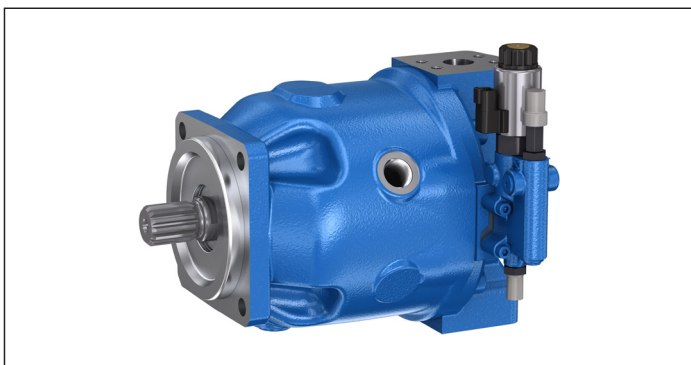


Axial piston variable pump

A10VO series 32



- ▶ Optimized medium pressure pump for high power machines
- ▶ Sizes 45 to 180
- ▶ Nominal pressure 280 bar (4100 psi)
- ▶ Maximum pressure 350 bar (5100 psi)
- ▶ 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 high pressure port for all sizes with port plate 22/72 and 32/82
- ▶ Low noise level
- ▶ Increased functional reliability
- ▶ High efficiency
- ▶ Good power to weight ratio
- ▶ Universal through drive for all sizes with port plate 22/72 and 32/82
- ▶ Optional pulsation damping

Inhalt

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Type code

01	02	03	04	05	06	07	08	09	10	11	12	13
A10V	O			/	32		-	V				

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar (4100 psi), maximum pressure 350 bar (5100 psi)	A10V
----	---	-------------

Operating mode

02	Pump, open circuit	O
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Sizes (NG)

03	Geometric displacement, see "Technical data" on page 8	45	71	100	140	180
----	--	-----------	-----------	------------	------------	------------

Control devices

04	Pressure controller	hydraulic				●	●	●	●	●	DR
	with flow controller	hydraulic	X-T open			●	●	●	●	●	DRF
			X-T plugged	with flushing function		●	●	●	●	●	DRS
			X-T plugged	without flushing function		●	●	●	●	●	DRSC
	pressure cut-off	hydraulic	remote controlled			●	●	●	●	●	DRG
		electric	negative control		$U = 12\text{ V}$	●	●	●	●	●	ED71
					$U = 24\text{ V}$	●	●	●	●	●	ED72
		electric	positive control		$U = 12\text{ V}$	●	●	●	●	●	ER71 ¹⁾
					$U = 24\text{ V}$	●	●	●	●	●	ER72 ¹⁾
	Electrohydraulic control valve			positive control	$U = 12\text{ V to }24\text{ V}$	–	● ³⁾	● ²⁾	● ²⁾	○	EC4
				negative control		–	○ ³⁾	○ ²⁾	○ ²⁾	○	EB4
	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
				via	240 bar	●	●	●	●	●	LA9D
pressure cut-off and flow control	hydraulic	beginning of control	see LA.D		●	●	●	●	●	LA.DS	
remote 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
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Directions of rotation

06	Viewed on drive shaft	clockwise	R
		counter-clockwise	L

● = Available ○ = On request - = Not available

1) Observe the project planning notes on page 19.
2) Only available with mounting flange D (not available for versions with mounting flange C).
3) Not available for versions with mounting flange U.

01	02	03	04	05	06	07	08	09	10	11	12	13
A10V	O			/	32		-	V				

Seal

07	FKM (fluorocarbon rubber)	V
----	---------------------------	----------

Drive shaft

			45	71	100	140	180	
08	Splined shaft	standard shaft	●	●	●	●	●	S
	ISO 3019-1	same as shaft "S", but for higher torque	●	●	-	-	-	R
	View in the data sheet has been standardized.	reduced diameter, limited suitability for through drive (see table of values, page 10)	●	●	●	●	-	U
	For a detailed view, see the installation drawing.	same as shaft "U", but for higher torque, limited suitability for through drive (see table of values, page 10)	○	●	●	●	●	W

Mounting flange

			45	71	100	140	180	
09	Based on	SAE B; 2-hole	●	-	-	-	-	C
	ISO 3019-1 (SAE)	SAE C; 2-hole	-	●	●	●	-	
		SAE C; 4-hole	●	●	-	-	-	D
		SAE D; 4-hole	-	-	●	●	●	
			-	●	-	-	-	U

Working port

			45	71	100	140	180	
10	SAE flange ports according to ISO 6162 (port plates and through drive assignment, see order item 11)	at rear, metric fastening thread (not for through drive, "N00" only)	●	●	●	●	●	11
		at rear, UNC fastening thread (not for through drive, "N00" only)	-	-	-	●	●	61
		at top, at bottom, on opposite side, metric fastening thread	●	●	●	●	●	12
		top, bottom, opposite, fastening thread UNC	-	-	-	●	●	62
		top, bottom, opposite, fastening thread metric , with universal through drive U..; without pulsation damping	●	●	●	●	●	22¹⁾
		top, bottom, opposite, UNC fastening thread, with universal through drive U..; without pulsation damping	●	●	●	●	●	72¹⁾
		top, bottom, opposite, fastening thread metric , with universal through drive U..; with pulsation damping	●	●	● ²⁾	○	●	32¹⁾
		top, bottom, opposite, UNC fastening thread, with universal through drive U..; with pulsation damping	●	●	● ²⁾	○	●	82¹⁾

● = Available ○ = On request - = Not available

1) Only with mounting flange (type code position 09) D or U
2) Use only possible in the case of reduced rotational speeds.
See also "Technical data" on page 8.

01	02	03	04	05	06	07	08	09	10	11	12	13
A10V	O			/	32		-	V				

Through drive (for mounting options, see page 68)

11	For flange ISO 3019-1	Hub for splined shaft ¹⁾										
	Diameter	Mounting ³⁾	Diameter									
	Only for port plate 12/62											
	Without through drive											
	82-2 (A)		5/8 in	9T 16/32DP								
			3/4 in	11T 16/32DP								
	101-2 (B)		7/8 in	13T 16/32DP								
			1 in	15T 16/32DP								
	127-2 (C)		1 1/4 in	14T 12/24DP								
			1 1/2 in	17T12/24DP								
	127-4 (C)		1 1/4 in	14T 12/24DP								
	152-4 (D)		1 3/4 in	13T 8/16DP								
	Only for port plate 22/72 and 32/82											
	Without through drive ²⁾											
	82-2 (A)		5/8 in	9T 16/32DP								
			3/4 in	11T 16/32DP								
	101-2 (B)		7/8 in	13T 16/32DP								
			1 in	15T 16/32DP								
	127-2 (C)		1 1/4 in	14T 12/24DP								
			1 1/2 in	17T 12/24DP								
	127-4 (C)		1 in	15T 16/32DP								
			1 1/4 in	14T 12/24DP								
	152-4 (D)		1 3/4 in	13T 8/16DP								

Connector for solenoids⁴⁾

12	Without connector (without solenoid, only for hydraulic controls, without code)											
	DEUTSCH molded connector, 2-pin – without suppressor diode											P

Swivel angle sensor

13	Without swivel angle sensor (without code)											
	With electric swivel angle sensor PAL	ratiometric	Power supply									
	(as per data sheet 95161)	SENT/SENT	U = 5V DC									

● = Available ○ = On request – = Not available

Notice

- Note the project planning notes on page 76 and the project planning notes regarding each control device.
- In addition to the type code, please specify the relevant technical data when placing your order.

- 1) According to ANSI B92.1a (splined shaft according to ISO 3019-1)
- 2) With through-drive shaft, without hub, without intermediate flange, plugged on a functionally reliable basis with cover. For mounting kits, see data sheet 95581.
- 3) Mounting holes pattern viewed from through drive with control at top.
- 4) Connectors for other electric components may deviate.
- 5) Only available with mounting flange D (not available for versions with mounting flange C).
- 6) Not available for versions with mounting flange U.

Hydraulic fluids

The A10VO 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)

Selection of hydraulic fluid

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

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

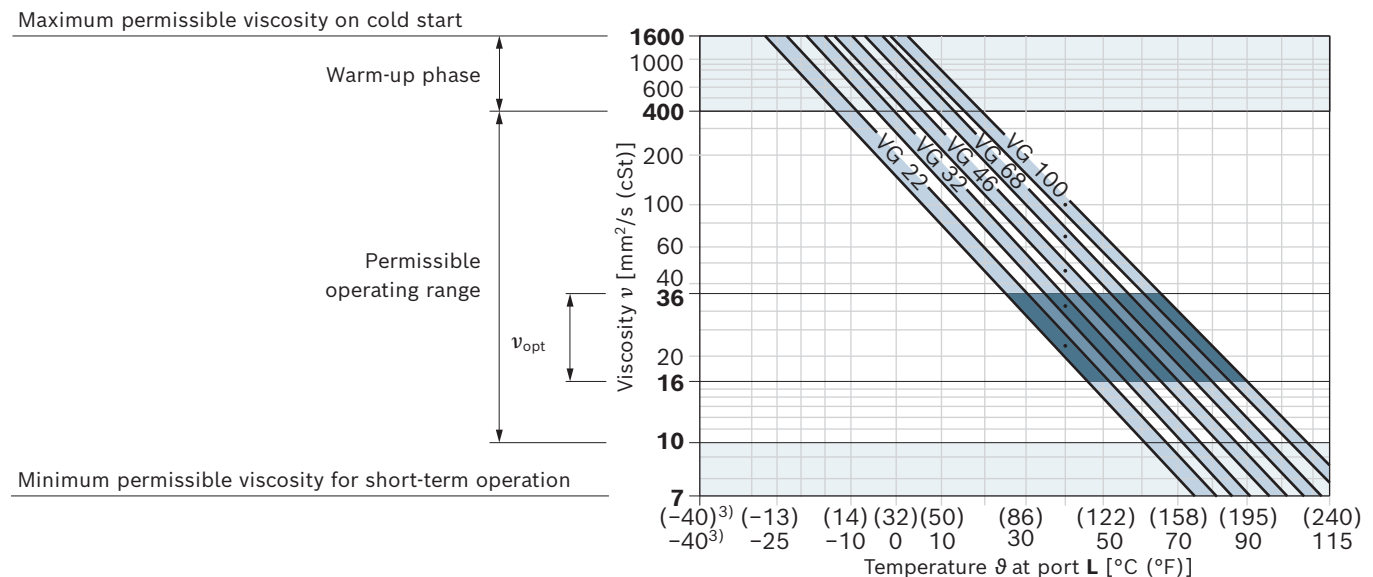
- ▶ 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The selection of hydraulic fluid shall take place so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} ; see selection diagram).

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ²⁾	Comment
Cold start	$v_{max} \leq 1600 \text{ mm}^2/\text{s (cSt)}$	FKM	$\vartheta_{st} \geq -25 \text{ °C (-13 °F)}$	$t \leq 3 \text{ min}$, without load ($p \leq 50 \text{ bar (725 psi)}$), $n \leq 1000 \text{ rpm}$ Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K (45 °F)
Warm-up phase	$v = 1600 \dots 400 \text{ mm}^2/\text{s (cSt)}$			$t \leq 15 \text{ min}$, $p \leq 0.7 \times p_{nom}$ und $n \leq 0.5 \times n_{nom}$
Permissible operating range	$v = 400 \dots 10 \text{ mm}^2/\text{s (cSt)}^{1)}$	FKM	$\vartheta \leq +110 \text{ °C (+230 °F)}$	Measured at port L , L₁
	$v_{opt} = 36 \dots 16 \text{ mm}^2/\text{s (cSt)}$			Optimal operating viscosity and efficiency range
Short-term operation	$v_{min} = 10 \dots 7 \text{ mm}^2/\text{s (cSt)}$	FKM	$\vartheta \leq +110 \text{ °C (+230 °F)}$	$t \leq 3 \text{ min}$, $p \leq 0.3 \times p_{nom}$, measured at port L

▼ Selection diagram



¹⁾ This corresponds, e.g. on the VG 46, to a temperature range of +4 °C to +85 °C (+39 °F to +185 °F) (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 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 (cSt) (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

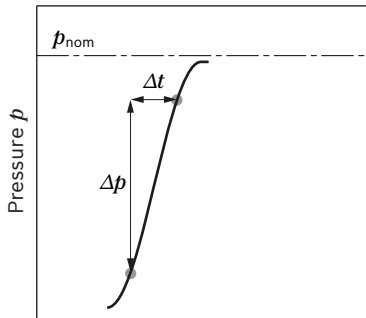
Examples of temperatures of hydraulic fluids at a viscosity of 10 mm²/s (cSt):

- ▶ 73 °C (163 °F) at HLP 32
- ▶ 85 °C (185 °F) at HLP 46

Working pressure range

Pressure at port B			Definition
Nominal pressure p_{nom}	280 bar (4100 psi)		The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar (5100 psi)		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 ms		
Total operating period	300 h		
Minimum pressure $p_{B absolute}$ (high-pressure side)	10 bar (145 psi) ¹⁾		Minimum pressure on the high-pressure side (B) required to prevent damage to the axial piston unit.
Rate of pressure change $R_{A max}$	16000 bar/s (232060 psi/s)		Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)			
Minimum pressure $p_{S min}$	NG 45 to 100 at 1800 rpm	0.8 bar (12 psi) 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.
	NG 140 to 180 at 1800 rpm	1.0 bar (15 psi) absolute	
Maximum pressure $p_{S max}$		10 bar (145 psi) ²⁾	
Case pressure at port L ₁ , L ₂			
Maximum pressure $p_{L max}$		2 bar (30 psi) ²⁾ absolute	Maximum 0.5 bar (7.5 psi) higher than inlet pressure at port S , but not higher than $p_{L max}$. The case pressure must always be higher than the ambient pressure at the shaft seal. A drain line to the reservoir is required.
Pilot pressure port X with external high pressure			
Maximum pressure p_{max}	350 bar (5100 psi)		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.

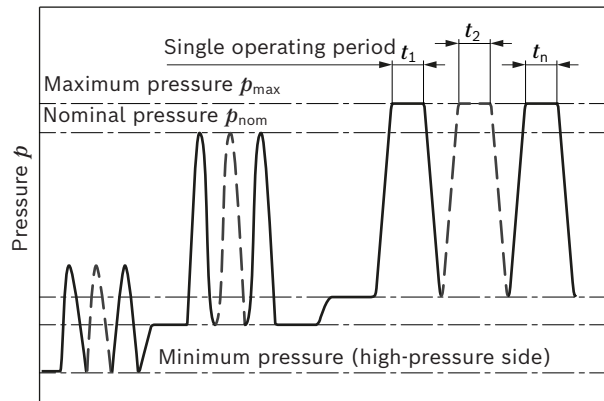
▼ Rate of pressure change $R_{A max}$


Time t

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.

▼ Pressure definition


Time t

$$\text{Total operating period} = t_1 + t_2 + \dots + t_n$$

1) Lower pressure is time-dependent, please contact us

2) Other values on request

Technical data

Size		NG		45	71	100	140	180
Geometric displacement, per revolution		$V_{g \max}$	cm ³	45	71.1	100	140	180
			inch ³	2.75	4.34	6.10	8.54	11
Maximum rotational speed ¹⁾²⁾	at $V_{g \max}$	n_{nom}	rpm	3000	2550	2300 ⁴⁾	2200	1800
Flow	at n_{nom} and $V_{g \max}$	q_v	l/min	135	181	230	308	324
			gmp	35.7	47.8	60.8	81.4	85.6
Power	at n_{nom} , $V_{g \max}$ and $\Delta p = 280$ bar (4000 psi)	P	kW	63	85	107	144	151
			HP	84	113	143	193	202
Torque	at $V_{g \max}$ and $\Delta p = 280$ bar	M	Nm	200	317	446	624	802
			lb-ft	148	234	328	460	592
	at $V_{g \max}$ and $\Delta p = 100$ bar	M	Nm	72	113	159	223	286
			lb-ft	53	83	117	164	211
Rotary stiffness of drive shaft	S	c	Nm/rad	37500	71884	121142	169537	227153
			lb-ft/rad	27659	53019	89350	125042	167539
	R	c	Nm/rad	41025	76545	–	–	–
			lb-ft/rad	30258	56457	–	–	–
	U	c	Nm/rad	30077	52779	91093	On request	–
			lb-ft/rad	22184	38928	67187	–	–
	W	c	Nm/rad	34463	57460	101847	165594	–
			lb-ft/rad	25419	42380	75118	122135	–
Moment of inertia of the rotary group		J_{TW}	kgm ²	0.0035	0.0087	0.0167	0.0242	0.033
			lb-ft ²	0.083	0.2065	0.3968	0.5743	0.7831
Maximum angular acceleration ³⁾		α	rad/s ²	4000	2900	2400	2000	2000
Case volume		V	l	1.0	1.6	2.2	3.0	2.7
			gal	0.264	0.420	0.580	0.79	0.71
Weight (with port plate 11(61)N00 and 12(62)N00 without through drive) approx.		m	kg	25.8	40.4	56.4	70.5	75.2
				57	89	124	155	166
Weight (with port plate 12(62) with through drive Kxx) approx.		m	kg	27.4	43.3	62.6	79.5	–
				60	95	138	175	–
Weight (with port plate 22/72Uxx/32/82Uxx) approx.		m	kg	32.6	51.8	76	90.2	89.4
			lbs	72	114	168	199	197

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 recommends testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

- 1) The values are applicable:
 - at absolute pressure $p_{\text{abs}} = 1.0$ bar (15 psi) at suction port **S**
 - for the optimum viscosity range from $\nu_{\text{opt}} = 36$ to 16 mm²/s (cSt)
 - with hydraulic fluid based on mineral oils
- 2) Higher rotational speeds on request.
- 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 the rotary frequency; cardan shaft 2 times the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.
- 4) Maximum rotational speed 2150 rpm for version with port plate 32/82.

Determination of the characteristics		
Flow	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[l/min]
	$q_v = \frac{V_g \times n \times \eta_v}{231}$	[gpm]
Torque	$M = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
	$M = \frac{V_g \times \Delta p}{24 \times \pi \times \eta_{hm}}$	[lb-ft]
Power	$P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]
	$P = \frac{2 \pi \times M \times n}{33000} = \frac{q_v \times \Delta p}{1714 \times \eta_t}$	[hp]
Key		
V_g	=	Displacement per revolution [cm ³ (in ³)]
Δp	=	Differential pressure [bar (psi)]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{hm}	=	Hydraulic-mechanical efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

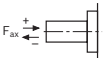
Pre compression volume for pulsation reduction (PCV)

The PCV reduces the pressure pulsation applied to the system by the pump. The peak-to-peak pulsation [bar (psi)] is reduced by approximately 30 to 50% depending on the operating point.

Depending on the mechanical design of the working machine, in our experience machine noise is reduced quite significantly.

The pre compression volume is standard on the connection plate 32/82 in the scope of delivery.

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
			lb	337	427	517	629	517
Maximum axial force		$\pm F_{ax \max}$	N	1500	2400	4000	4800	800
			lb	337	540	900	1080	180

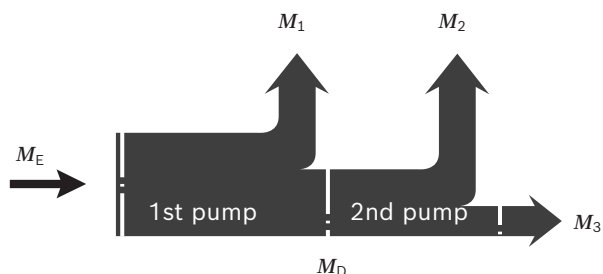
Notice

- The values given are maximum values and do not apply to continuous operation.
- For drives with radial loading (pinions, V-belt drives), please contact us!

Permissible input and through-drive torques

Size			45	71	100	140	180
Torque at $V_{g\max}$ and $\Delta p = 280$ bar (4100 psi) ¹⁾	$M_{\max}$	Nm	200	317	446	624	802
		lb-ft	148	234	328	460	592
Maximum input torque on drive shaft ²⁾							
S	$M_{E\max}$	Nm	319	626	1104	1620	1834
		lb-ft	235	462	814	1195	1353
	Ø	inch	1	1 1/4	1 1/2	1 3/4	1 3/4
R	$M_{E\max}$	Nm	400	644	–	–	–
		lb-ft	295	475	–	–	–
	Ø	inch	1	1 1/4	–	–	–
U	$M_{E\max}$	Nm	188	300	595	on	–
		lb-ft	139	221	439	Request	–
	Ø	inch	7/8	1	1 1/4	1 1/2	–
W	$M_{E\max}$	Nm	–	394	636	1220	1488
		lb-ft	–	291	469	900	1097
	Ø	inch	–	1	1 1/4	1 1/2	1 1/2
Maximum through-drive torque							
S	$M_{D\max}$	Nm	319	492	778	1266	1266
		lb-ft	235	363	574	934	934
R	$M_{D\max}$	Nm	365	548	–	–	–
		lb-ft	269	404	–	–	–
U	$M_{D\max}$	Nm	188	300	595	on	–
		lb-ft	139	221	439	Request	–
W	$M_{D\max}$	Nm	–	–	636	1220	1266
		lb-ft	–	–	469	900	934

▼ 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

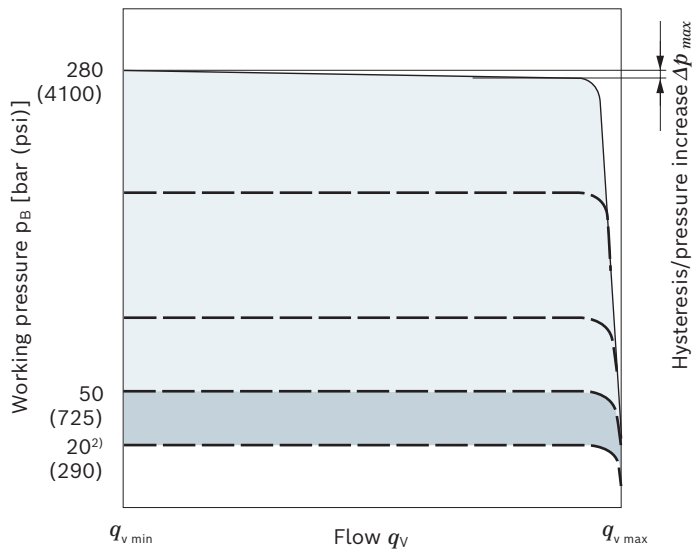
2) For drive shafts with no radial force

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.

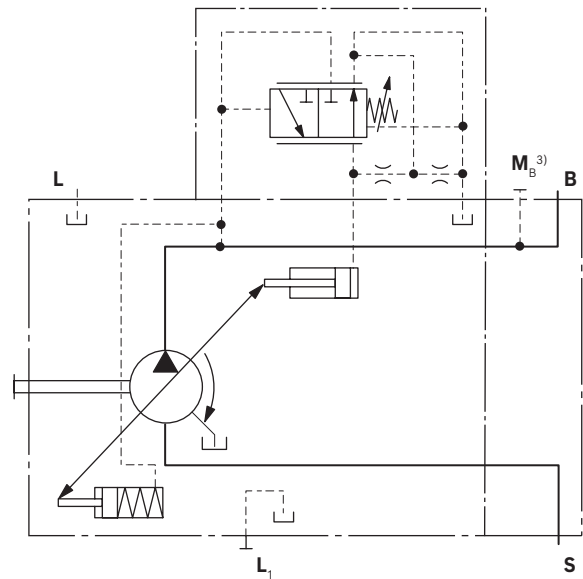
- Basic position in depressurized state: $V_{g \max}$.
- Setting range¹⁾ for infinitely variable 50 to 280 bar pressure control (725 to 4100 psi).
Standard is 280 bar (4100 psi).

▼ Characteristic curve DR



Characteristic curve valid at $n_1 = 1500$ rpm and $\vartheta_{\text{fluid}} = 50$ °C (122 °F).

▼ Circuit diagram DR



Controller data

Size		45	71	100	140	180
Pressure increase	Δp [bar]	6	8	10	12	14
	[psi]	90	115	145	175	200
Hysteresis	Δp [bar]	maximum 4				
	[psi]	maximum 60				
Pilot fluid consumption	[l/min]	maximum approx. 3				
	[gpm]	maximum approx. 0.8				

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 (725 psi), please use the SO275 special pressure controller (setting range: 20 to 100 bar (290 to 1450 psi)).

3) Only for port plate 22/72 and 32/82

DRG – Pressure controller, remote controlled

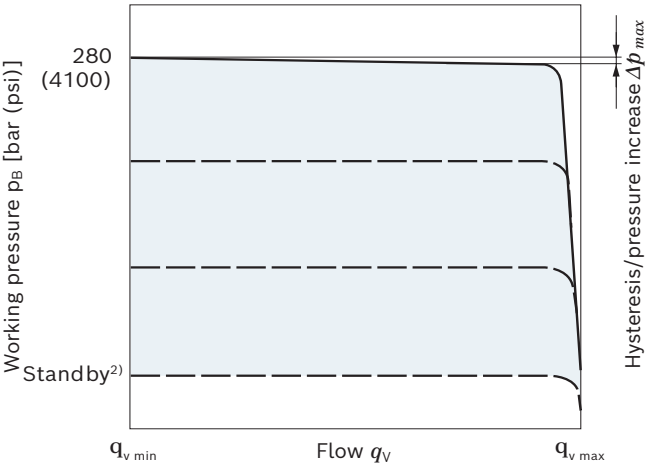
For the remote controlled pressure controller, the pressure limitation is performed using a separately arranged pressure relief valve. Therefore, any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 11. A pressure relief valve 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. When there is differential pressure of 20 bar (290 psi) Δp (standard setting), the control fluid quantity at port **X** is approx. 1.5 l/min (0.4 gpm). If another setting is required (range from 14 to 22 bar (200 to 320 psi)) 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 control fluid quantity mentioned above. The maximum line length should not exceed 2 m (6.5 ft).
- ▶ Basic position in depressurized state: $V_{g \max}$.
- ▶ Setting range¹⁾ for pressure control 50 to 280 bar (725 to 4100 psi) (**3**). Standard is 280 bar (4100 psi).
- ▶ Setting range for differential pressure 14 to 22 bar (200 to 320 psi) (**2**), standard is 20 bar (290 psi).

