection.
The spacer must be removed before the 2nd pump is installed and before commissioning. For information, please refer to the 92714-01-B operating instructions.

Permissible moments of inertia

NG			45	71	100	140	180
static	T_m	Nm	3000	3000	7000	7000	7000
dynamic at 10 g (98.1 m/s^2)	T_m	Nm	300	300	700	700	700
Weight with port plate 12N00	m	kg	–	–	–	70.5	–
Weight with port plate 12Kxx	m	kg	–	–	–	79.5	–
Weight with port plate 22/32Uxx	m	kg	32.6	51.8	76	90.2	89.4
Distance from center of gravity with 12N00	l_1	mm	–	–	–	158	–
Distance from center of gravity with 12Kxx	l_1	mm	–	–	–	177	–
Distance from center of gravity with 22/32Uxx	l_1	mm	135	153	184	196	190

Please also pay attention to the installation information on page 52.

Connector for solenoids

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

Without bidirectional suppressor diode ______________ H

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

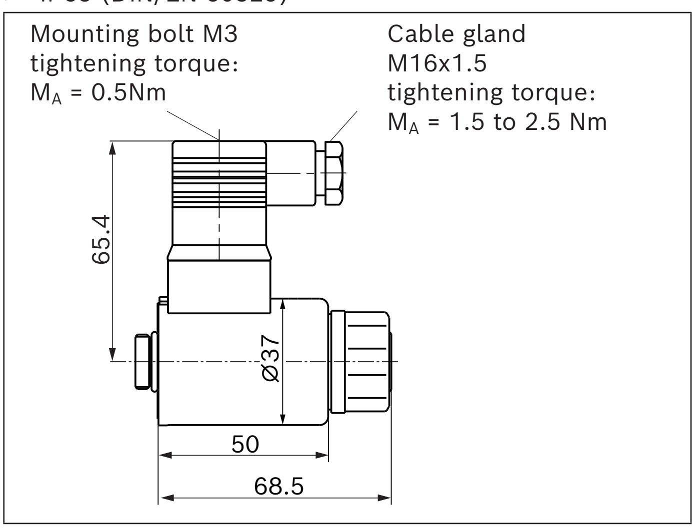
The plug-in connector is not included in the scope of delivery.

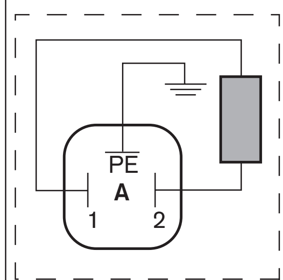
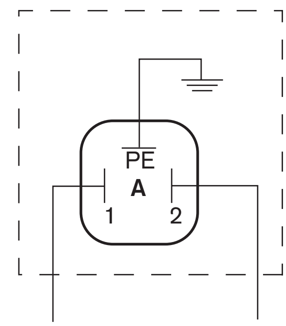
This can be supplied by Bosch Rexroth on request.

Bosch Rexroth material number: R902602623

With correctly mounted mating connector, the following type of protection can be achieved:

- IP65 (DIN/EN 60529)



Connector on solenoid according to DIN 43650	Plug-in connector DIN EN 175301-803-A Line screw fitting M16x1.5
 	

Notice

If necessary, you can change the position of the connector by turning the solenoid body.

This procedure is defined in 92714-01-B operating instructions.

Control electronics 24 V nominal voltage, for ED72/ER72

Control	Electronics function	Electronics		Further information
Electric pressure control	Valve amplifier for proportional valves without electrical position feedback	VT-MSPAx	analog	30232

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest positioned drain port (**L**, $\mathbf{L_1}$).
For combination pumps, the leakage
must be drained off at each single pump. 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 achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
Under all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the total pressure loss. However, it must not be higher than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port **S** (see technical data on page 7) must not be fallen short of during operation and at cold start.
When designing the reservoir, ensure adequate distance between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

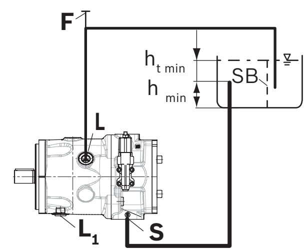
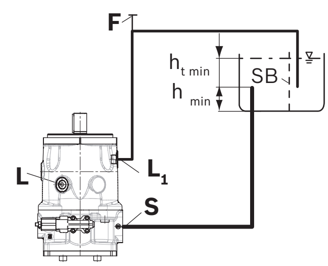
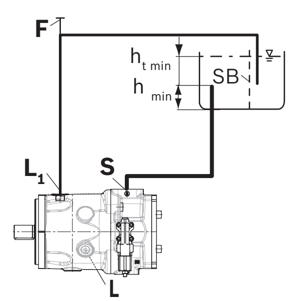
For key, see page 51.