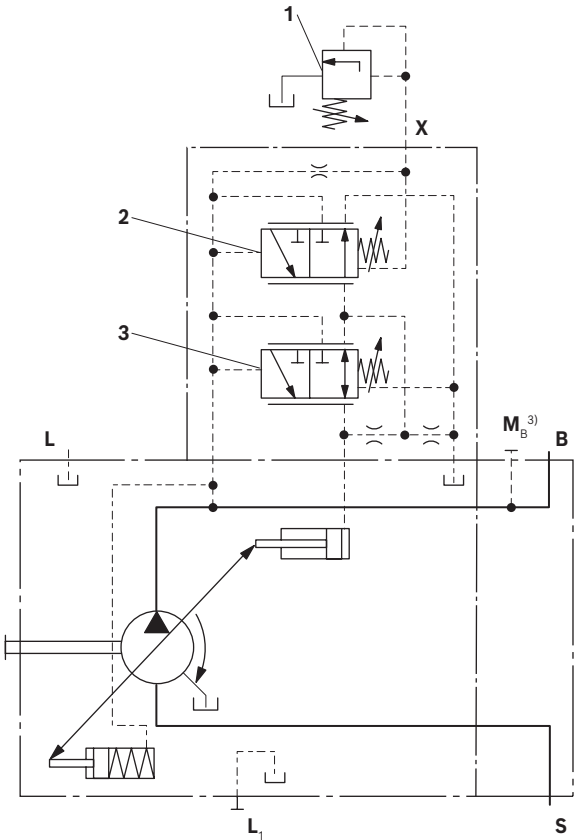
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp , however system influences are not taken into account.

▼ Characteristic curve DRG



Characteristic curve valid at $n_1 = 1500$ rpm and $\vartheta_{\text{fluid}} = 50\text{ }^{\circ}\text{C}$ (122 $^{\circ}\text{F}$).

▼ 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

Size		45	71	100	140	180
Pressure increase	Δp [bar]	6	8	10	12	14
	Δp [psi]	90	115	145	175	500
Hysteresis	Δp [bar]	maximum 4				
	Δp [psi]	maximum 60				
Pilot fluid consumption	[l/min]	maximum approx. 4.5				
	[gpm]	maximum approx. 1.19				

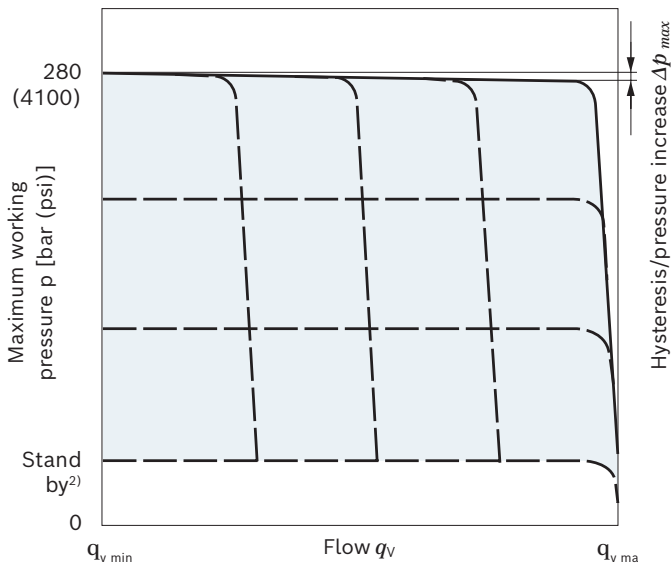
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting Δp on controller (**2**)
3) Only for port plate 22/72 and 32/82

DRF/DRS/DRSC – Pressure flow controller

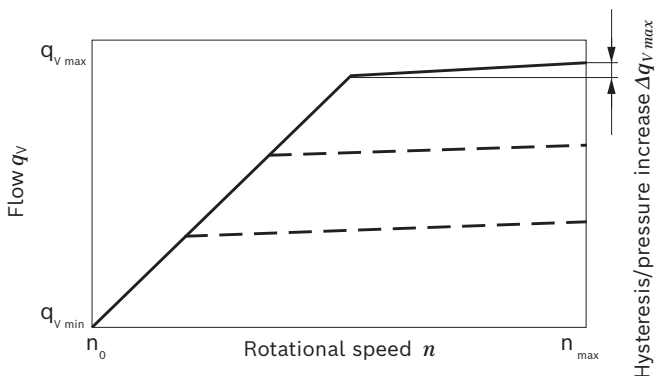
In addition to the pressure controller function (see page 11), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the V_g reduction has priority.

- ▶ Basic position in depressurized state: $V_{g \max}$.
- ▶ Setting range¹⁾ to 280 bar (4100 psi)
Standard is 280 bar (4100 psi)
- ▶ DR pressure controller data see page 11

▼ Characteristic curve DRF/DRS/DRSC

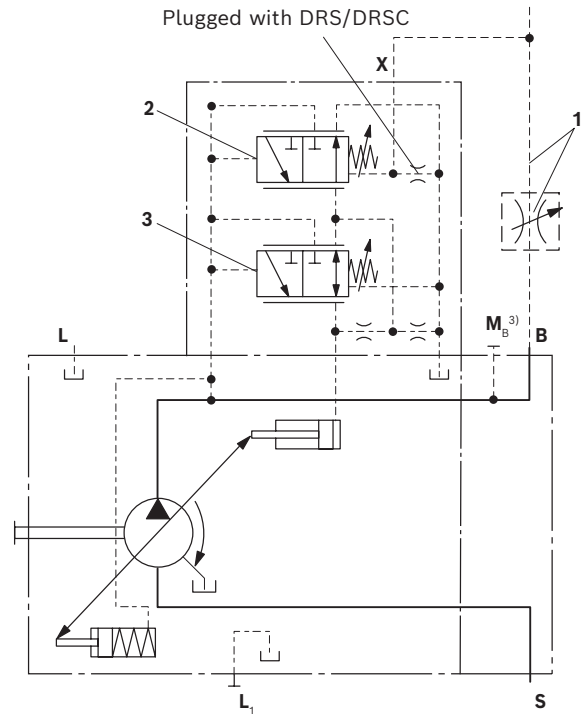


▼ Characteristic curve at variable rotational speed



Characteristic curves valid at $n_1 = 1500$ rpm and $\vartheta_{\text{fluid}} = 50$ °C (122 °F).

▼ 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**)

Notice

The DRS and DRSC versions have no unloading from **X** to 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.
If this unloading of the **X**-line cannot be ensured, the DRF control valve must be used.

For further information see page 14

- 1) 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 for port plate 22/72 and 32/82

Differential pressure Δp

- ▶ Standard setting: 14 bar (200 psi)
If another setting is required, please state in clear text.
- ▶ Setting range: 14 bar to 22 bar (200 to 320 psi)

Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp , however system influences are not taken into account.

Controller data

DR pressure controller data, see page 11.
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
	Δp [psi]	90	115	145	175	200
Flow deviation	Δq_{Vmax} [l/min]	1.8	2.8	4.0	6.0	8.0
	Δq_{Vmax} [gpm]	0.48	0.74	1.06	1.59	2.11
Hysteresis	Δp [bar]	maximum 4				
	Δp [psi]	maximum 60				
Pilot fluid consumption	[l/min]	maximum approx. 3 to 4.5 (DRF) maximum approx. 3 (DRSC)				
	[gpm]	maximum approx. 0.8 to 1.2 (DRF) maximum approx. 0.8 (DRSC)				

LA... – Pressure, flow and power controller

Pressure controller equipped as DR(G), see page 11 (12).

Equipment of the flow controller like DRS, see page 13. To achieve a constant drive torque with varying working pressures, the swivel angle and also 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 (27 HP) at 1500 rpm.

Controller data

- For technical data of pressure controller DR, see page 11.
- For technical data of flow controller FR, see page 13.
- Pilot fluid consumption max. approx. 5.5 l/min (1.4 gpm).

Torque M [Nm (lb-ft)] for size						Type code
Beginning of control [bar (psi)]	45	71	100	140	180	
up to 50 (725)	up to 42.0 (29)	up to 67.0 (47)	up to 94.0 (67)	up to 132.0 (95)	up to 167.0 (121)	LA5
51 to 90 (726 to 1300)	42.1 - 76.0 (29.1 - 54)	67.1 - 121.0 (47.1 - 87)	94.1 - 169.0 (67.1 - 122)	132.1 - 237.0 (95.1 - 172)	167.1 - 302.0 (121.1 - 220)	LA6
91 to 160 (1301 to 2350)	76.1 - 134.0 (54.1 - 96)	121.1 - 213.0 (87.1 - 155)	169.1 - 299.0 (122.1 - 218)	237.1 - 418.0 (172.1 - 306)	302.1 - 540.0 (220.1 - 396)	LA7
161 to 240 (2351 to 3500)	134.1 - 202.0 (96.1 - 147)	213.1 - 319.0 (155.1 - 233)	299.1 - 449.0 (218.1 - 329)	418.1 - 629.0 (306.1 - 461)	540.1 - 810.0 (396.1 - 595)	LA8
over 240 (3500)	over 202.1 (147.1)	over 319.1 (233.1)	over 449.1 (329.1)	over 629.1 (461.1)	over 810.1 (595.1)	LA9

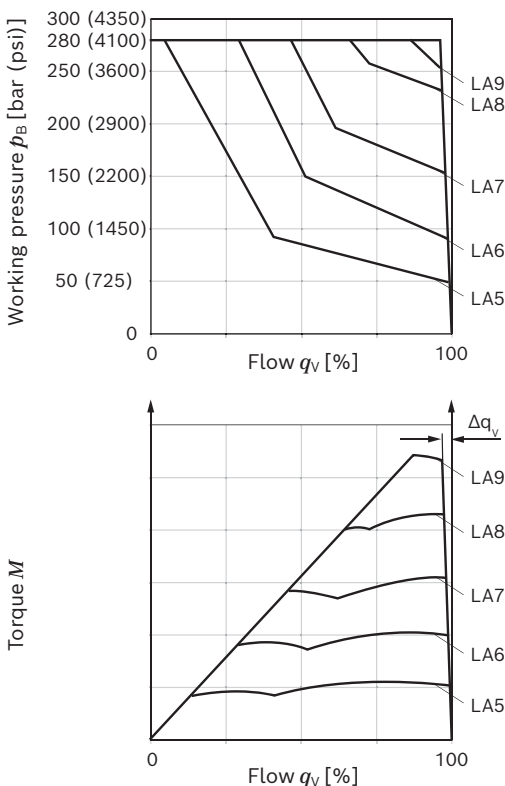
Conversion of the torque values in power [kW (HP)]

$$P = \frac{M}{6.4 (3.5)} \text{ [kW (HP)] (at 1500 rpm)}$$

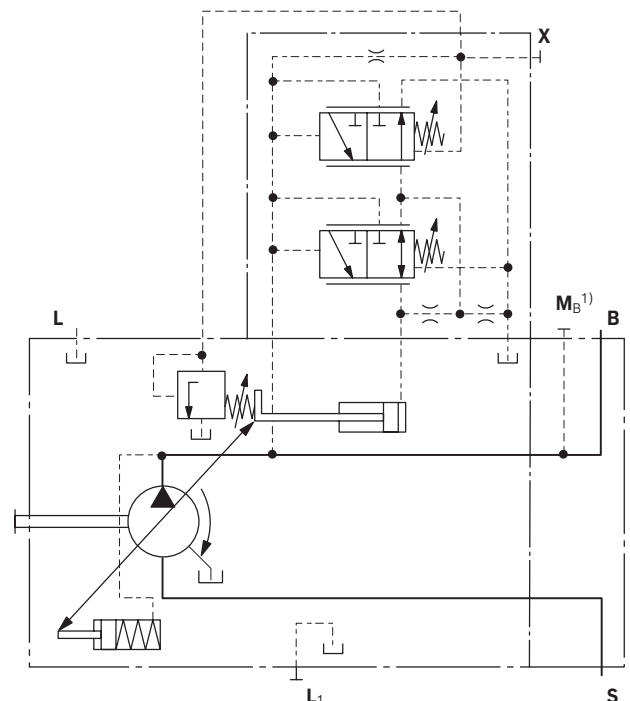
or

$$P = \frac{2\pi \times M \times n}{60000 (33000)} \text{ [kW (HP)] (For rotational speeds see table on page 8)}$$

▼ Characteristic curve LA.



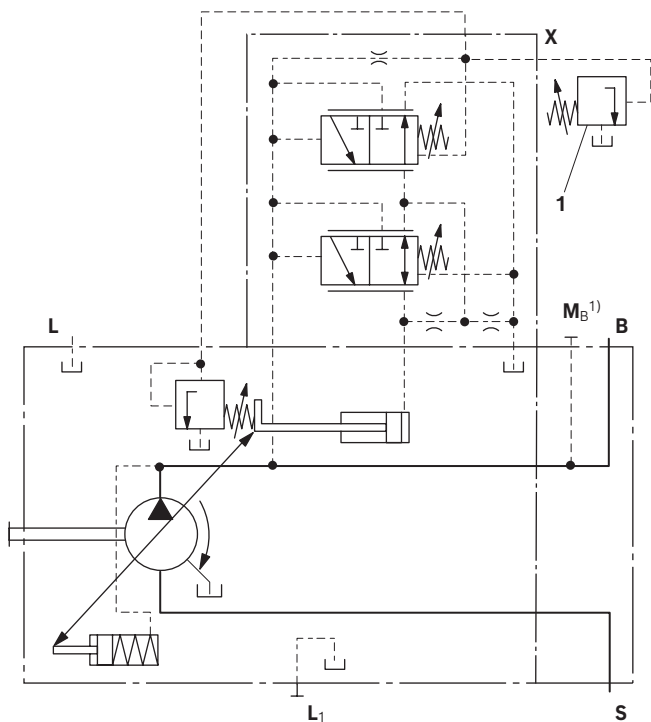
▼ Circuit diagram LA.D with pressure cut-off (for further combination options with LA.. see page 16)



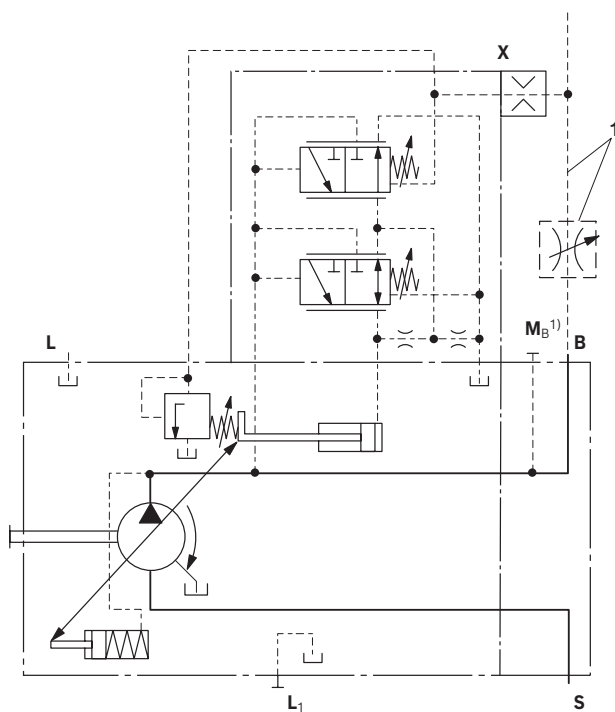
1) Only for port plate 22/72 and 32/82

LA... – Variations

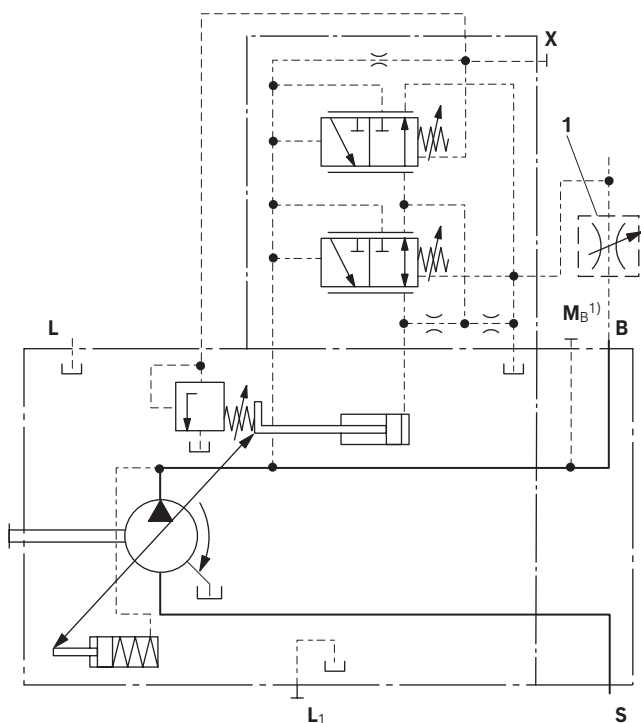
▼ Circuit diagram LA.DG with pressure cut-off, remote controlled



▼ Circuit diagram LA.DS



▼ Circuit diagram LA.S with separate flow control



1 The metering orifice and the pressure relief valve and line are not included in the scope of delivery.

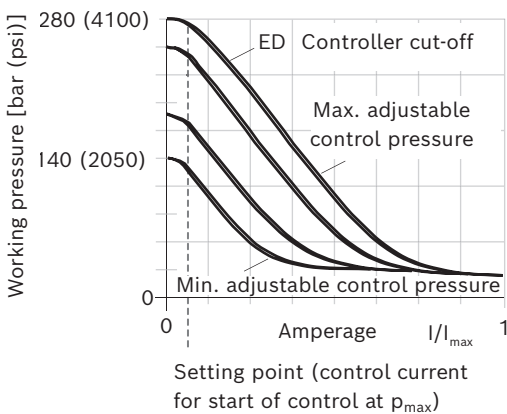
¹⁾ Only for port plate 22/72 and 32/82

ED – Electrohydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

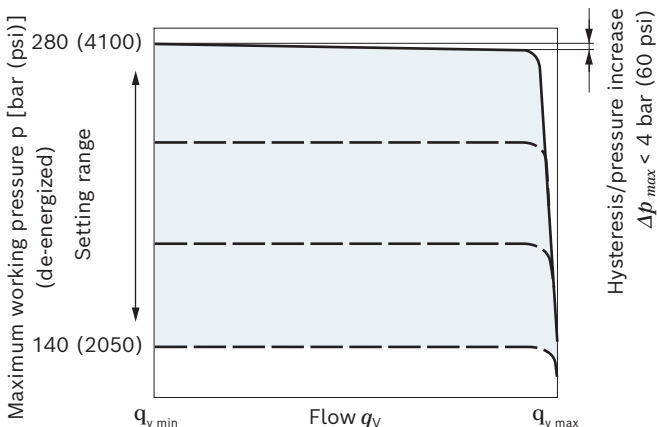
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level is infinitely adjustable 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 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 <25 bar (365 psi).

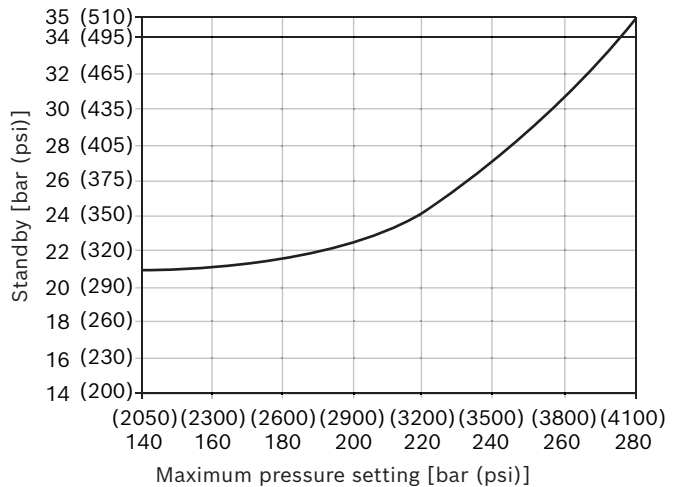
▼ Flow-pressure characteristic curve



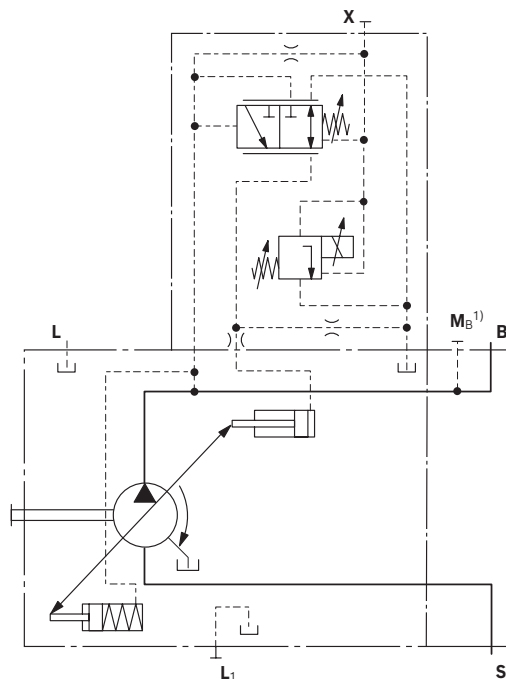
Characteristic curves valid at $n_1 = 1500 \text{ rpm}$ and $\vartheta_{\text{fluid}} = 50 \text{ }^\circ\text{C (122 }^\circ\text{F)}$.

- Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- For standby standard setting, see the following diagram; other values on request.

▼ Influence of the pressure setting on standby (maximally energized)



▼ Circuit diagram ED71/ED72



1) Only for port plate 22/72 and 32/82

18 **A10VO series 32** | Axial piston variable pump
ED – Electrohydraulic pressure control

Technical data, solenoids	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $p_{\max}$	100 mA	50 mA
End of control at $p_{\min}$	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%
Type of protection: see connector version page 71		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

The following electronic control units are available for controlling the electrohydraulic pressure control:

BODAS Controllers	Data sheet
RC5-6, series 40	95207
RC18-12, series 40	95208
RC27-18, series 40	95208

Notice

With **ED71**, de-energized operating condition (jump from 100 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).

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 (60 to 75 psi).

For circuit diagram and more characteristic curves see page 17

ER – Electrohydraulic pressure control

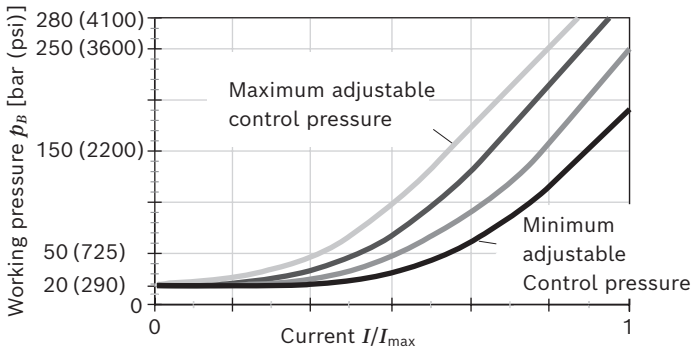
The ER valve is set to a certain pressure by a specified variable solenoid current.

When a change is made at the consumer (load pressure), the position of the control piston will shift.

This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

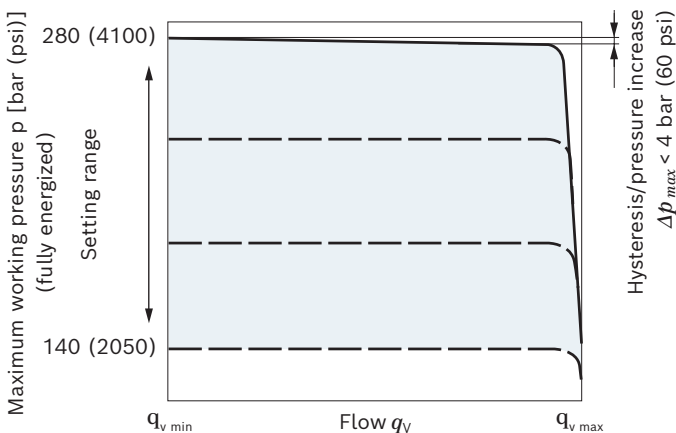
The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level is infinitely adjustable by varying the solenoid current. If the solenoid current goes to zero, the pressure is limited to $p_{\min}$ (standby) by the adjustable, hydraulic pressure cut-off. Observe project planning note.

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



Hysteresis static <25 bar (365 psi).

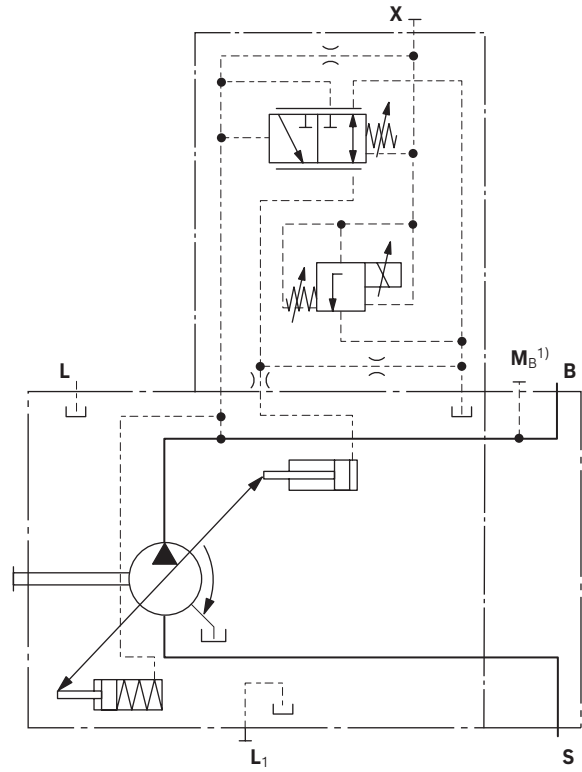
▼ Flow-pressure characteristic curve



Characteristic curves valid at $n_1 = 1500$ rpm and $\vartheta_{\text{fluid}} = 50$ °C (120 °F).

- ▶ Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- ▶ Standby standard setting 20 bar (290 psi). Other values on request.
- ▶ Influence of pressure setting on standby ± 2 bar (± 30 psi).

▼ Circuit diagram ER71/ER72



Technical data, solenoids	ER71	ER72
Voltage	12 V ($\pm 20\%$)	24 V ($\pm 20\%$)
Control current		
Start of control at $p_{\min}$	100 mA	50 mA
End of control at $p_{\max}$	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%
Type of protection: see connector version page 71		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

1) Only for port plate 22/72 and 32/82

The following electronic control units are available for controlling the electrohydraulic pressure control:

BODAS controllers	Data sheet
RC5-6, series 40	95207
RC18-12, series 40	95208
RC27-18, series 40	95208

Project planning note!

Excessive current levels ($I > 1200 \text{ mA}$ at 12 V or $I > 600 \text{ mA}$ at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage. Therefore:

- Use $I_{\max}$ current limiter solenoids.

EC4 – Electrohydraulic control valve (positive control)

The proportional directional valve EC4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.

The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.

This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.

The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.

If the solenoid current is above the neutral current (I_{neutral}), the pump swivels in the direction of $V_{g \text{ max}}/100\%$; if it is below, the pump swivels in the direction of $V_{g \text{ min}}/0\%$.

A BODAS eOC control system is required to control the pump. The required system components are listed in data sheet 95345 and must be ordered separately.

The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically closed-loop control circuits:

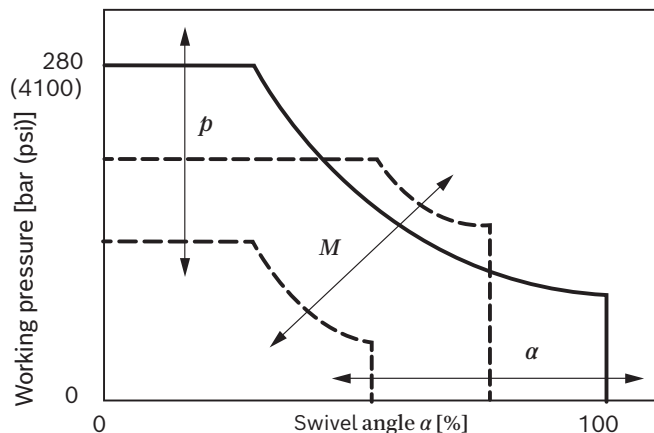
- ▶ Pressure and differential pressure regulation (p)
- ▶ Swivel angle and flow control (α)
- ▶ Torque control (M)
- ▶ Power control

A PAL2/20 swivel angle sensor is also required in order to control the pump with BODAS eOC. It must be specified in type code position 13. For more information on the PAL2/20 swivel angle sensor, see page 72 and data sheet 95161.

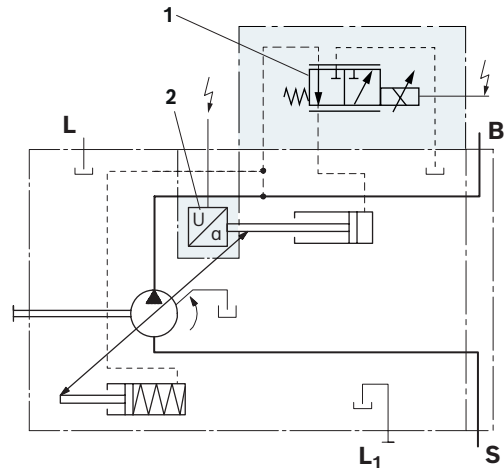
▶

▼ Control variants with EC4

Representation for positive quadrants 0% to +100%



▼ Circuit diagram EC4



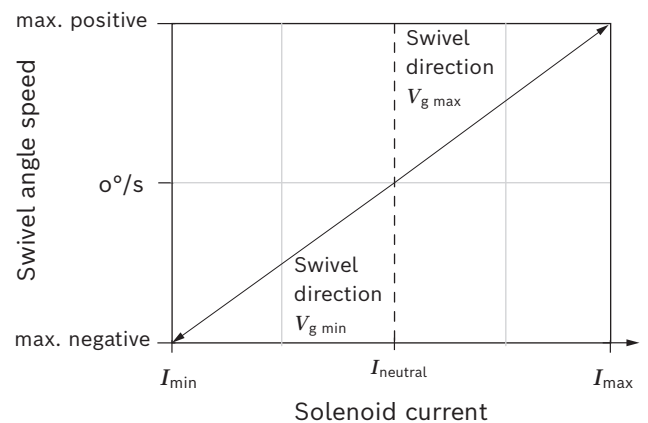
- 1 Proportional directional valve EC4
- 2 Swivel angle sensor (see data sheet 95161)

For further technical data on the solenoid with respective information, see pages 22 and 71.

The following electronic control units are available for control:

BODAS Controllers RC series	Data sheet
30	95205
40	95207 and 95208

▼ Operating principle EC4



1) Representation for positive quadrants 0% to +100%

Solenoid technical data

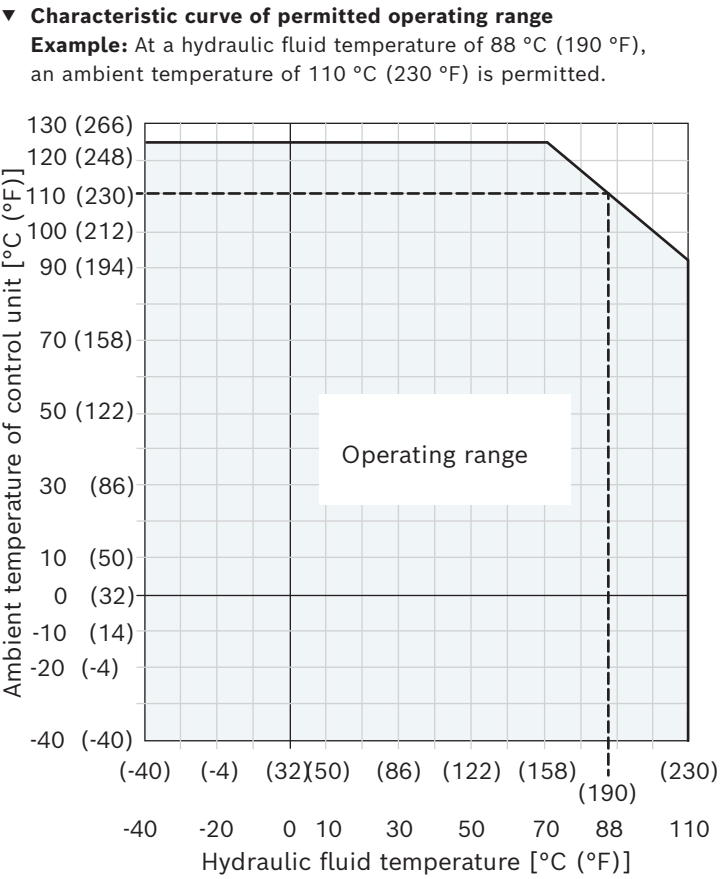
EC4	
Permissible maximum solenoid current. $I_{\max} < 1900\text{ mA}$ The current supply time with $I_{\max}$ depends on the mean current value ($I_{\text{permissible average}}\ 1355\text{ mA}$)	
Permissible average solenoid current over a maximum interval width of 5 s	$I_{\text{Medium Perm}} < 1355\text{ mA}$
Nominal resistance at 20 °C (68 °F) winding temperature	4.26 Ω
Hot resistance 180 °C (356 °F) winding temperature	6.92 Ω
Limit temperature for winding	insulating material class H (180 °C (356 °F))
Hydraulic fluid or operating temperature	from -40 °C to 110 °C (-40 °F to 230 °F)
Type of protection and control electronics, see page 71	

Notice

► The coil has a limit voltage of 36 VDC. In general, the maximum current must not be exceeded by the actual current.

► For calculation of the hot resistance, a temperature coefficient of 0.0039K^{-1} is to be applied.

► A variable dither is necessary. The frequency and amplitude must be adapted to the specific system.



EB4 – Electrohydraulic control valve (negative control)

The proportional directional valve EB4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.

The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.

This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.

The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.

If the solenoid current is below the neutral current (I_{neutral}), the pump swivels in the direction of $V_{g \text{ max}}/100\%$; if it is above, the pump swivels in the direction of $V_{g \text{ min}}/0\%$.

A BODAS eOC control system is required to control the pump. The required system components are listed in data sheet 95345 and must be ordered separately.

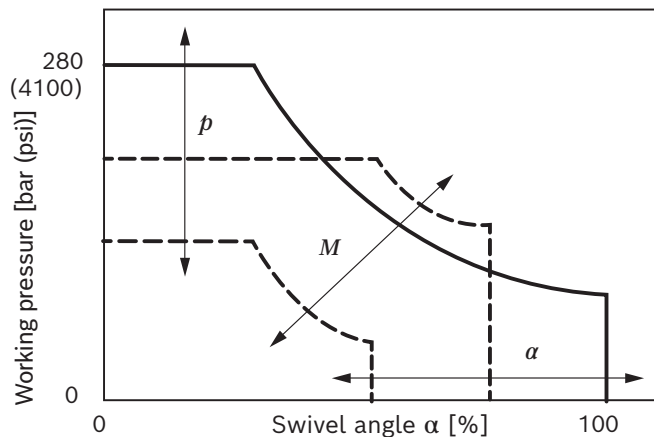
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically closed-loop control circuits:

- ▶ Pressure and differential pressure regulation (p)
- ▶ Swivel angle and flow control (α)
- ▶ Torque control (M)
- ▶ Power control

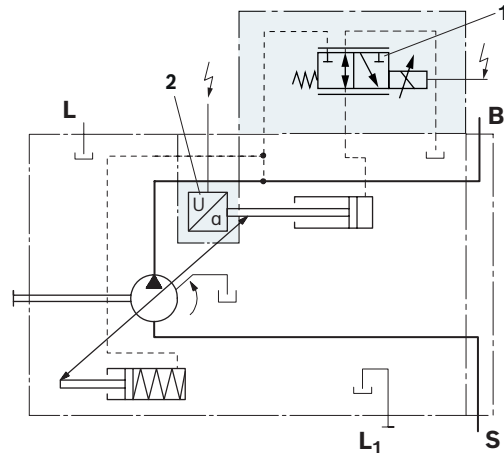
A PAL2/20 swivel angle sensor is also required in order to control the pump with BODAS eOC. It must be specified in type code position 13. For more information on the PAL2/20 swivel angle sensor, see page 72 and data sheet 95161.

▼ Control variants with EB4

Representation for positive quadrants 0% to +100%



▼ Circuit diagram EB4



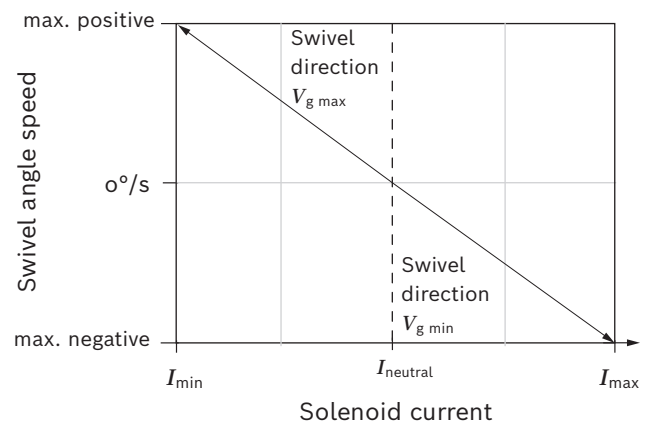
- 1 Proportional directional valve EB4
- 2 Swivel angle sensor (see data sheet 95161)

For further technical data on the solenoid with respective information, see pages 24 and 71.

The following electronic control units are available for control:

BODAS Controllers RC series	Data sheet
30	95205
40	95207 and 95208

▼ Operating principle EB4



Solenoid technical data

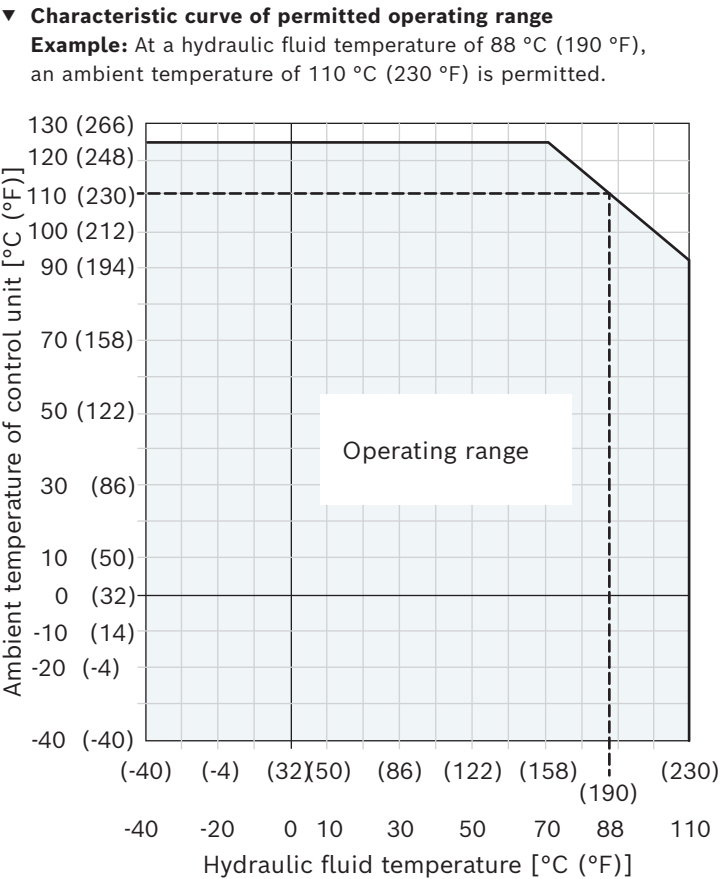
EB4	
Permissible maximum solenoid current. $I_{\max}$	$I_{\max} < 4000\text{ mA}$
The current supply time with $I_{\max}$ depends on the mean current value ($I_{\text{permissible average}}\text{ }1355\text{ mA}$)	
Permissible average solenoid current over a maximum interval width of 5 s	$I_{\text{Medium Perm}} < 1355\text{ mA}$
Nominal resistance at 20 °C (68 °F) winding temperature	4.26 Ω
Hot resistance at 180°C (356°F) winding temperature	6.92 Ω
Limit temperature for winding	insulating material class H (180 °C (356 °F))
Hydraulic fluid or operating temperature	from -40 °C to 110 °C (-40 °F to 230 °F)
Type of protection, see page 71	

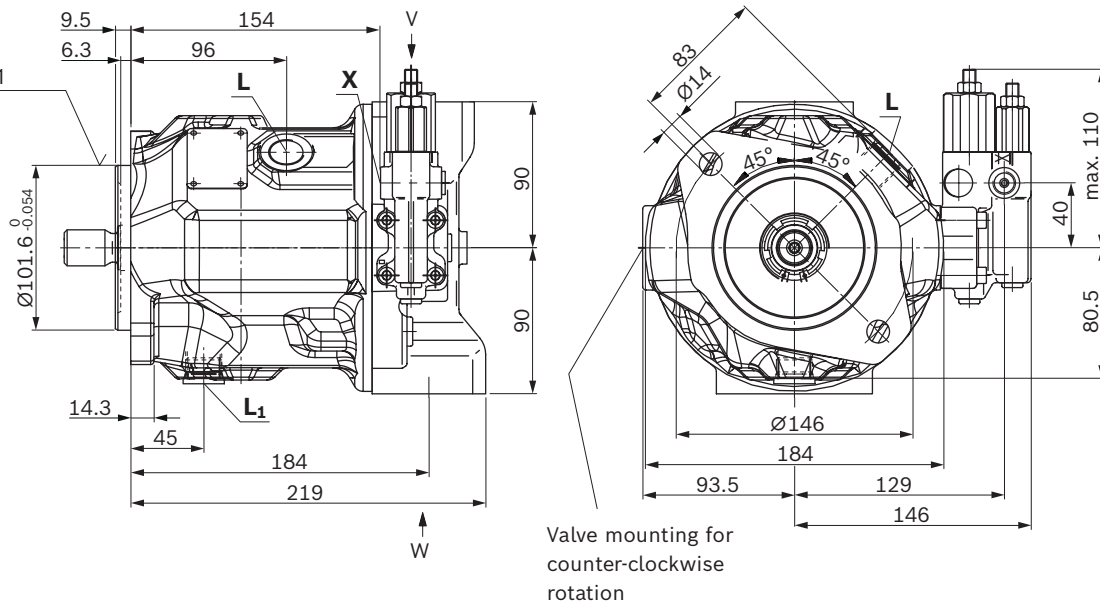
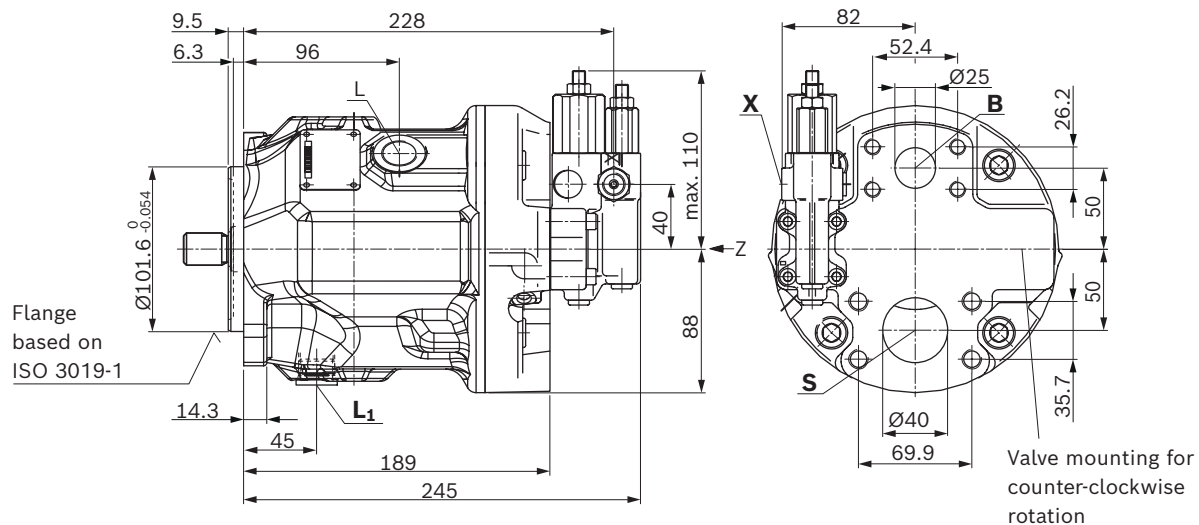
Notice

► The coil has a limit voltage of 36 VDC. In general, the maximum current must not be exceeded by the actual current.

► For calculation of the hot resistance, a temperature coefficient of 0.0039k^{-1} is to be applied.

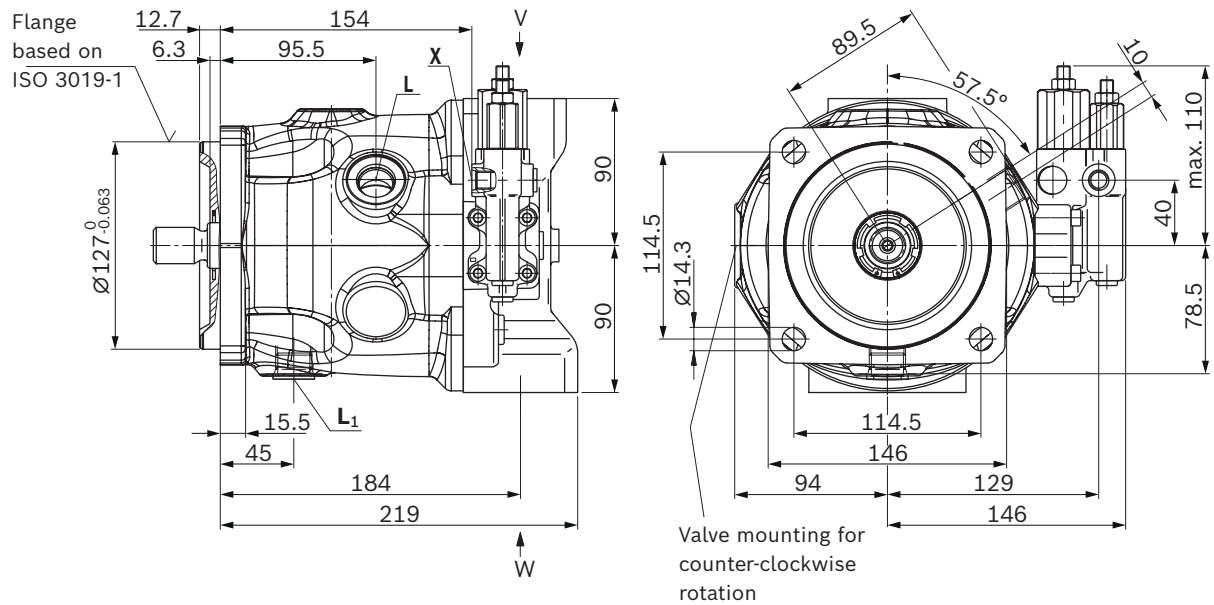
► A variable dither is necessary. The frequency and amplitude must be adapted to the specific system.



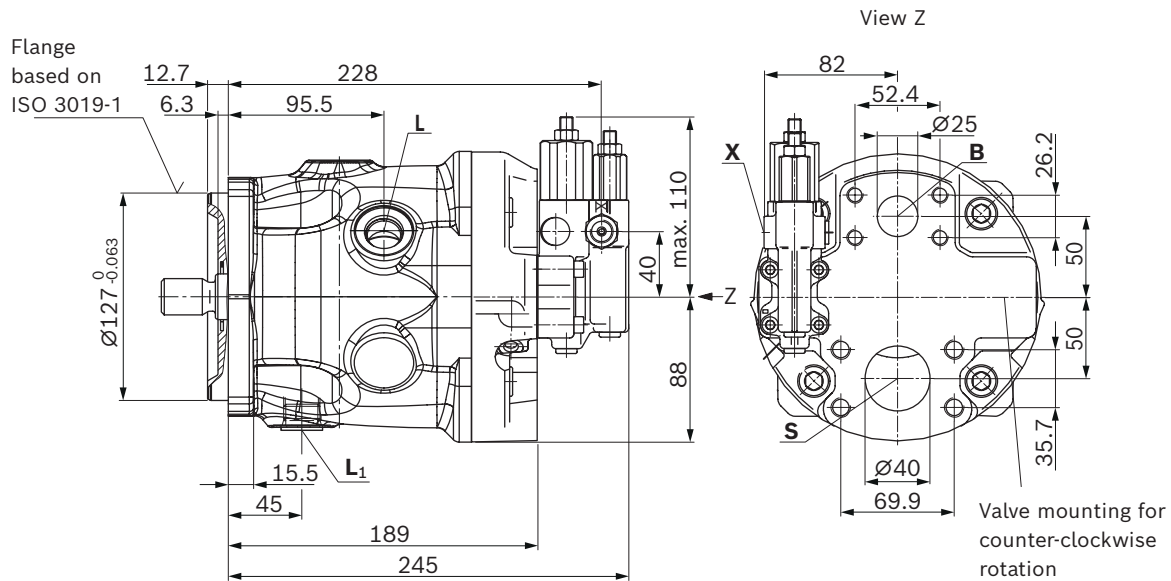
Dimensions, size 45**DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-B; 101-2)****▼ Port plate 12**Flange
based on
ISO 3019-1**▼ Port plate 11**

DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange D (SAE-C; 127-4)

▼ **Port plate 12**

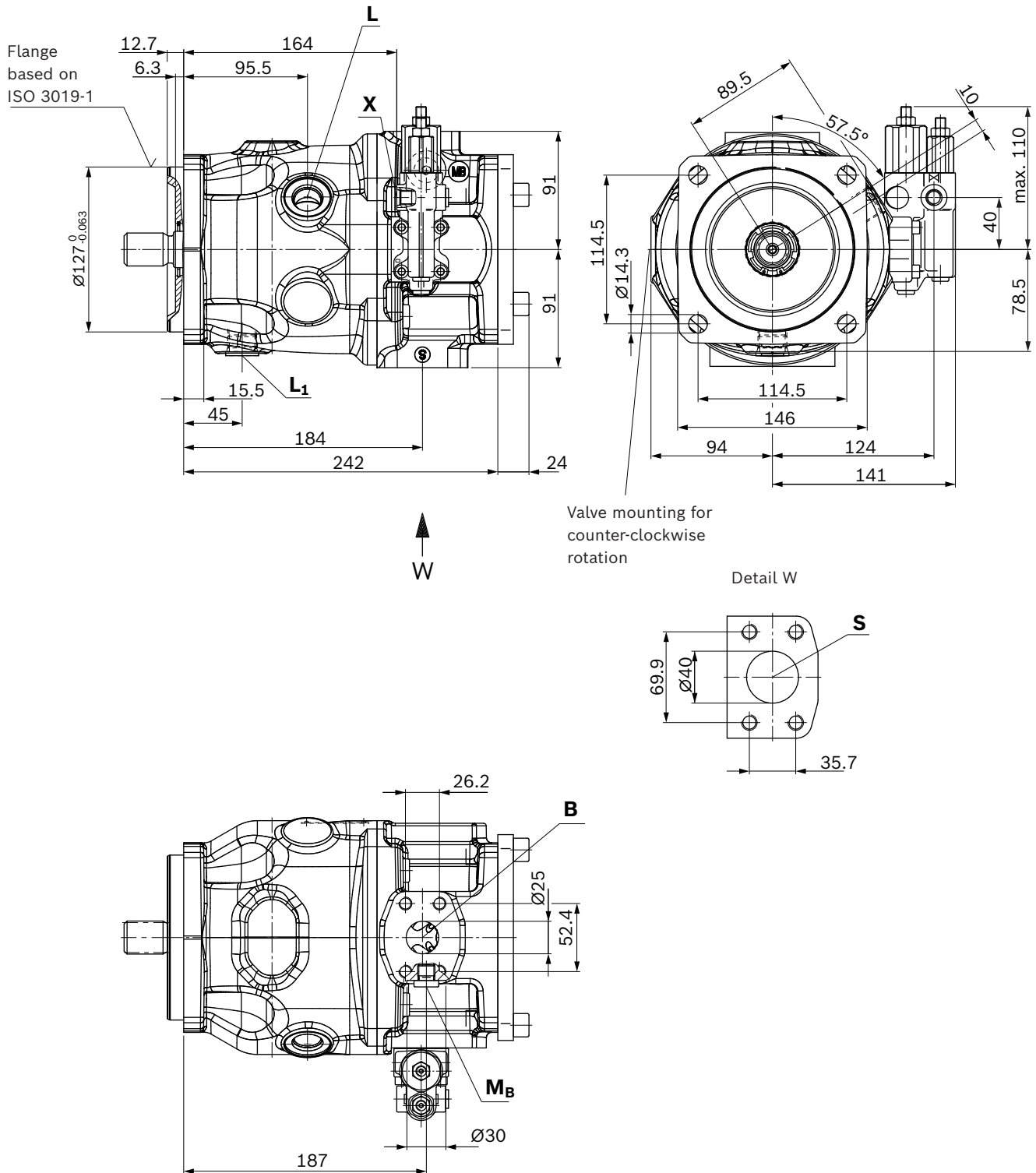


▼ **Port plate 11**

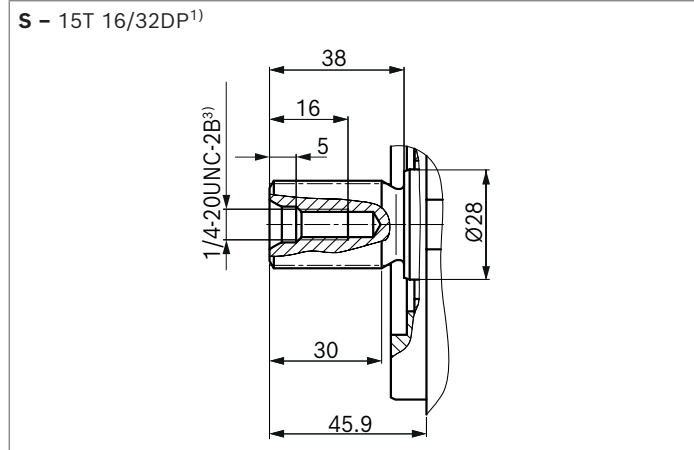


DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-C; 127-4)