Installation position

See the following examples **1** to **9**.
Further installation positions are available upon request.
Recommended installation position: **1** and **3**

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 	F	F (L)
2[1)] 	F	F (L_1)
3 	F	F (L_1)

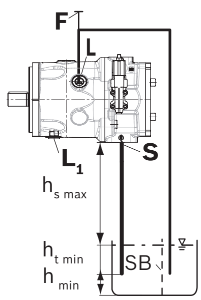
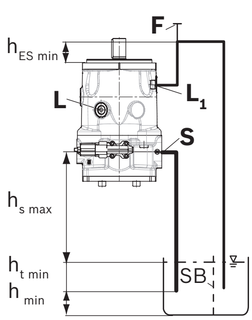
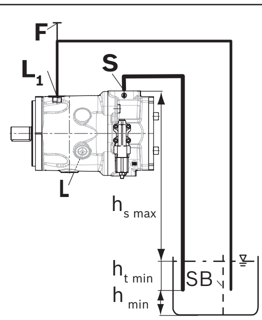
Notice
Port **F** is part of the external piping and must be provided by the customer to simplify the filling and bleeding.

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining in position 5, the height difference $h_{ES\ min}$ must be at least 25 mm. Observe the maximum admissible suction height $h_{S\ max}$ = 800 mm.

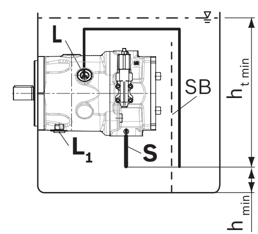
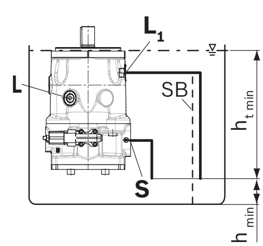
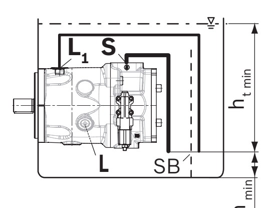
A check valve in the drain line is only permissible in individual cases. Consult us for approval.

Installation position		Air bleed	Filling
4		F	F (L)
5[1]		F	F (L_1)
6		F	F (L_1)

Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter **"Above-reservoir installation"**.

Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.

Installation position		Air bleed	Filling
7		automatically due to the position below the hydraulic fluid level. Via the highest available port **L**	Automatically via the open port **L** or **L_1** due to the position under the hydraulic fluid level
8[1]		Via the highest available port **L_1**	
9		Via the highest available port **L_1**	

Key

Key	
L, L_1 (F)	Filling / Air bleeding
S	Suction port
L, L_1	Drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)
$h_{ES\ min}$	Minimum height required to prevent axial piston unit from draining (25 mm)
$h_{S\ max}$	Maximum permissible suction height (800 mm)

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Project planning notes

- The A10VSO axial piston variable pump is intended to be used in open circuit.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift. The characteristic curve may also shift due to the dither frequency or control electronics.
- 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 instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal) Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- For drives that are operated for a long period of time with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency x 9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- The ports and fastening threads are designed for the 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 working ports and function ports are only intended to accommodate hydraulic lines.

Assembly information

Due to the compact design of the housing, socket-head screws with a hexagon socket must be used to attach the axial piston pump. Please observe the maximum permissible surface pressure according to VDI 2230. Furthermore, observe the information regarding tightening torques in the 92714-01-B operating instructions.

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 should test whether additional measures are required on the machine for the relevant application in order to bring the driven consumer into a safe position (e.g. safe stop) and make sure any measures are properly implemented.

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