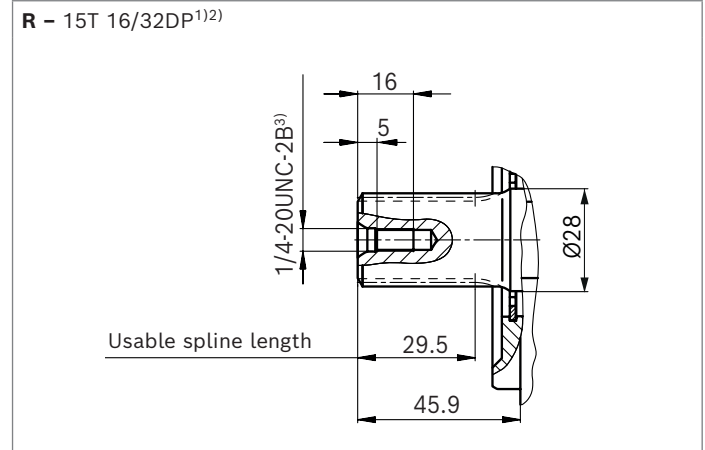
▼ Port plate 22/72 and 32/82



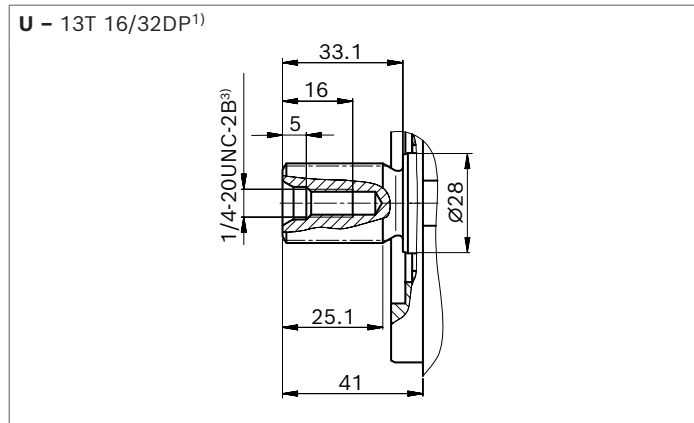
▼ **Splined shaft 1 in** (25-4, ISO 3019-1)



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



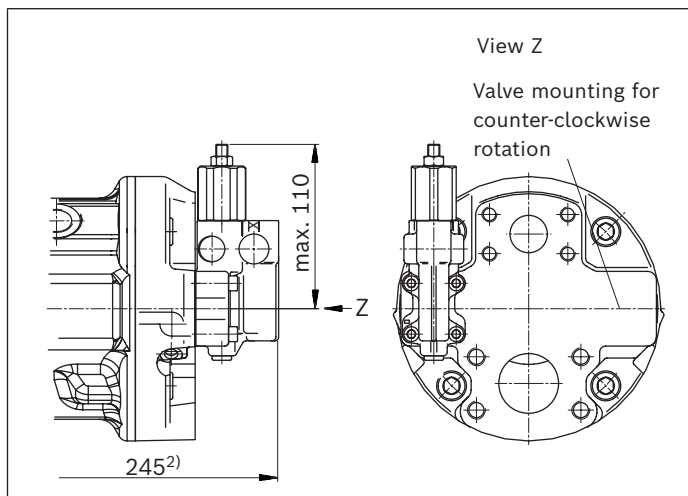
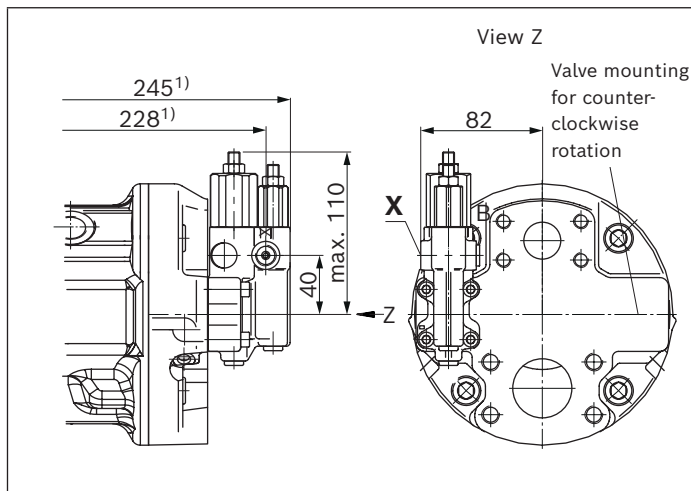
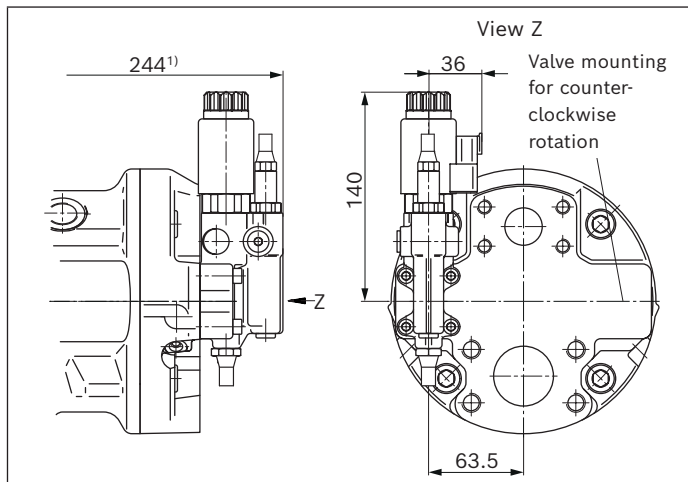
▼ **Splined shaft 7/8 in** (22-4, ISO 3019-1)



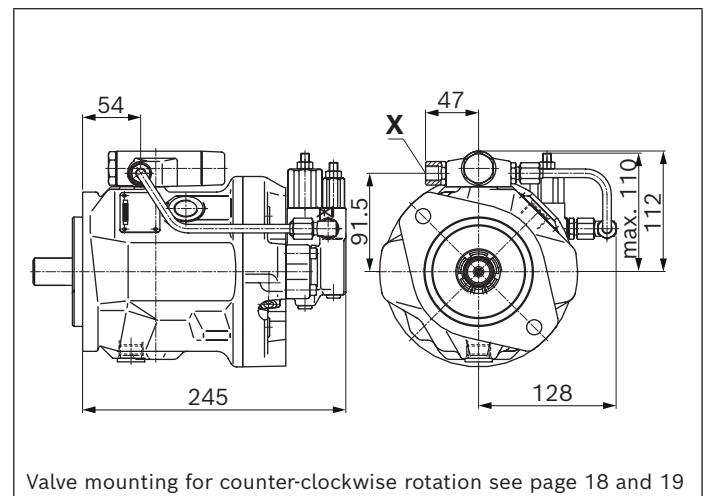
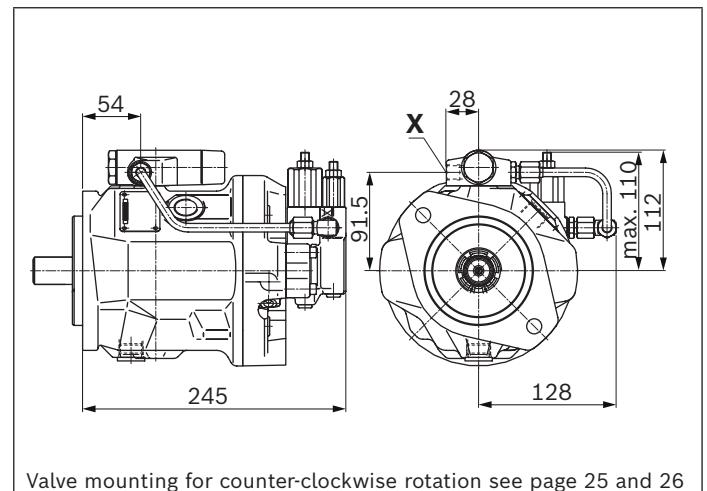
Port plate ports 11, 12, 22 and 32		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	O
	Fastening thread	DIN 13	M10 x 1.5; 17 (0.67) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/2 in	10 (145)	O
	Fastening thread	DIN 13	M12 x 1.75; 20 (0.79) deep		
Port plate ports 72, 82		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	O
	Fastening thread	ASME B1.1	3/8-16 UNC-2B; 18 (0.71) deep		
S	Suction port (standard pressure series)	ISO 6162-1	1 1/2 in	10 (145)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 22 (0.87) deep		
Other ports		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
L	Drain port	ISO 11926 ⁵⁾	7/8-14UNF-2B; 17 (0.67) deep	2 (30)	O ⁶⁾
L₁	Drain port	ISO 11926 ⁵⁾	7/8-14UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	O
M_B	Measuring pressure B (only with port plates 22/72 and 32/82)	DIN 3852-2 ⁵⁾	G 1/4 in; 12 (0.47) deep	350 (5100)	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) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

- 5) The countersink may be deeper than specified in the standard.
- 6) Depending on the installation position, **L** or **L₁** must be connected (also see installation instructions on page 73).
- 7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Port plate 11▼ **DR – Pressure controller; mounting flange C**▼ **DRG – Pressure controller, remote controlled; mounting flange C**▼ **ED7./ER7. – Pressure controller, electric; mounting flange C**

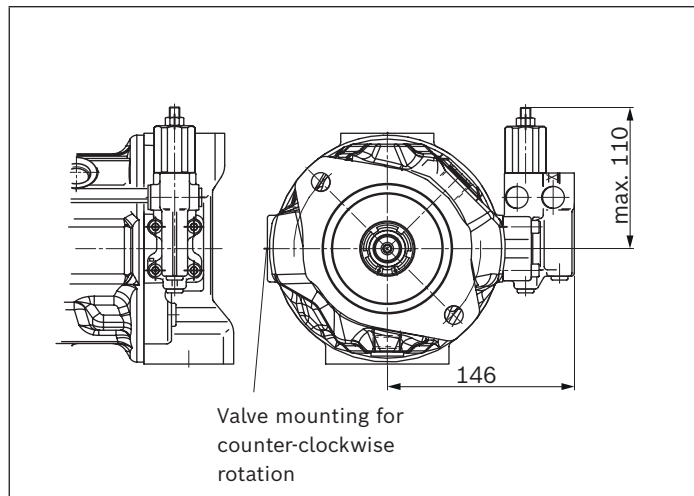
1) To mounting flange

▼ **LA.DS – Pressure, flow and power controller; mounting flange C**▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange C**

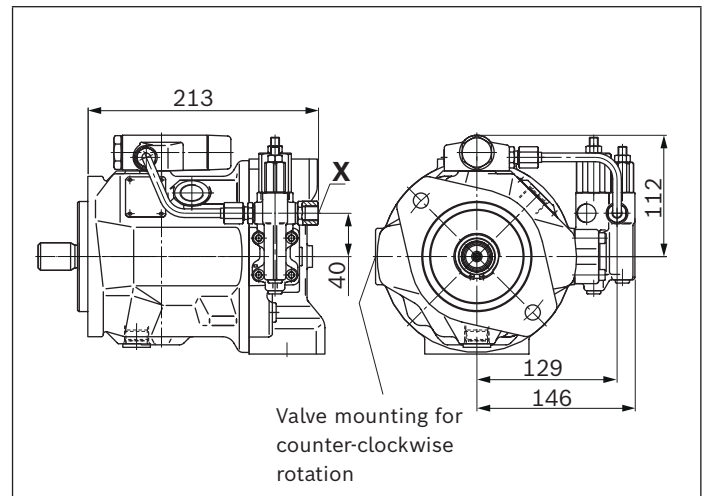
Valve mounting for counter-clockwise rotation see page 25 and 26

Port plate 12

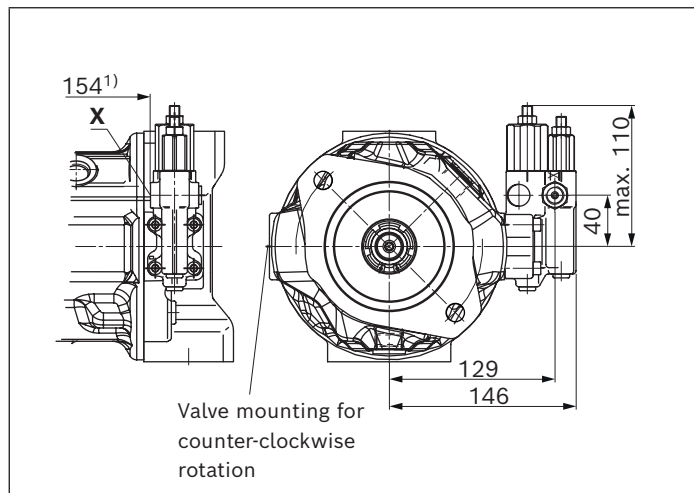
▼ DR – Pressure controller; mounting flange C



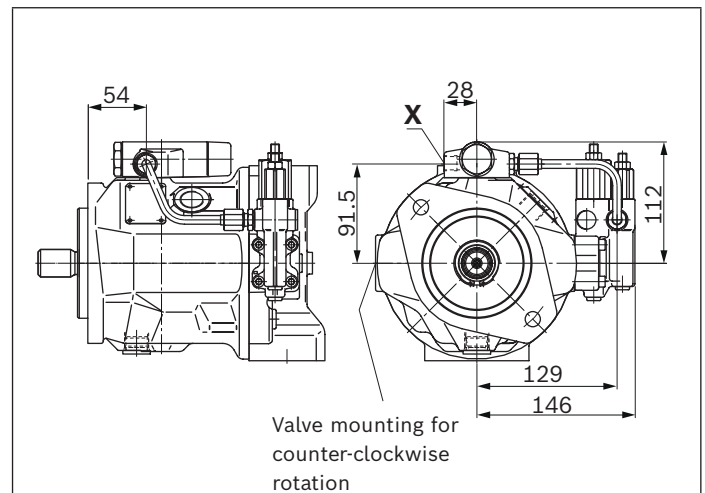
▼ LA.DS – Pressure, flow and power controller; mounting flange C



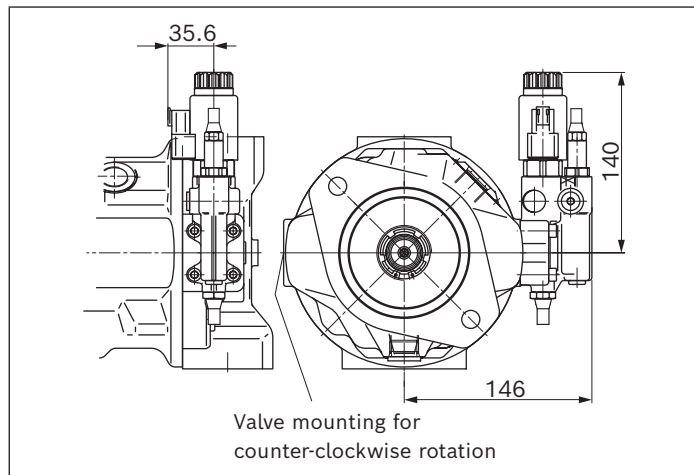
▼ DRG – Pressure controller, remote controlled; mounting flange C



▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange C



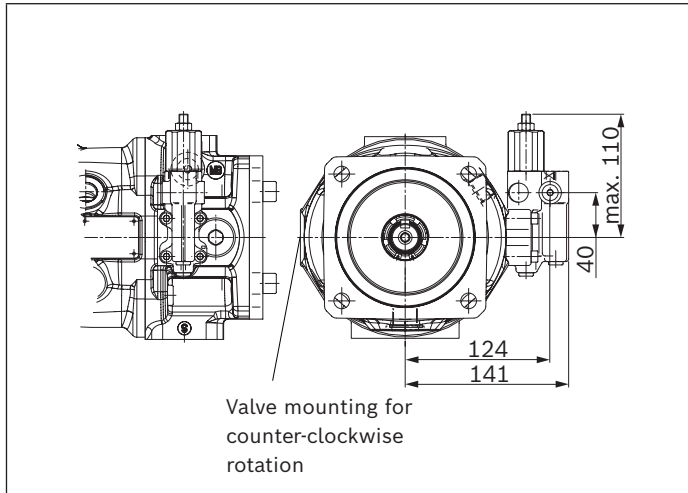
▼ ED7./ER7. – Pressure controller, electric; mounting flange C



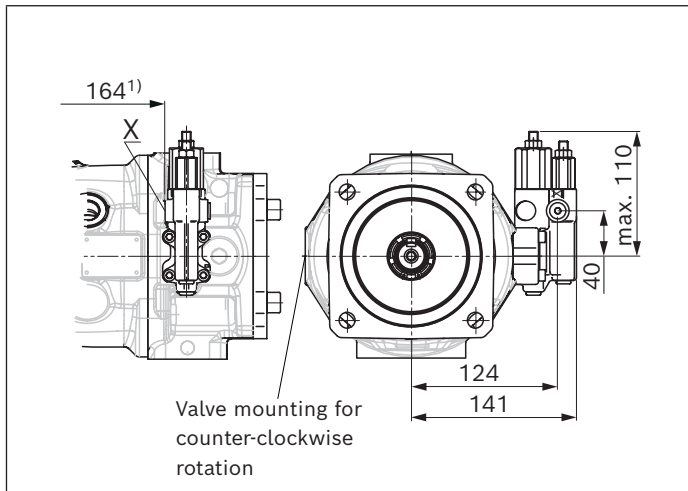
1) To mounting flange

Port plate 22/72 and 32/82

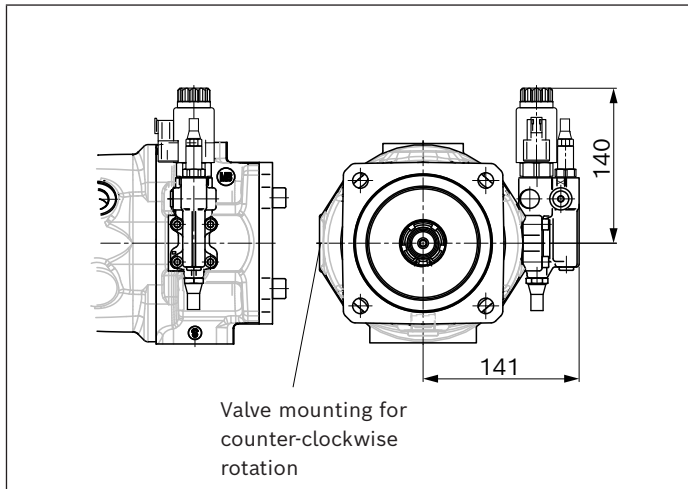
▼ DR – Pressure controller; mounting flange D



▼ DRG – Pressure controller, remote controlled; mounting flange D

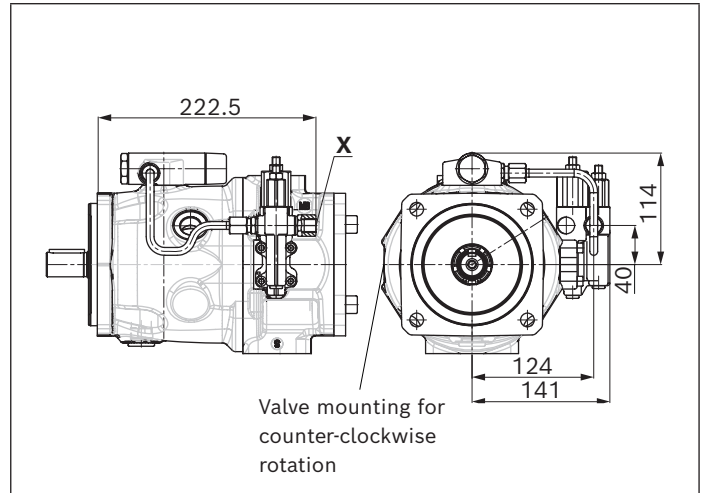


▼ ED7./ER7. – Pressure controller, electric; mounting flange D

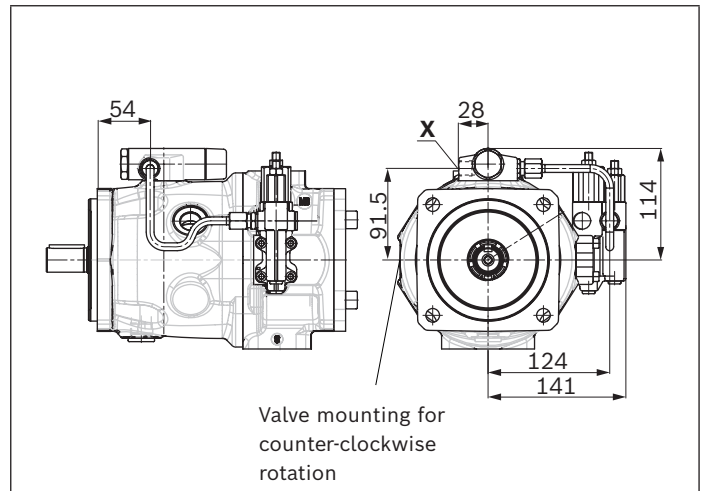


1) To mounting flange

▼ LA.DS – Pressure, flow and power controller; mounting flange D

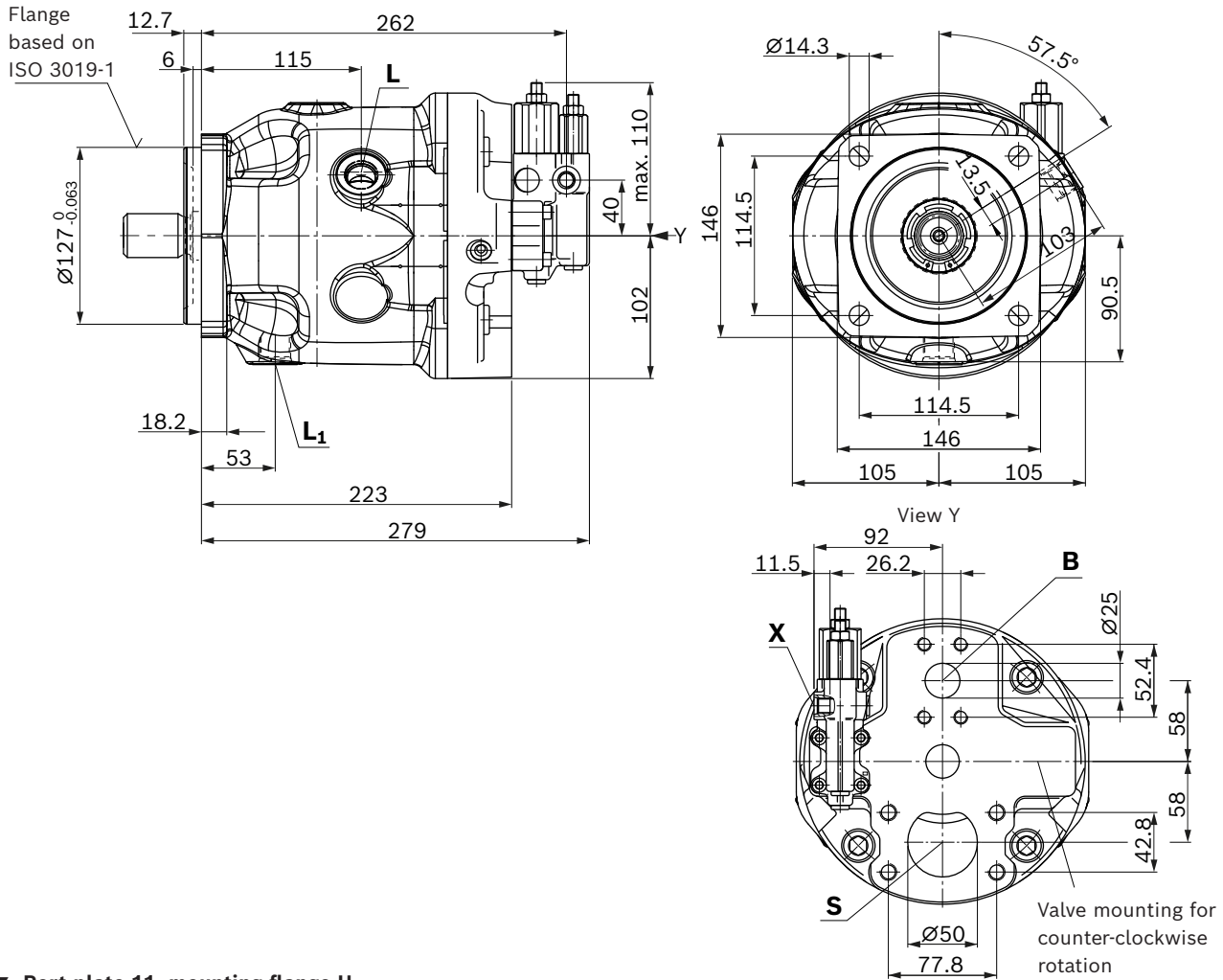


▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D

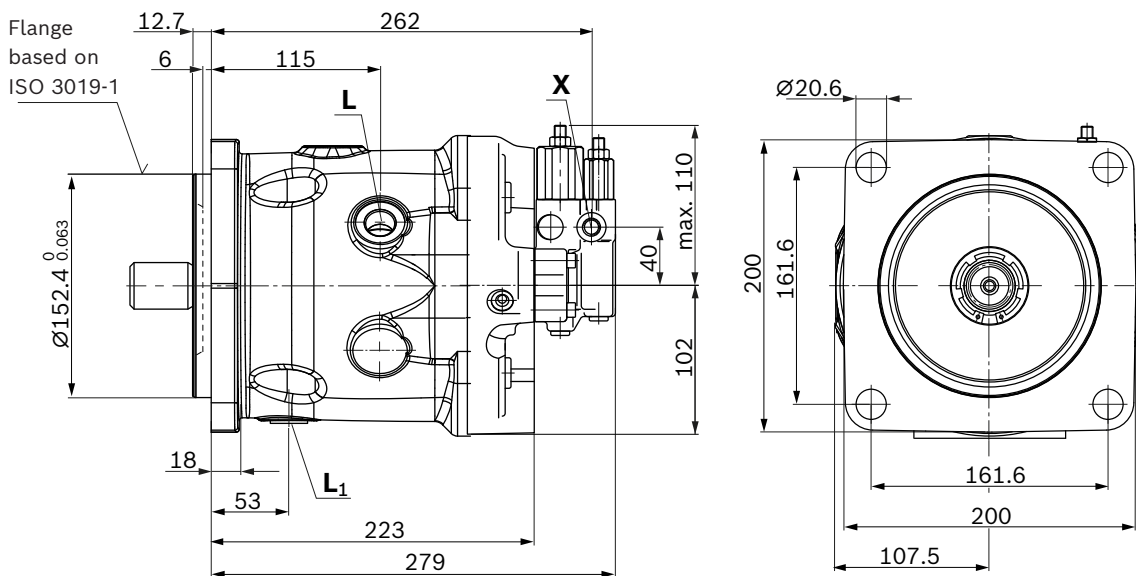


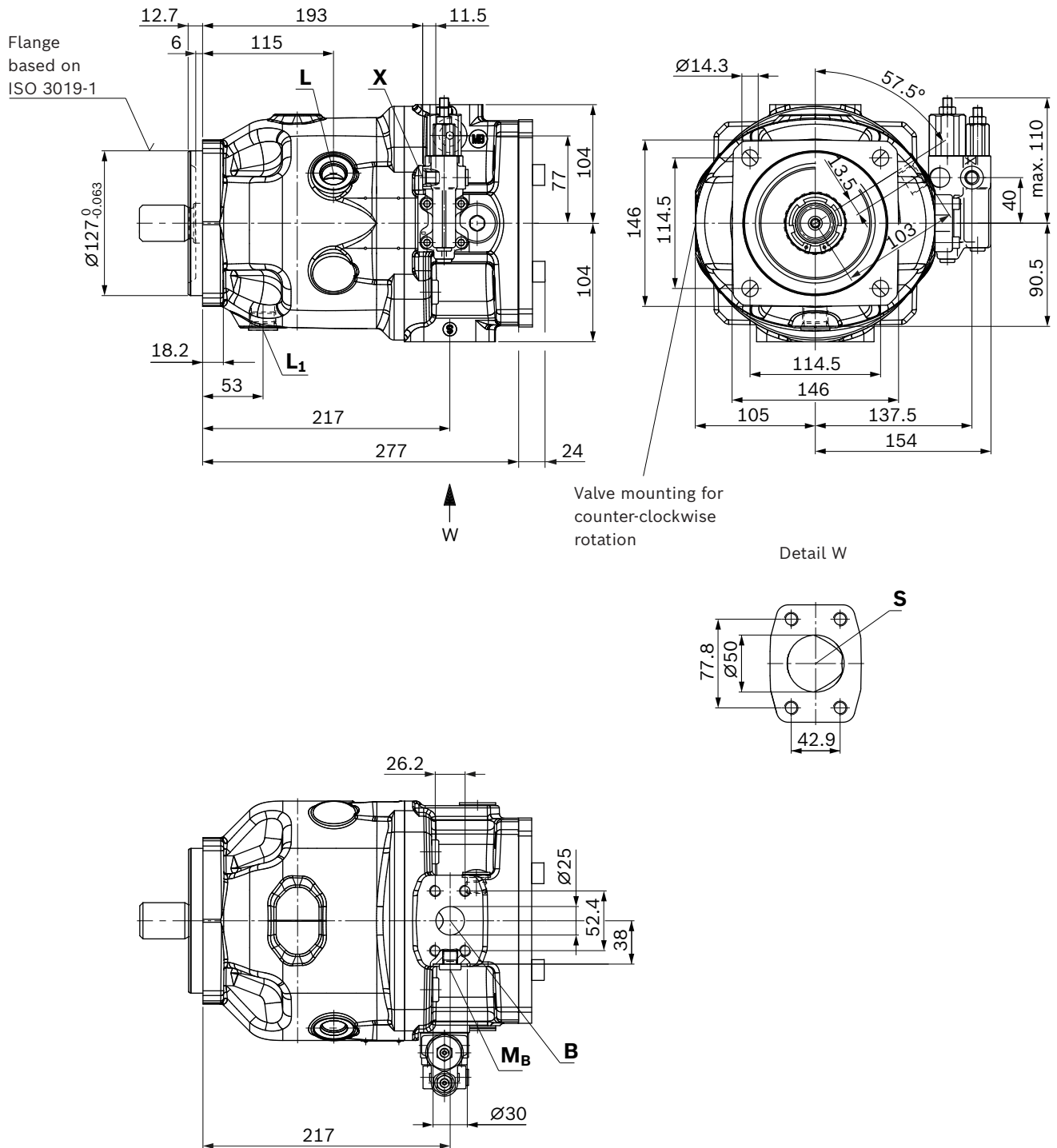
DRF, DRS, DRSC – Pressure flow controller, port plate 11; mounting flange D (SAE-C; 127-4) and U (SAE-D; 152-4)

▼ **Port plate 11; mounting flange D**



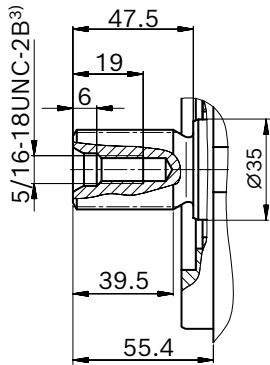
▼ **Port plate 11; mounting flange U**



DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-C; 127-4)**▼ Port plate 22/72 and 32/82**

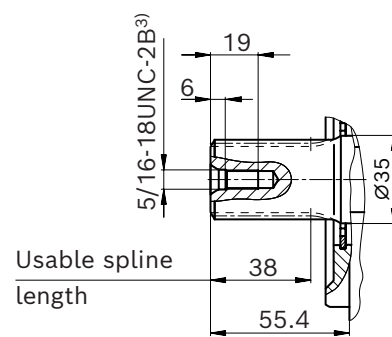
▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)**

S – 14T 12/24DP¹⁾



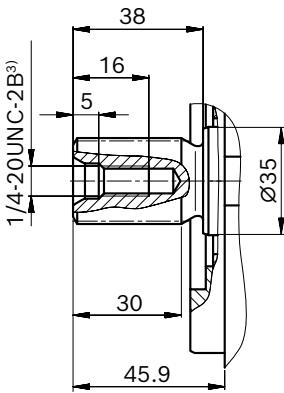
▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)**

R – 14T 12/24DP¹⁾²⁾



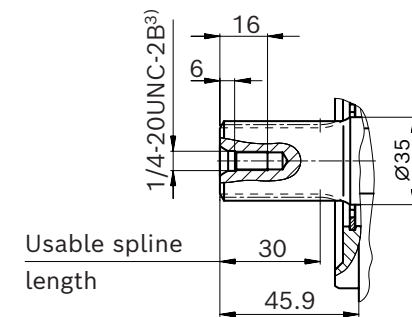
▼ **Splined shaft 1 in (25-4, ISO 3019-1)**

U – 15T 16/32DP¹⁾



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

W – 15T 16/32DP¹⁾²⁾



Port plate ports 11, 12, 22 and 32		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	O
	Fastening thread	DIN 13	M10 x 1.5; 17 (0.67) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 in	10 (145)	O
	Fastening thread	DIN 13	M12 x 1.75; 20 (0.79) deep		
Port plate ports 72, 82		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (standard pressure series)	ISO 6162-1	1 in	350 (5100)	O
	Fastening thread	ASME B1.1	3/8-16 UNC-2B; 18 (0.71) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 in	10 (145)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 20 (0.79) deep		
Other ports		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
L	Drain port	ISO 11926 ⁵⁾	7/8-14UNF-2B; 17 (0.67) deep	2 (30)	O ⁶⁾
L₁	Drain port	ISO 11926 ⁵⁾	7/8-14UNF-2B; 17 (0.67) deep	2 (30)	X ⁶⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	O
M_B	Measuring pressure B (only for port plate 22/72 and 32/82)	DIN 3852-2 ⁵⁾	G 1/4 in; 12 (0.47) deep	350 (5100)	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⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

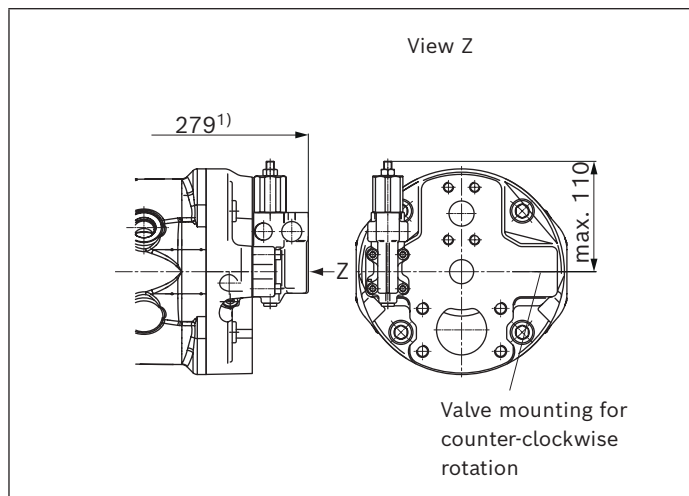
⁵⁾ The countersink may be deeper than specified in the standard.

⁶⁾ Depending on the installation position, **L** or **L₁** must be connected (also see installation instructions on page 73).

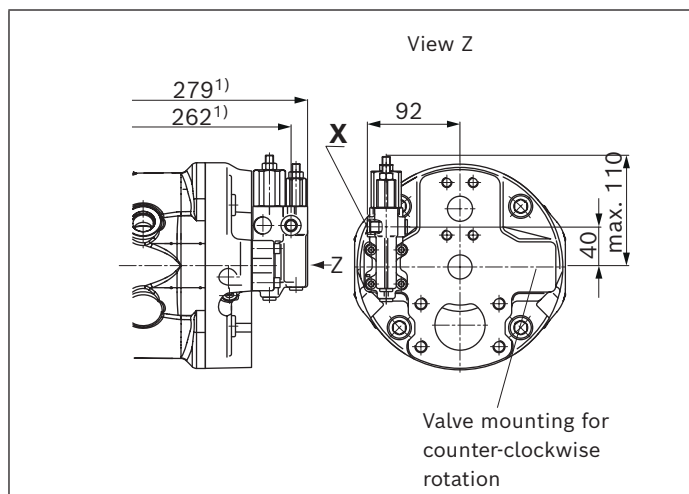
⁷⁾ O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Port plate 11

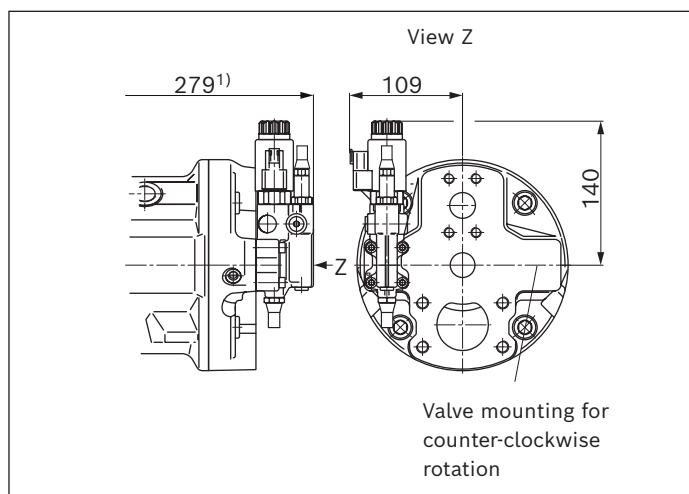
▼ DR – Pressure controller; mounting flange D



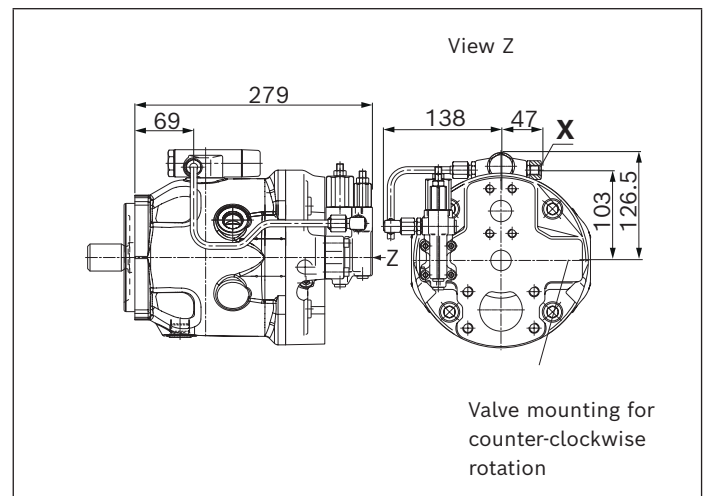
▼ DRG – Pressure controller, remote controlled; mounting flange D



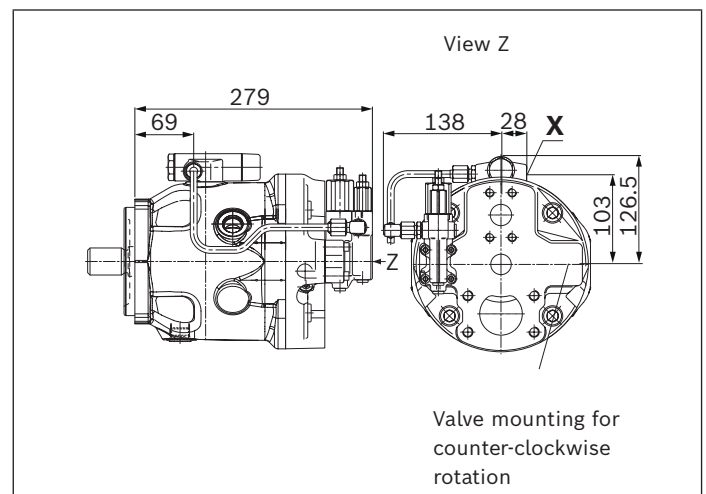
▼ ED7./ER7. – Pressure controller, electric; mounting flange D



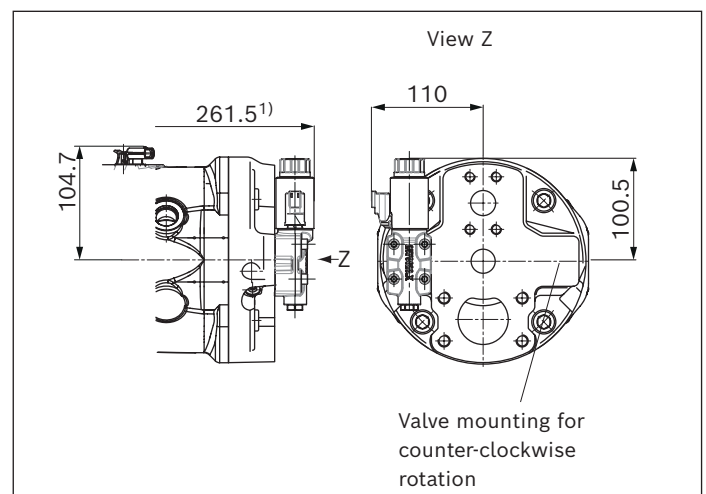
▼ LA.DS – Pressure, flow and power controller; mounting flange D



▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D



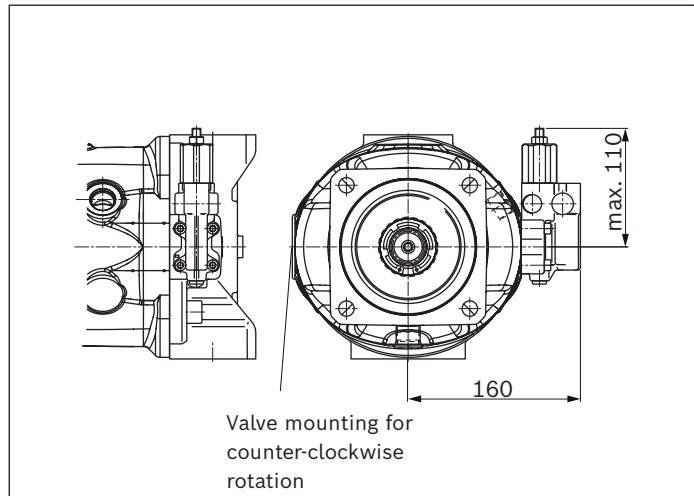
▼ EC4/EB4 – Electrohydraulic control valve



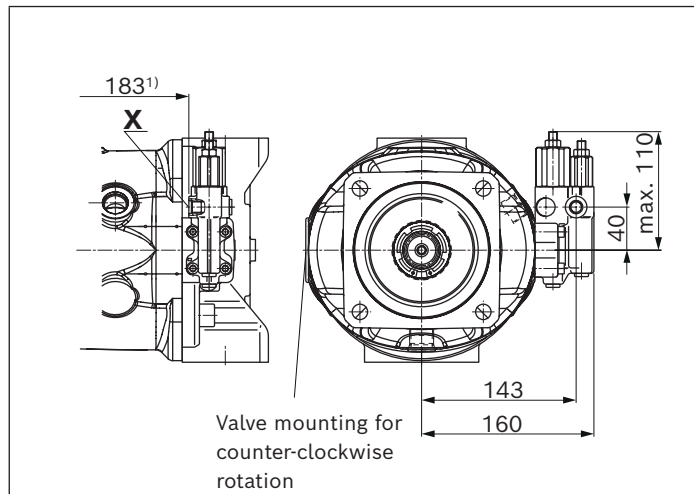
1) To mounting flange

Port plate 12

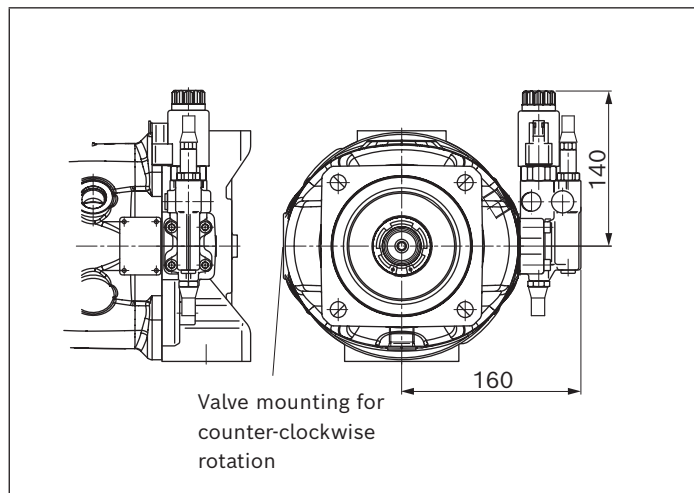
▼ DR – Pressure controller; mounting flange D



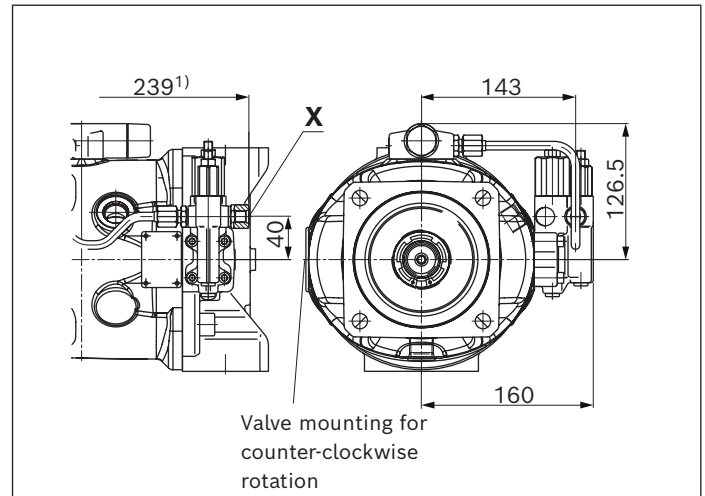
▼ DRG – Pressure controller, remote controlled; mounting flange D



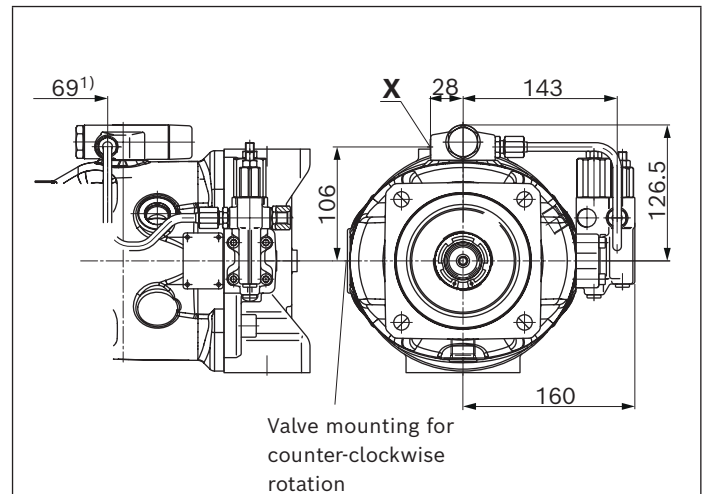
▼ ED7./ER7. – Pressure controller, electric; mounting flange D



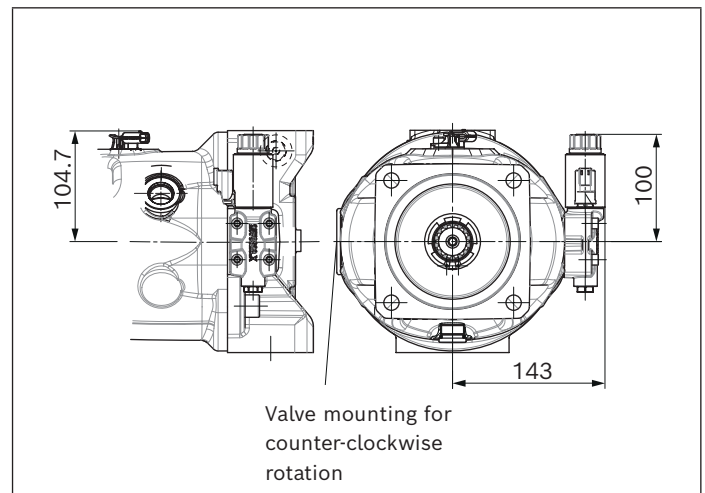
▼ LA.DS – Pressure, flow and power controller; mounting flange D



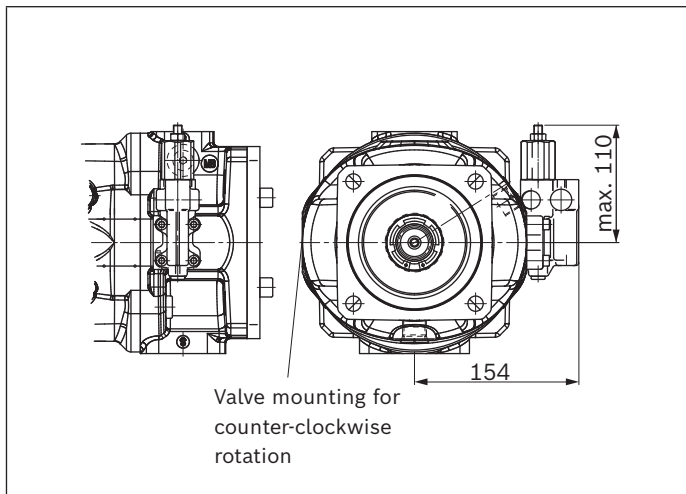
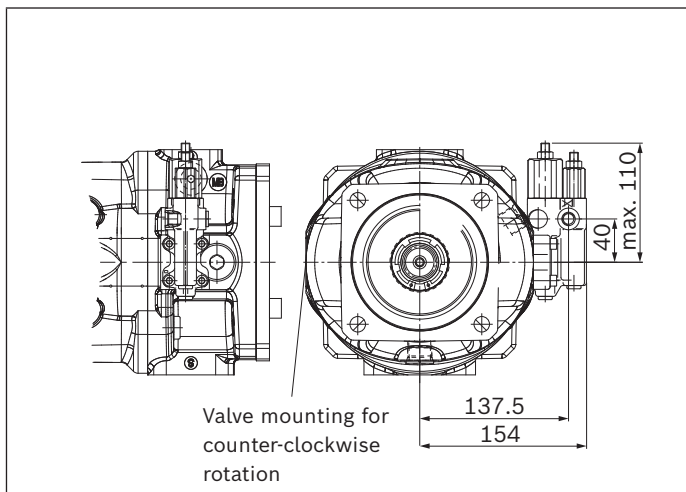
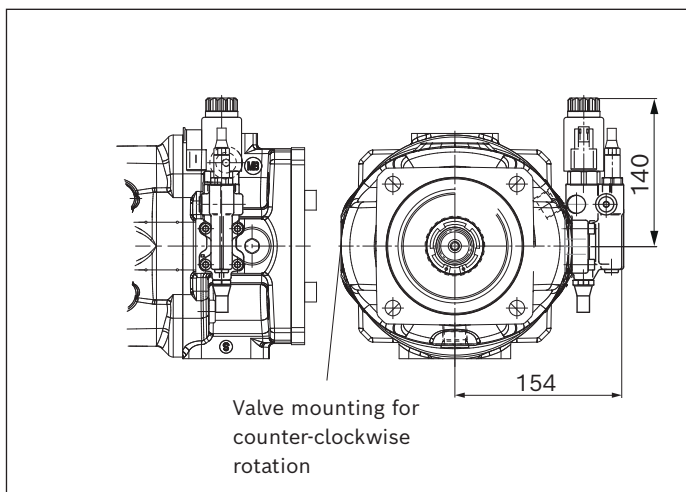
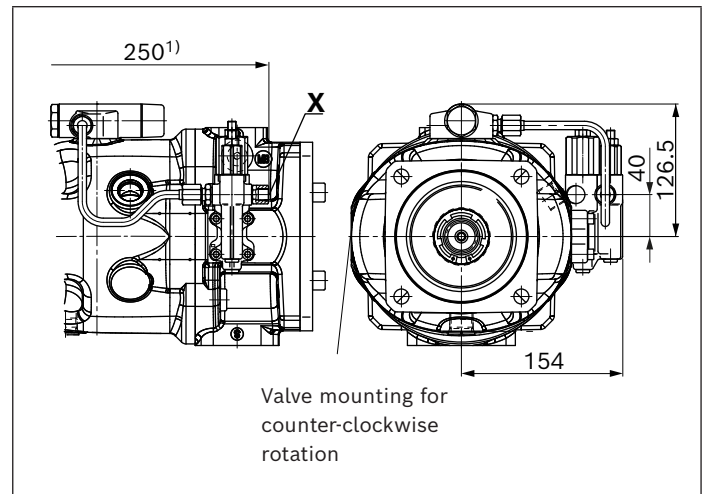
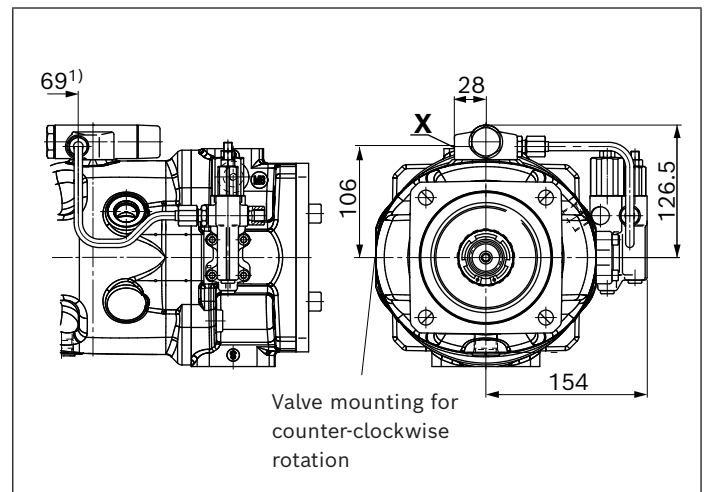
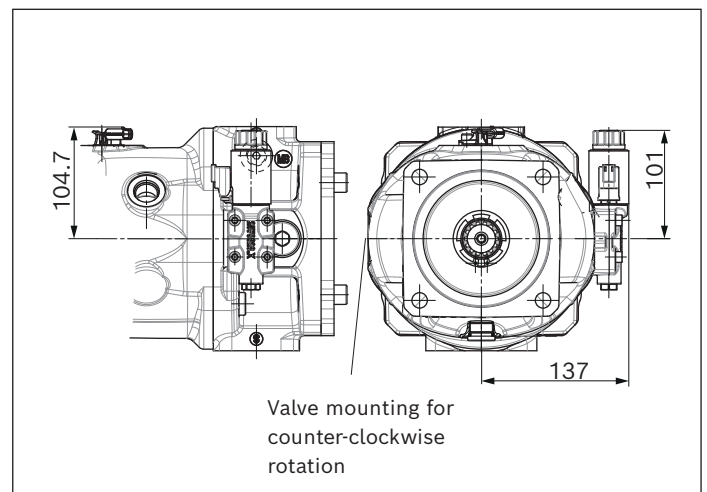
▼ LA.DG – Pressure, with pressure cut-off, remote controlled; mounting flange D



▼ EC4/EB4 – Electrohydraulic control valve



1) To mounting flange

Port plate 22/72 and 32/82**▼ DR – Pressure controller; mounting flange D****▼ DRG – Pressure controller, remote controlled; mounting flange D****▼ ED7./ER7. – Pressure controller, electric; mounting flange D****▼ LA.DS – Pressure, flow and power controller; mounting flange D****▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D****▼ EC4/EB4 – Electrohydraulic control valve**

1) To mounting flange

DRF, DRS, DRSC – Pressure flow controller, port plate 11, 12; mounting flange D (SAE-D; 152-4)

Flange based on ISO 3019-1

$\text{Ø}152.4 \begin{smallmatrix} 0 \\ -0.063 \end{smallmatrix}$

12.7

5.7

312

149.5

L

X

max. 110

40

Z

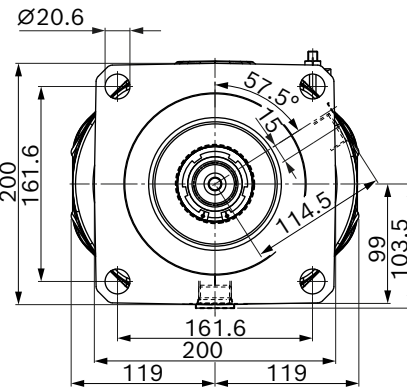
20

80

L₁

273

329



Technical drawing of Detail W, a square flange with a central hole and four corner holes. Dimensions: overall width 88.9, overall height 88.9, central hole diameter $\varnothing 60$, corner hole diameter $\varnothing 10$, corner hole pitch diameter $\varnothing 25.4$, corner hole center-to-center distance 50.8. A section line S-S is shown.

Detail V

31.8

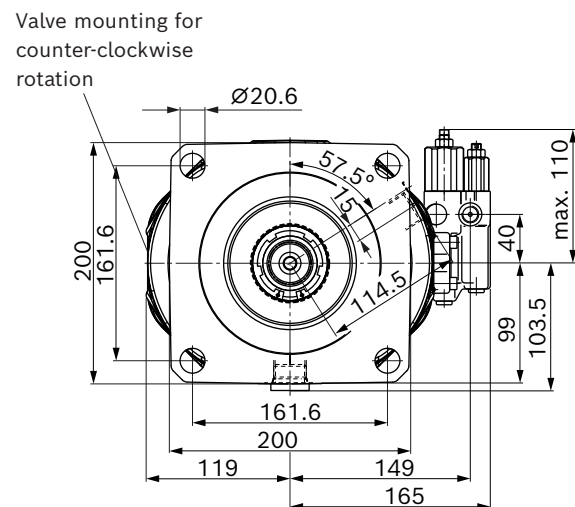
Ø32

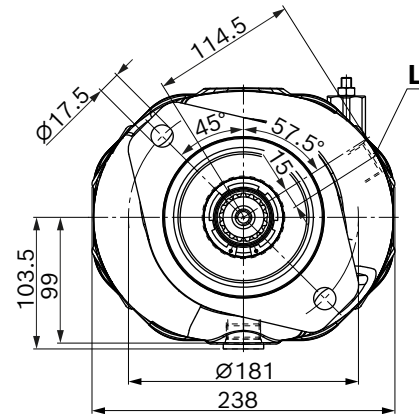
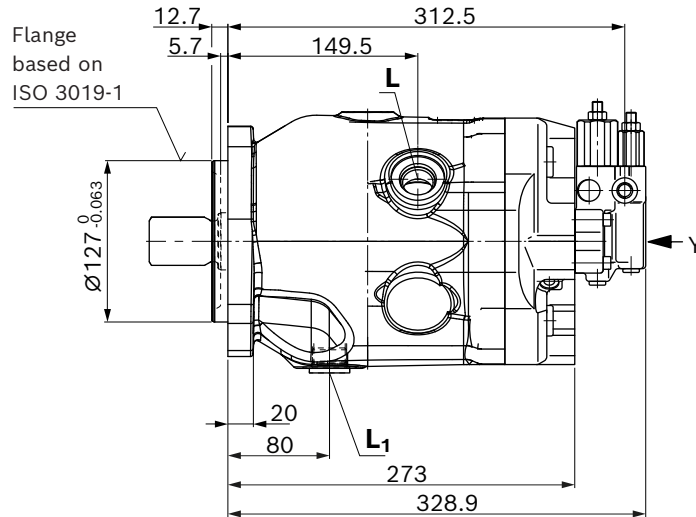
66.7

B

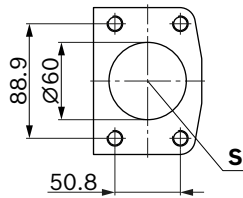
[illegible]

Valve mounting for counter-clockwise rotation

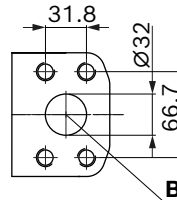
[illegible]

Dimensions, size 100**DRF, DRS, DRSC – Pressure flow controller, port plate 11, 12; mounting flange C (SAE-C; 127-2)****▼ Port plate 11; mounting flange C**

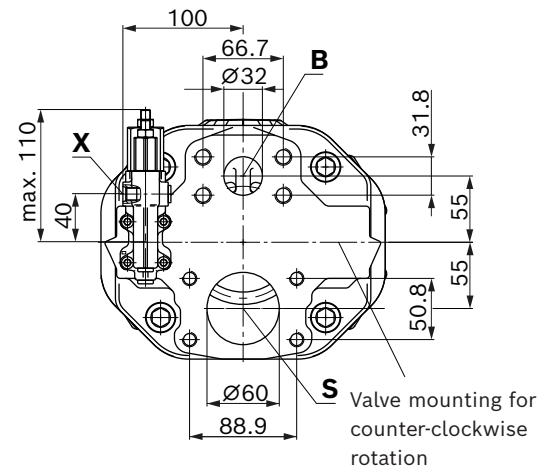
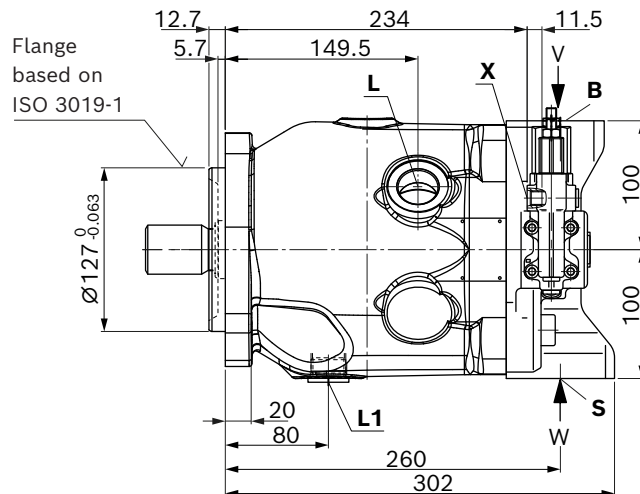
Detail W



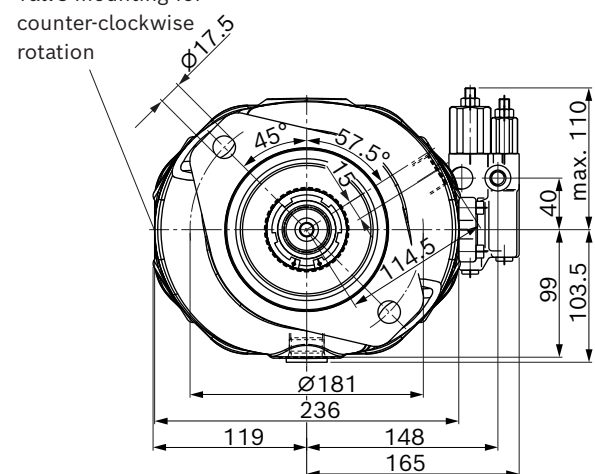
Detail V



View Z

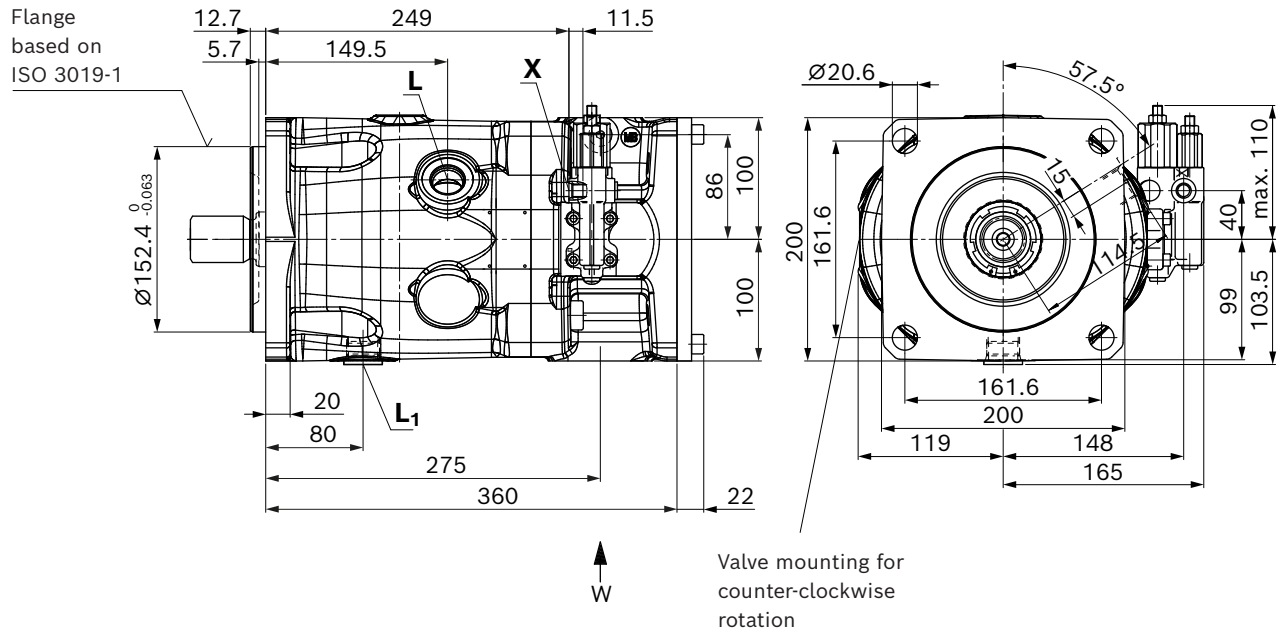
**▼ Port plate 12; mounting flange C**

Valve mounting for counter-clockwise rotation

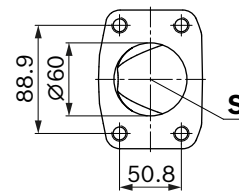


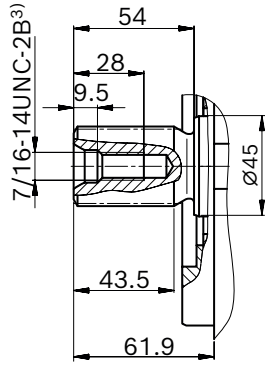
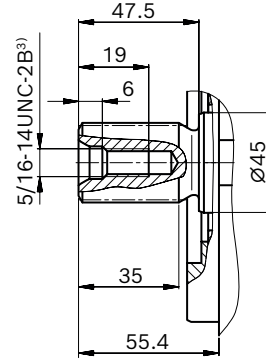
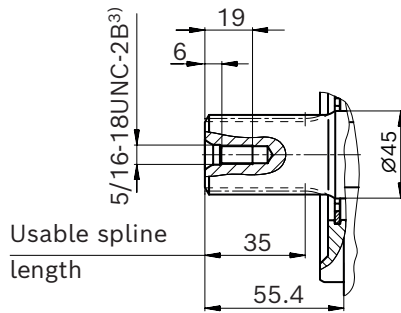
DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22/72 and 32/82**



Detail W



▼ **Splined shaft 1 1/2 in (38-4, ISO 3019-1)****S** – 17T 12/24DP¹⁾▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)****U** – 14T 12/24DP¹⁾▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)****W** – 14T 12/24DP¹⁾²⁾

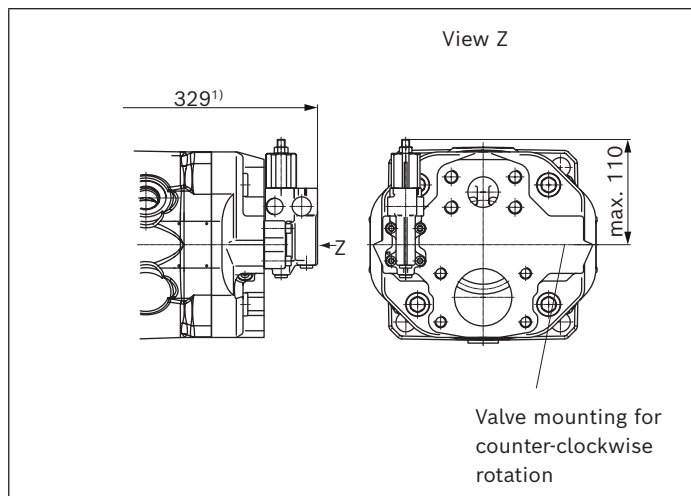
Port plate ports 11, 12, 22 and 32		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 x 2 ⁸⁾ ; 19 (0.75) deep	350 (5100)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 x 1.75; 17 (0.67) deep	10 (145)	O
Port plate ports 72, 82		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	1 1/4 in 1/2-13 UNC-2B; 19 (0.75) deep	350 (5100)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 1/2 in 1/2-13 UNC-2B; 24 (0.94) deep	10 (145)	O
Other ports		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
L	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	O ⁶⁾
L₁	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	X ⁶⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	O
M_B	Measuring pressure B (only with port plates 22/72 and 32/82)	DIN 3852-2 ⁵⁾	G 1/4 in; 12 (0.47) deep	350 (5100)	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) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

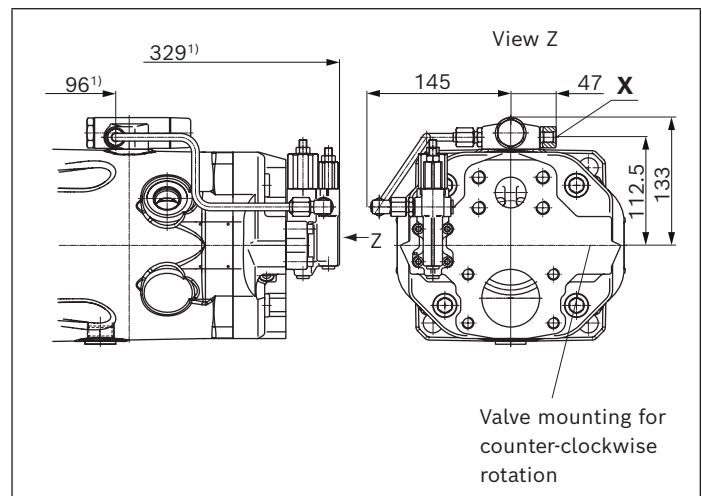
- 5) The countersink may be deeper than specified in the standard.
- 6) Depending on the installation position, **L** or **L₁** must be connected (also see installation instructions on page 73).
- 7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
- 8) Fastening thread M14 deviating from standard ISO 6162-2.

Port plate 11

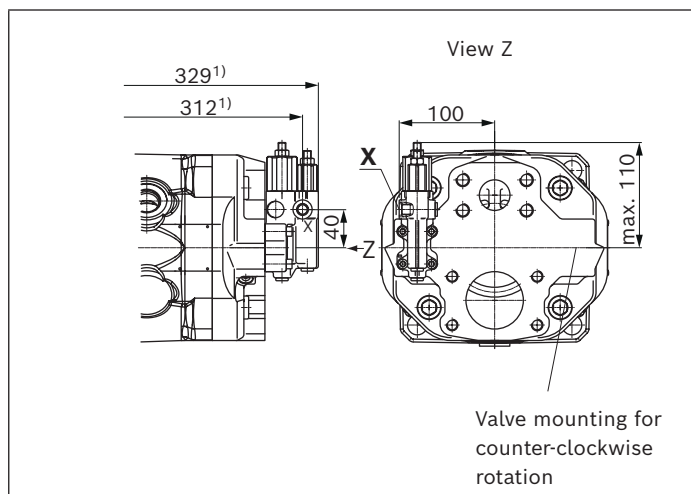
▼ DR – Pressure controller; mounting flange D



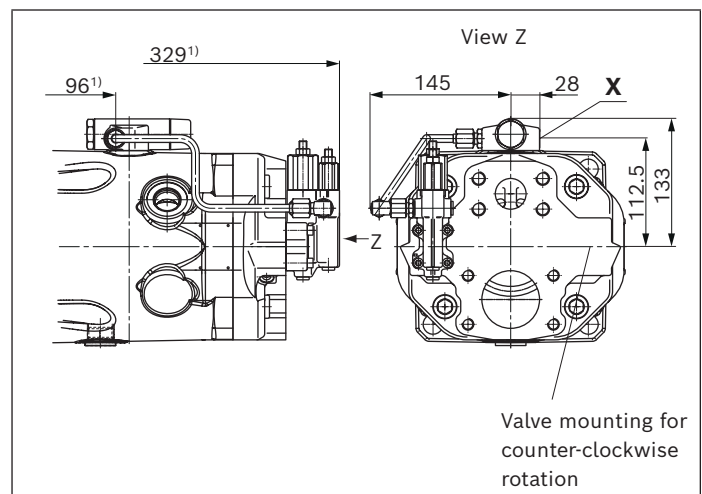
▼ LA.DS – Pressure, flow and power controller; mounting flange D



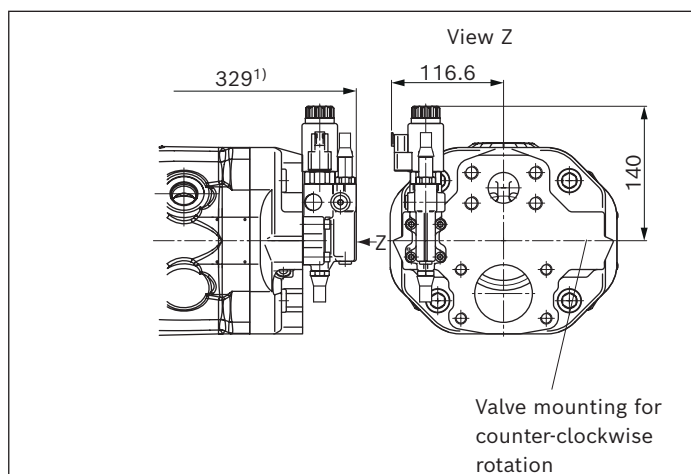
▼ DRG – Pressure controller, remote controlled; mounting flange D



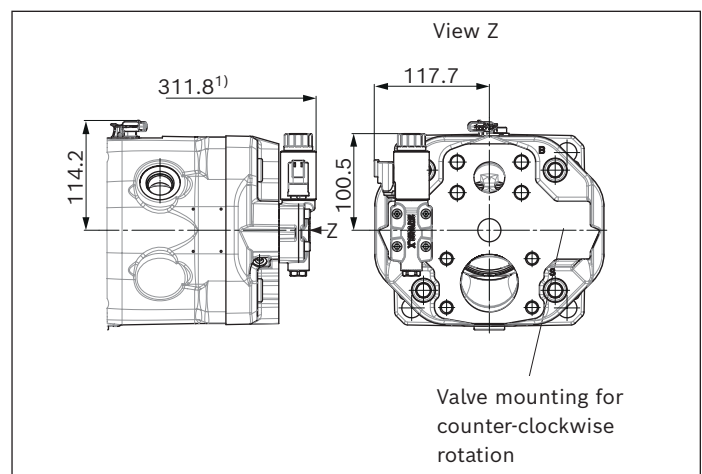
▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D



▼ ED7./ER7. – Pressure controller, electric; mounting flange D



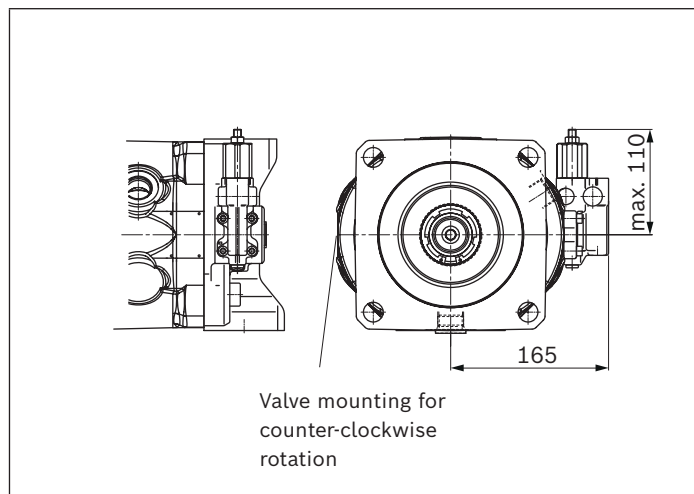
▼ EC4/EB4 – Electro-hydraulic control valve; mounting flange D



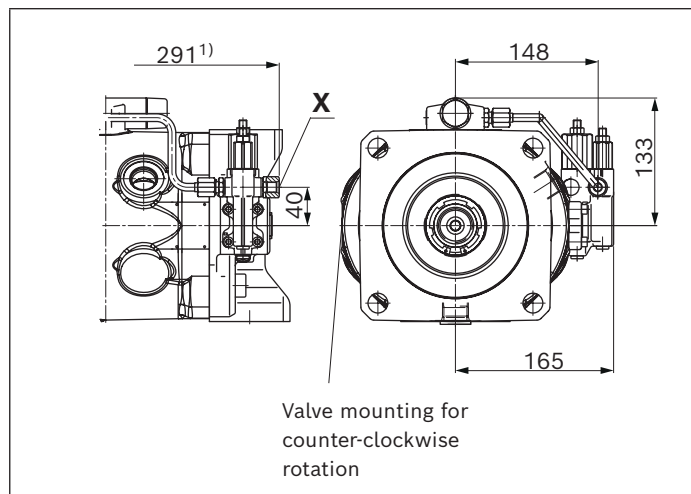
1) To mounting flange

Port plate 12

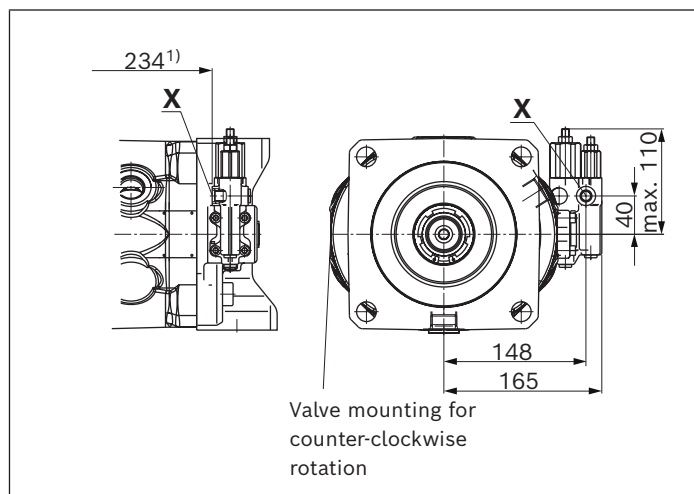
▼ DR – Pressure controller; mounting flange D



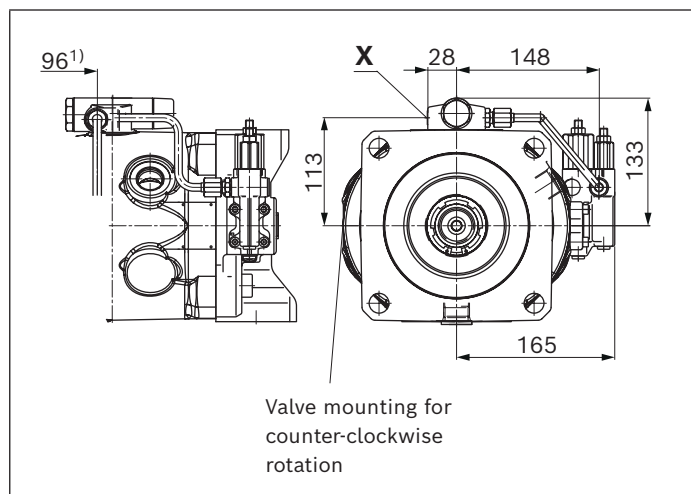
▼ LA.DS – Pressure, flow and power controller; mounting flange D



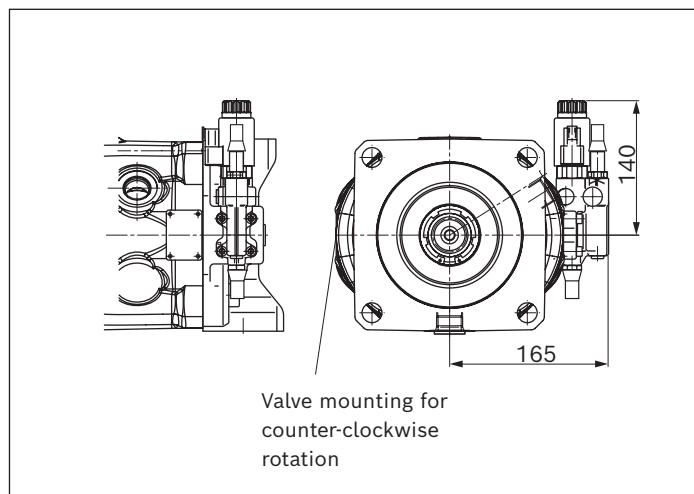
▼ DRG – Pressure controller, remote controlled; mounting flange D



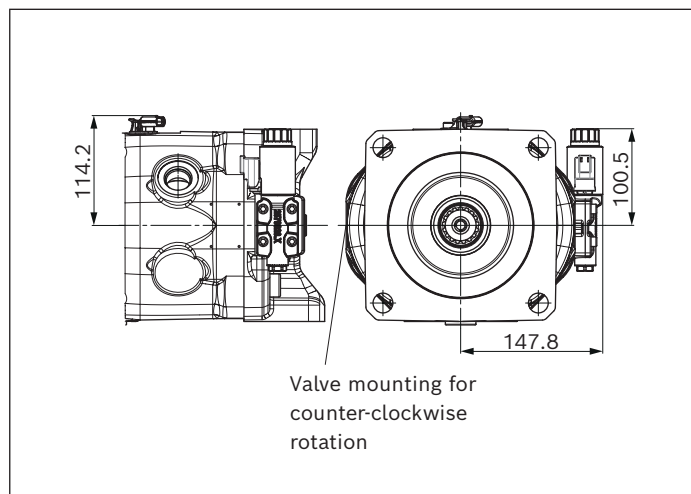
▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D



▼ ED7./ER7. – Pressure controller, electric; mounting flange D



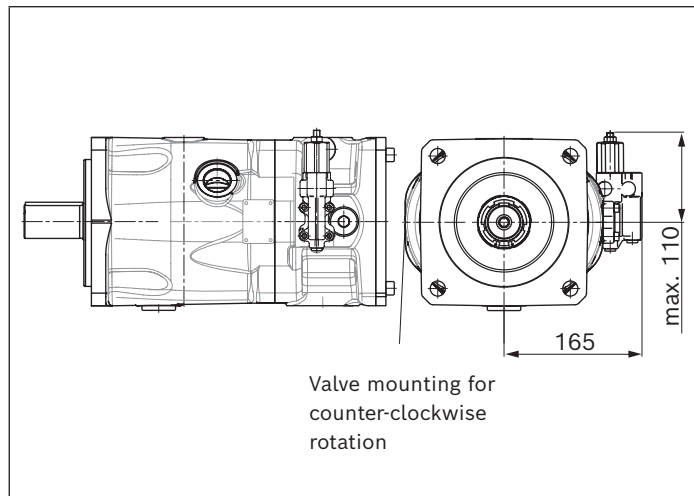
▼ EC4/EB4 – Electro-hydraulic control valve; mounting flange D



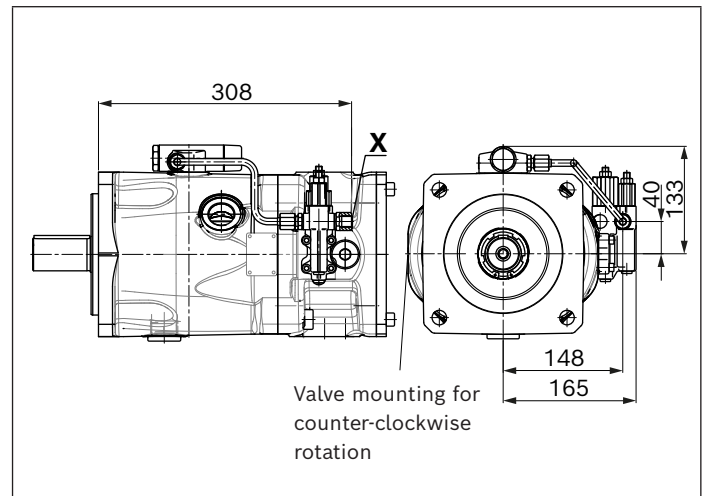
1) To mounting flange

Port plate 22/72 and 32/82

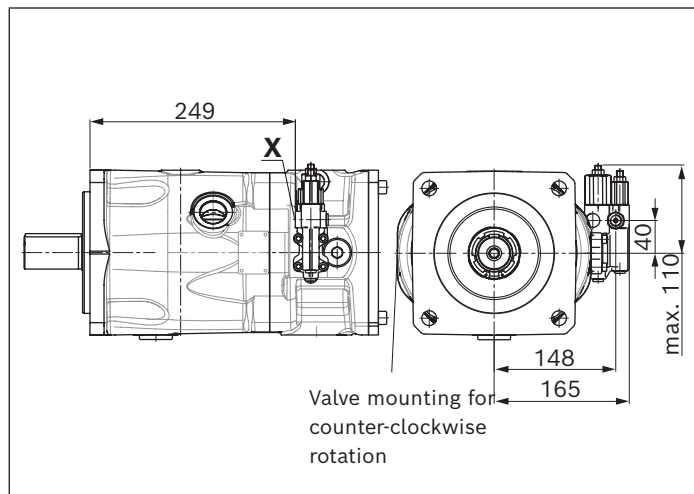
▼ **DR – Pressure controller; mounting flange D**



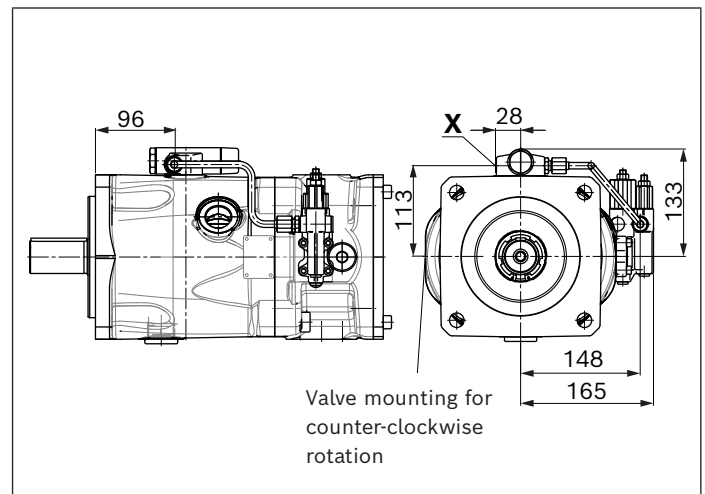
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



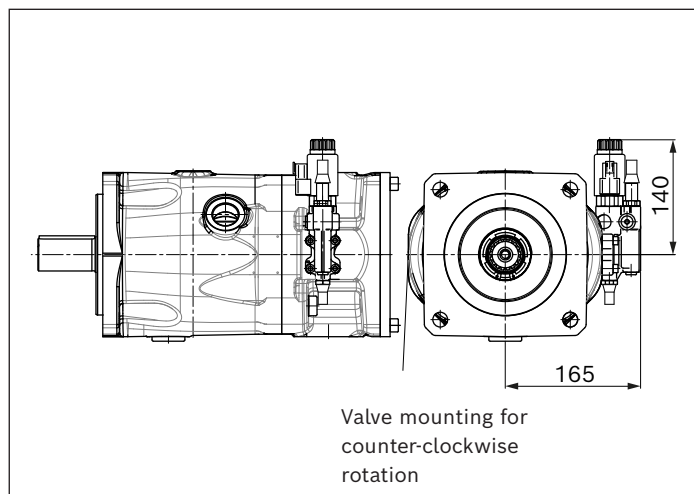
▼ **DRG – Pressure controller, remote controlled; mounting flange D**



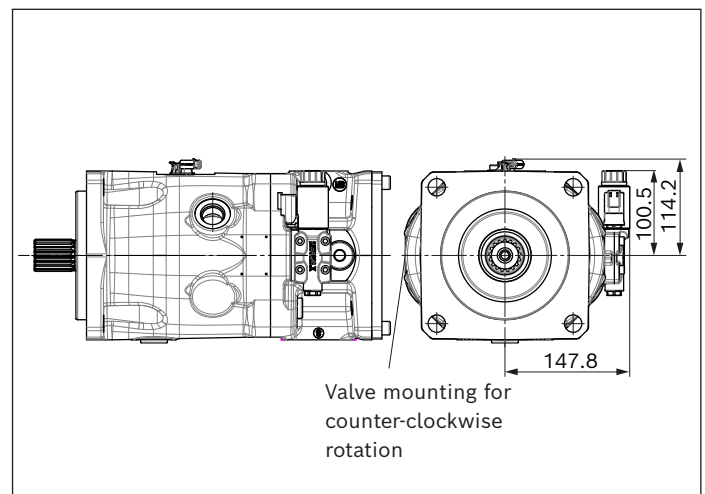
▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**

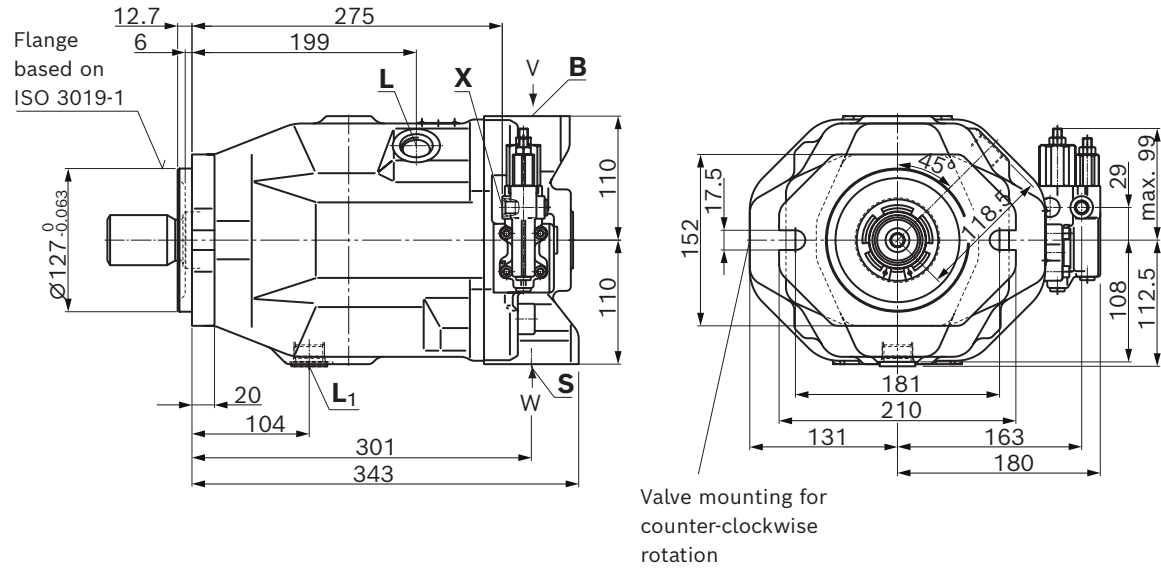
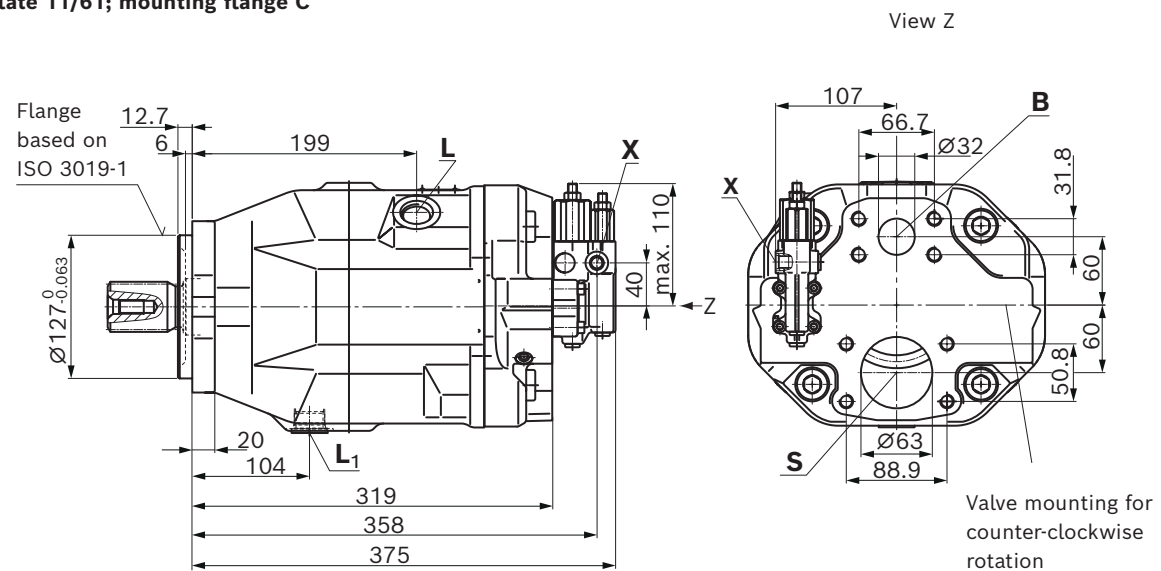


▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



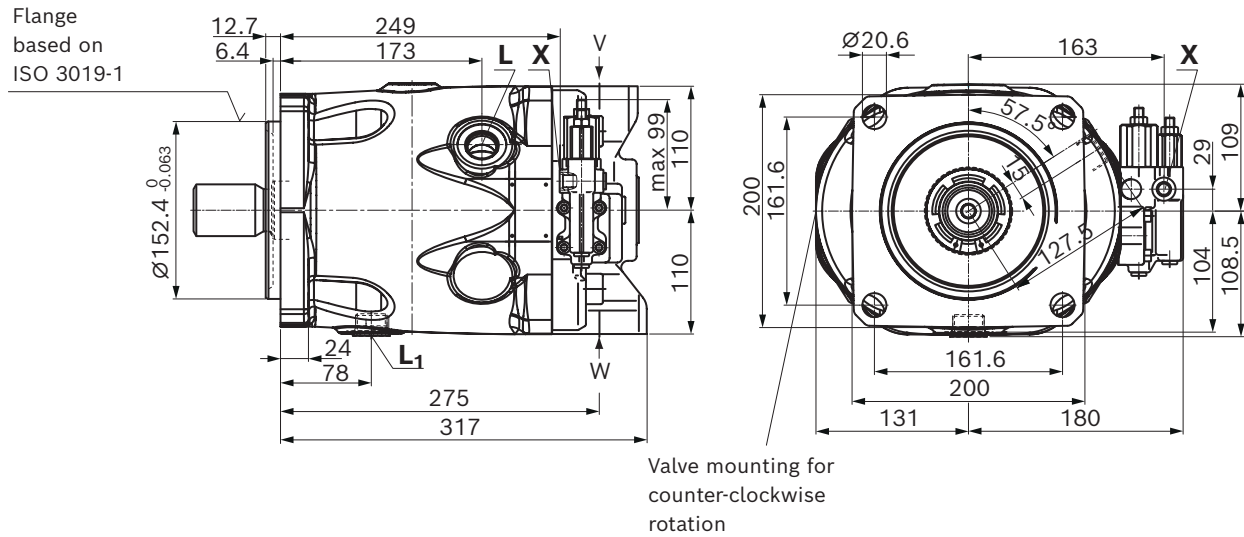
▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



Dimensions, size 140**DRF, DRS, DRSC – Pressure flow controller, port plate 11/61 and 12/62; mounting flange C (SAE-C; 127-2)****▼ Port plate 12/62; mounting flange C****▼ Port plate 11/61; mounting flange C**

DRF, DRS, DRSC – Pressure flow controller, port plate 11/61 and 12/62; mounting flange D (SAE-D; 152-4)

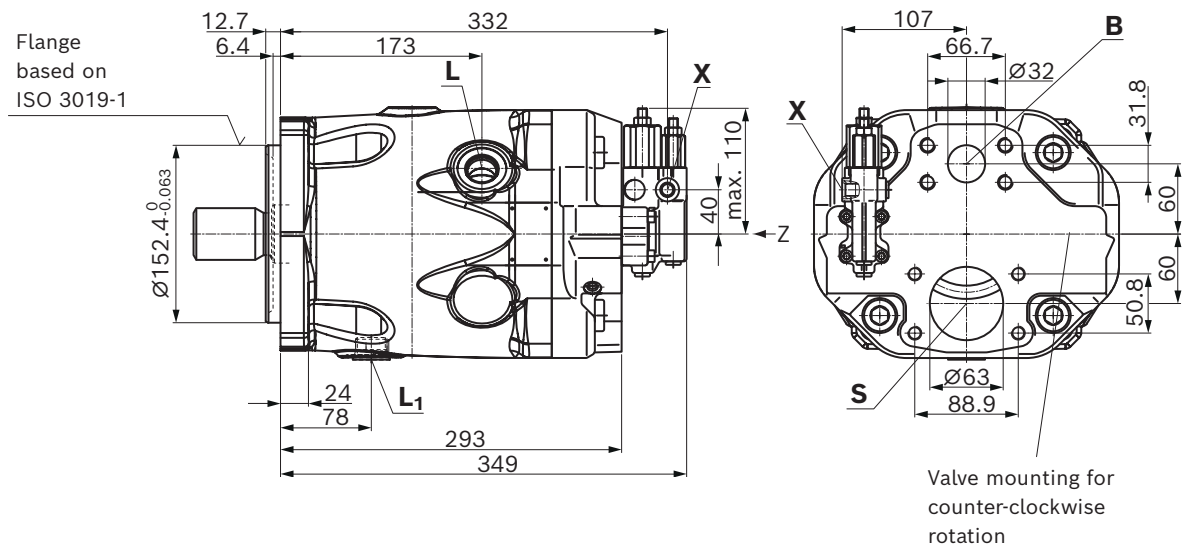
▼ **Port plate 12/62; mounting flange D**



Detail W

Detail V

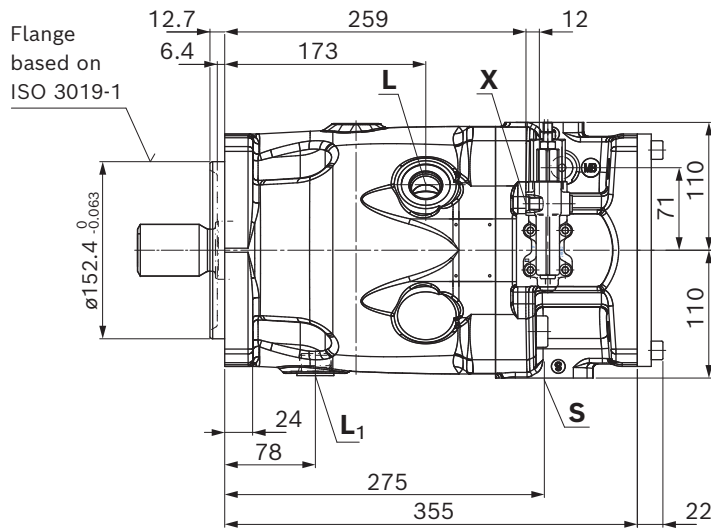
▼ **Port plate 11/61; mounting flange D**



View Z

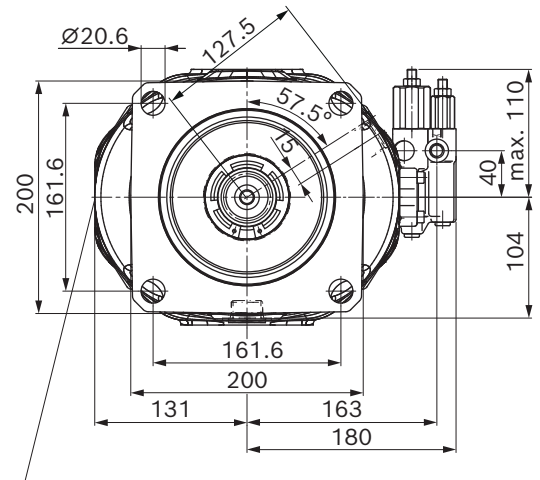
DRF, DRS, DRSC – Pressure flow controller, port plate 22/72; mounting flange D (SAE-D; 152-4)

▼ Port plate 22/72; mounting flange D

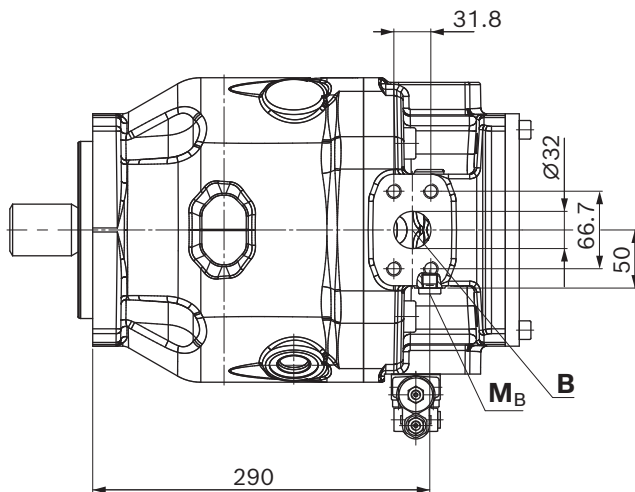
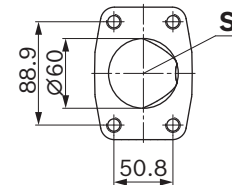


W

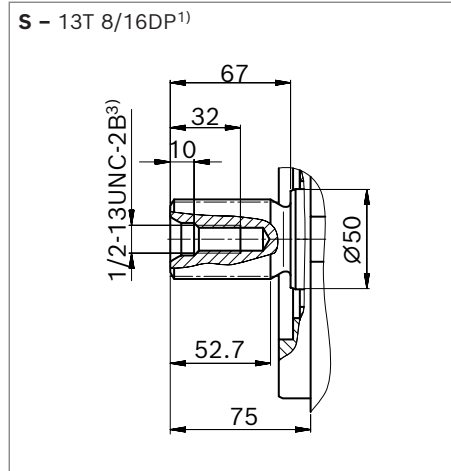
Valve mounting for counter-clockwise rotation



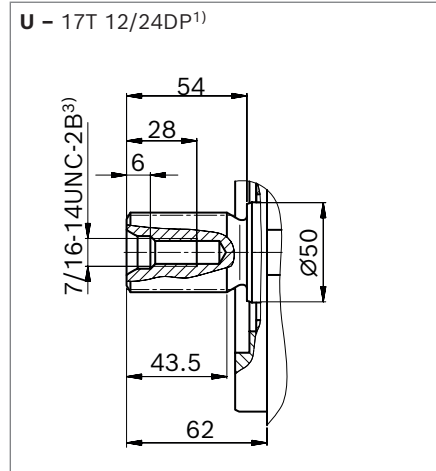
Detail W



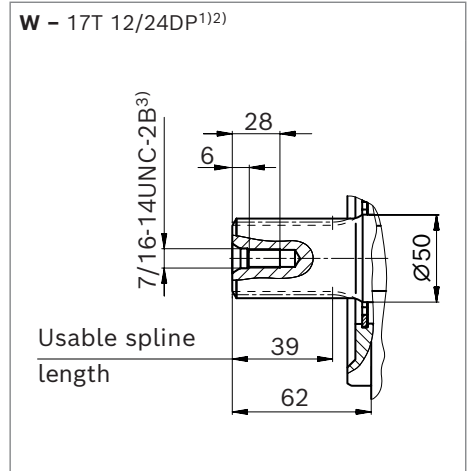
▼ **Splined shaft 1 3/4 in (44-4, ISO 3019-1)**



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



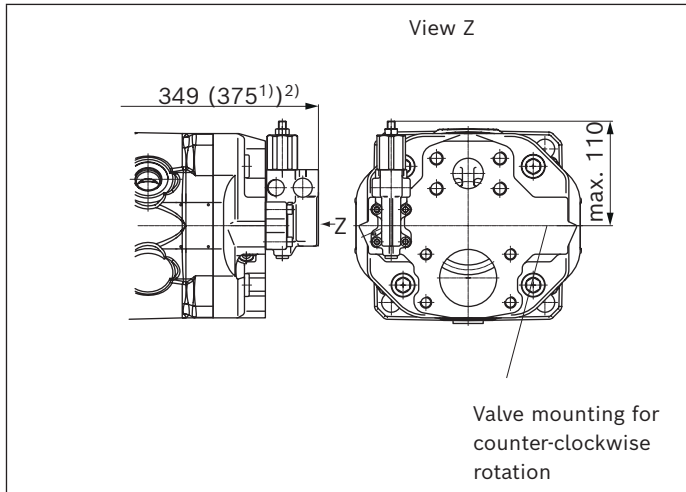
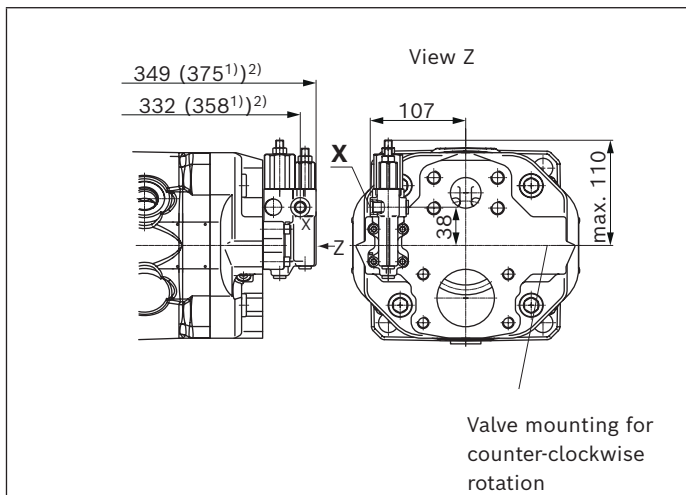
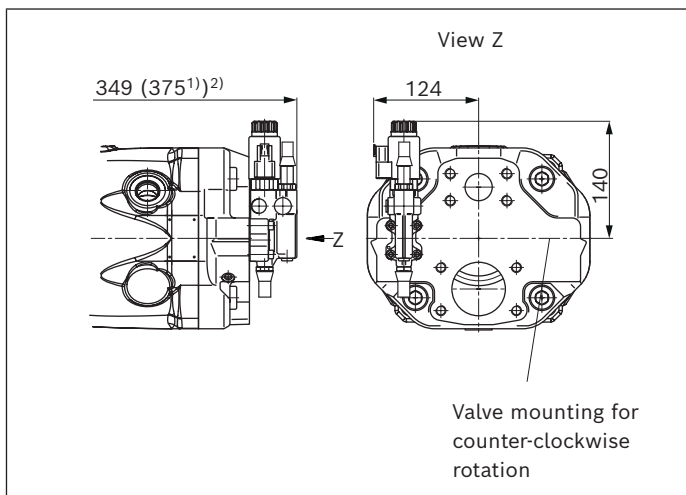
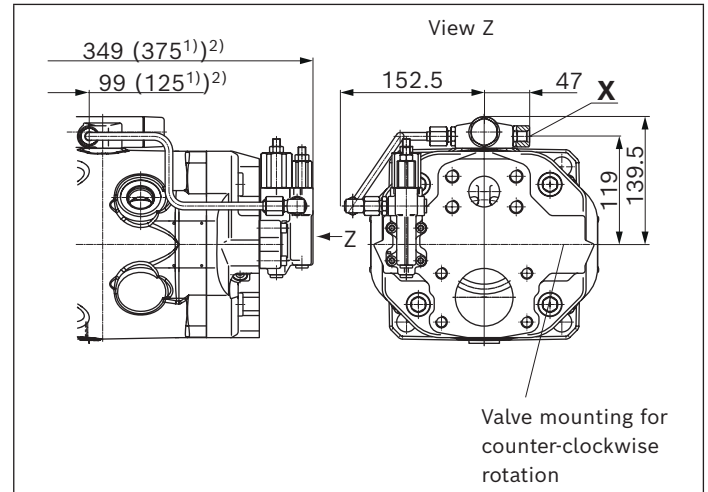
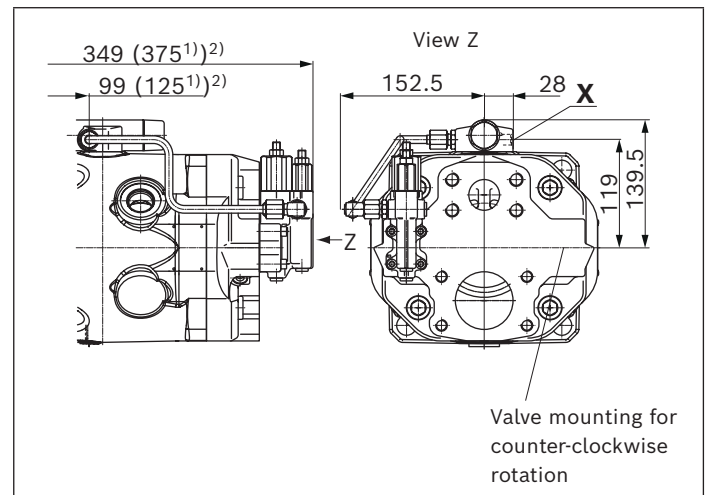
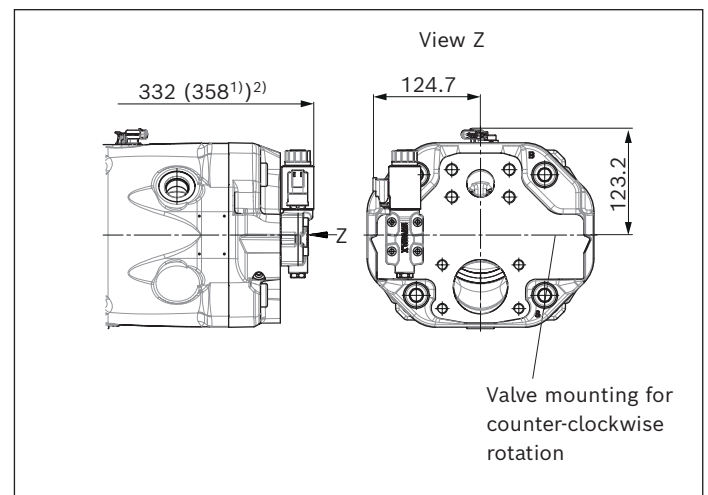
▼ **Splined shaft 1 1/2 in (38-4, ISO 3019-1)**



Port plate ports 11, 12 and 22		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series)	ISO 6162-2	1 1/4 in	350 (5100)	O
	Fastening thread	DIN 13	M14 x 2 ⁸⁾ ; 19 (0.75) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 1/2 in	10 (145)	O
	Fastening thread	DIN 13	M12 x 1.75; 17 (0.67) deep		
Port plate ports 61, 62 and 72		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series)	ISO 6162-2	1 1/4 in	350 (5100)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 19 (0.75) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 1/2 in	10 (145)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 24 (0.94) deep		
Other ports		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
L	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	O ⁶⁾
L₁	Drain port	ISO 11926 ⁵⁾	1 1/16-12 UNF-2B; 20 (0.79) deep	2 (30)	X ⁶⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	O
M_B	Measuring pressure B (only with port plates 22/72 and 32/82)	DIN 3852-2 ⁵⁾	G 1/4 in; 12 (0.47) deep	350 (5100)	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 SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L₁** must be connected (also see installation instructions on page 73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
8) Fastening thread M14 deviating from standard ISO 6162-2.

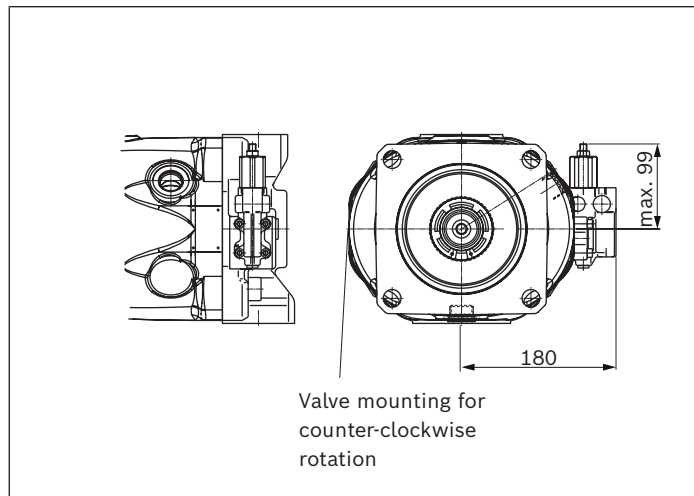
Port plate 11/61▼ **DR – Pressure controller; mounting flange D**▼ **DRG – Pressure controller, remote controlled; mounting flange D**▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**▼ **LA.DS – Pressure, flow and power controller; mounting flange D**▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**

1) Dimension of mounting flange C

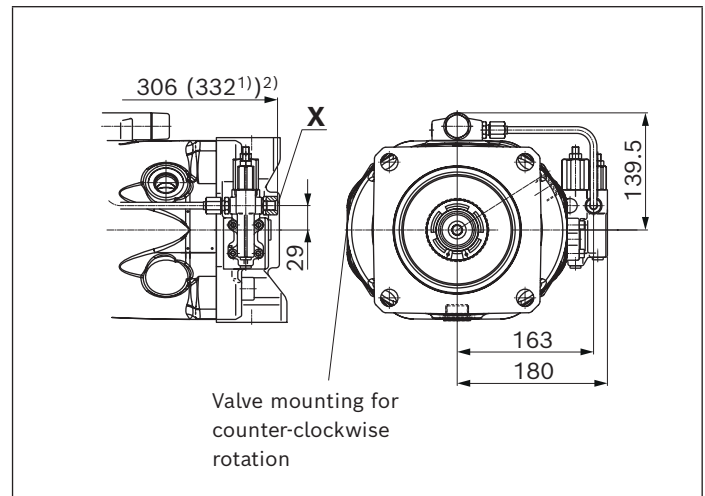
2) To mounting flange

Port plate 12/62

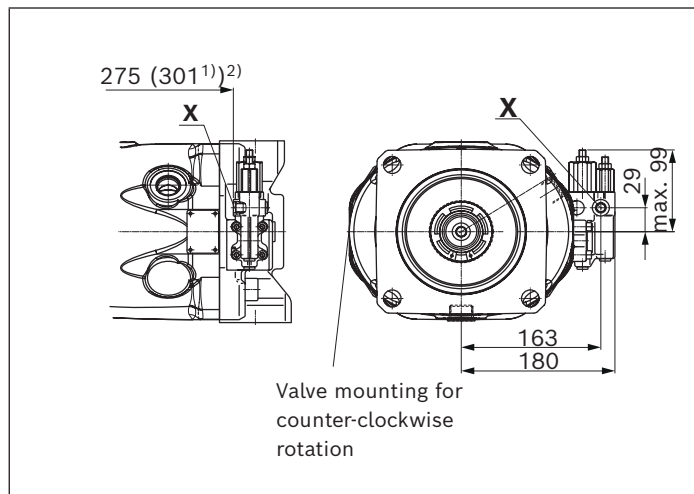
▼ DR – Pressure controller; mounting flange D



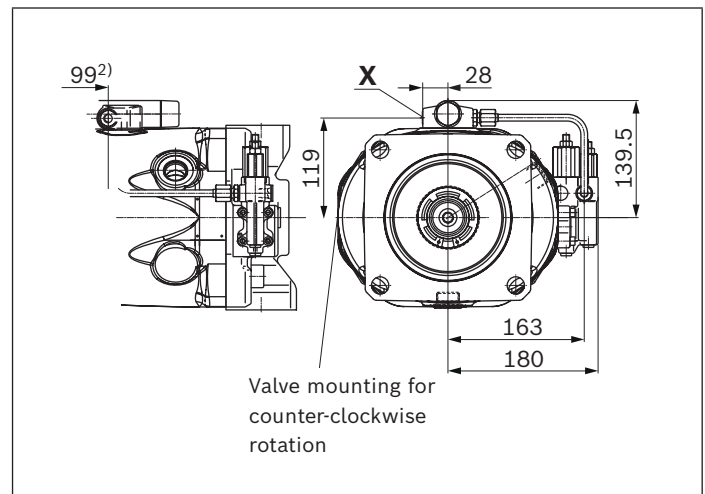
▼ LA.DS – Pressure, flow and power controller; mounting flange D



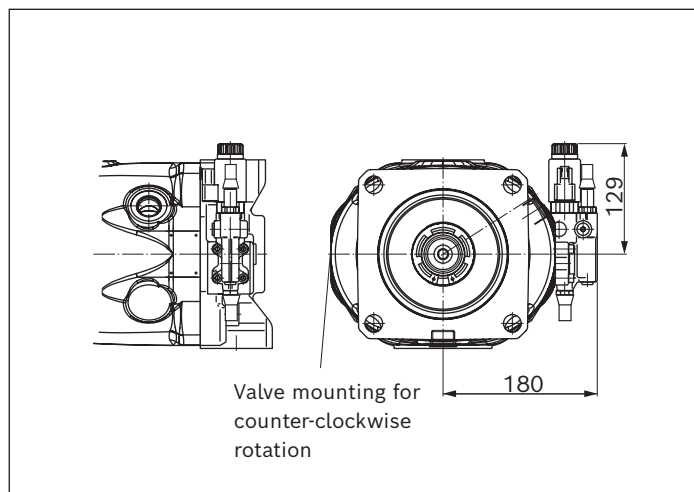
▼ DRG – Pressure controller, remote controlled; mounting flange D



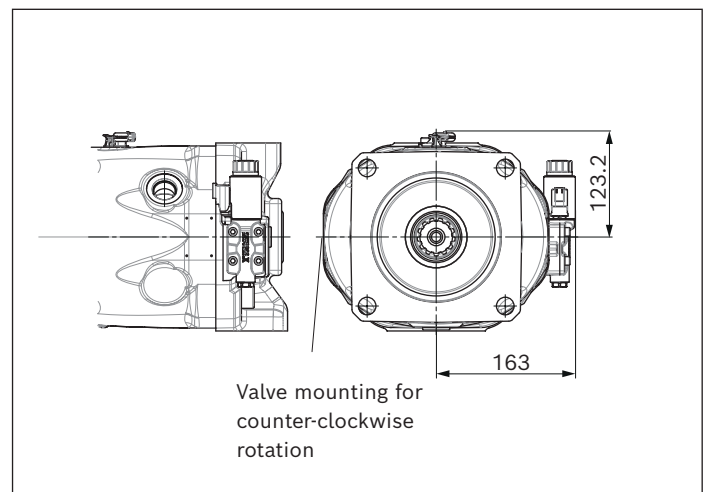
▼ LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D



▼ ED7./ER7. – Pressure controller, electric; mounting flange D

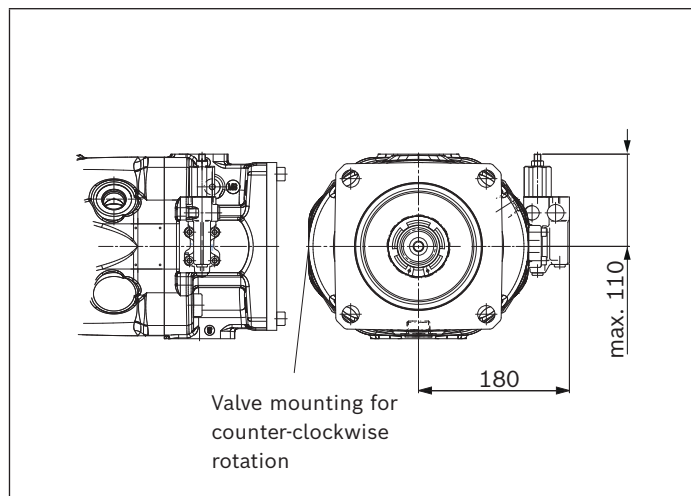
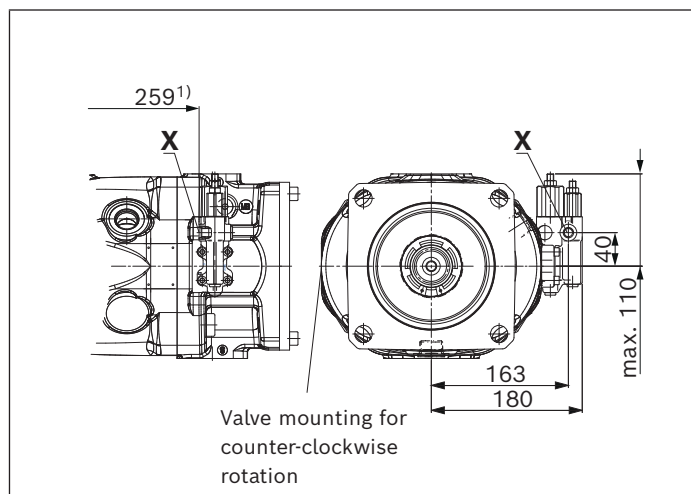
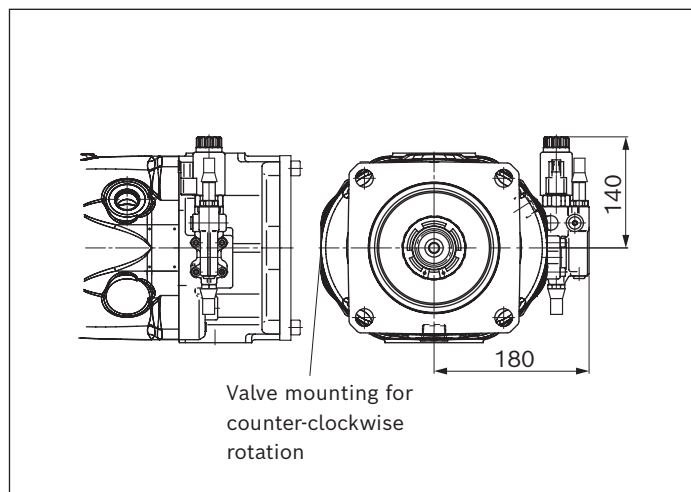


▼ EC4/EB4 – Electro-hydraulic control valve; mounting flange D

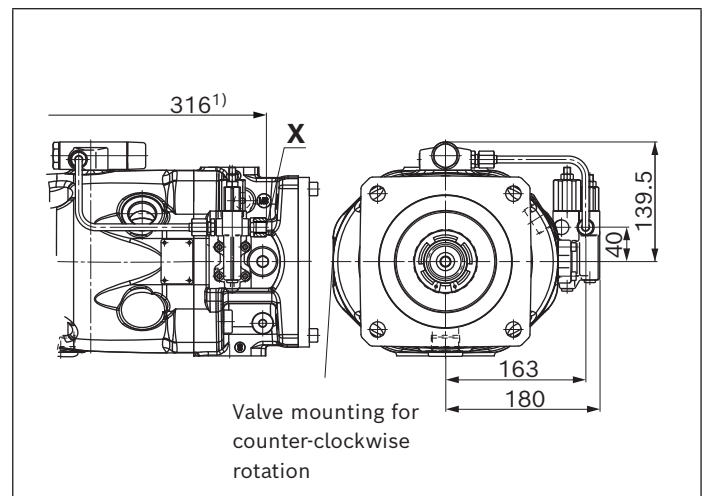
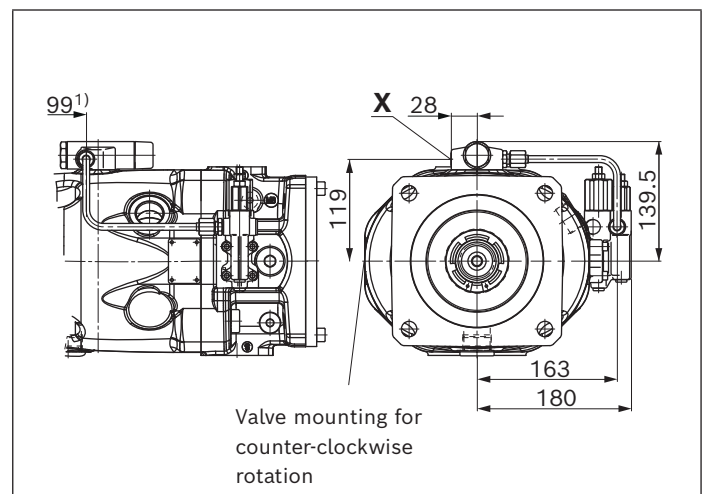
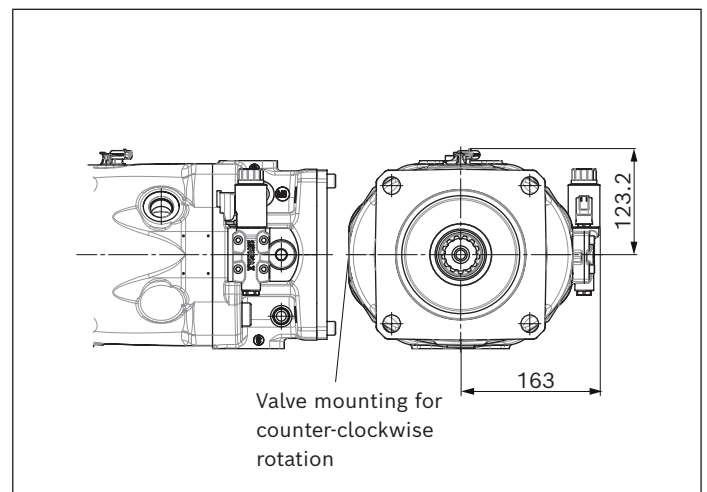


1) Dimension of mounting flange C

2) To mounting flange

Port plate 22/72▼ **DR – Pressure controller; mounting flange D**▼ **DRG – Pressure controller, remote controlled; mounting flange D**▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**

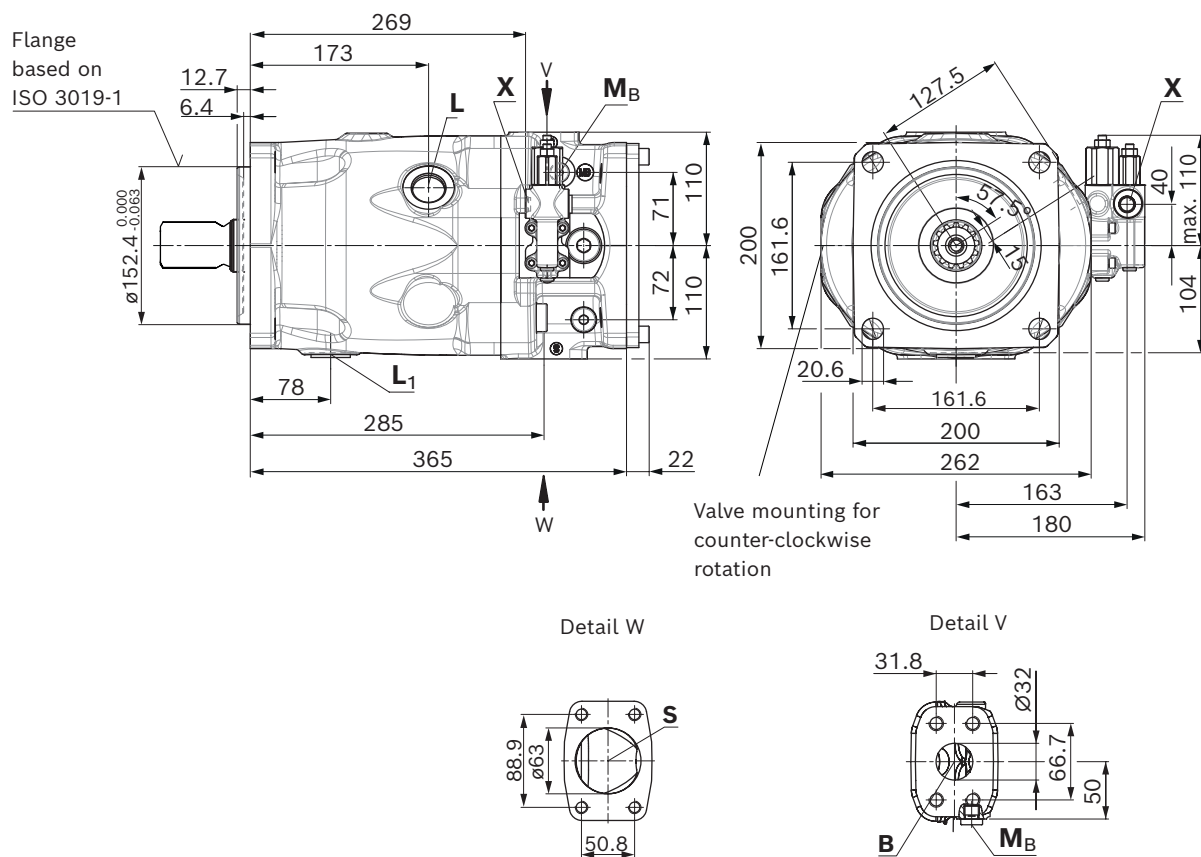
1) To mounting flange

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**

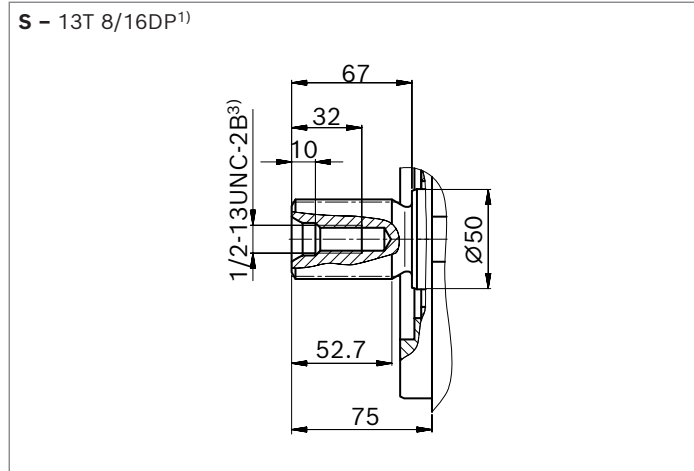
Dimensions, size 180

DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-D; 152-4)

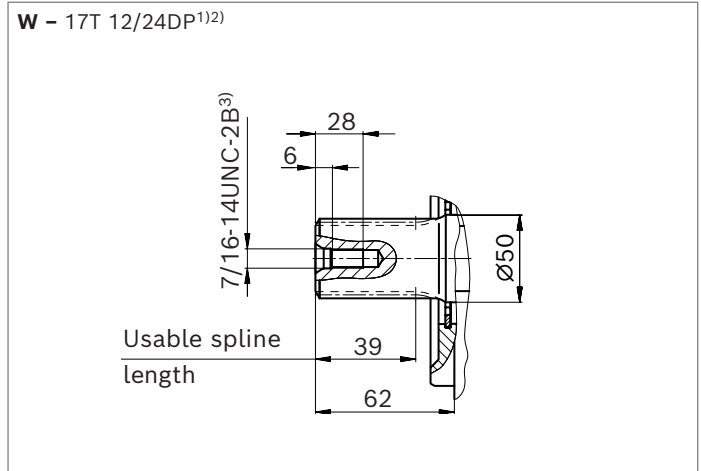
▼ Port plate 22/72 and 32/82



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



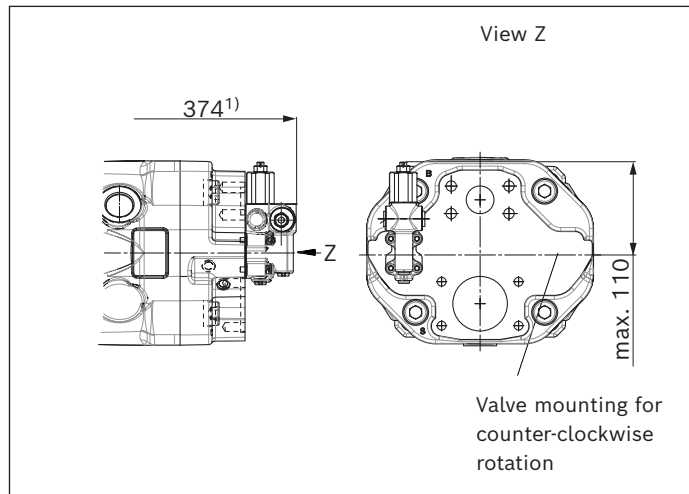
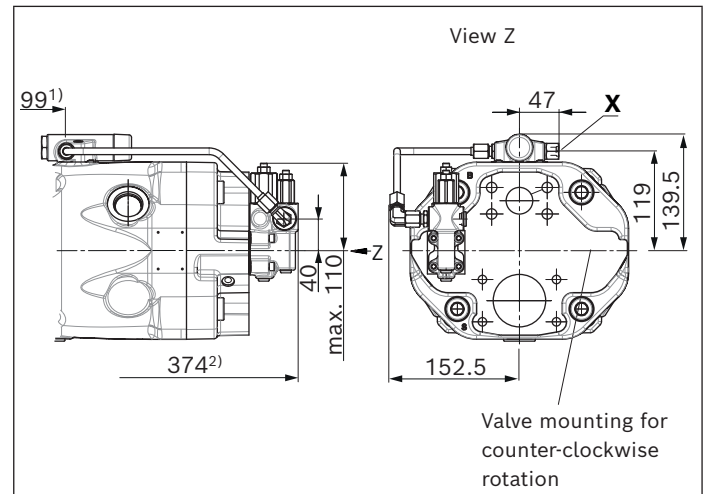
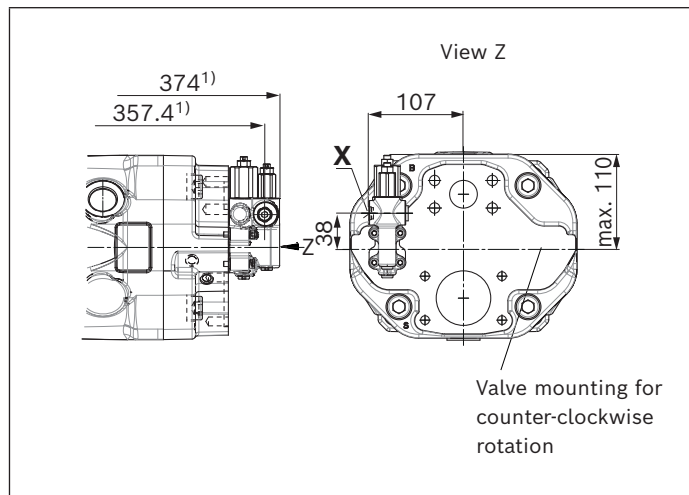
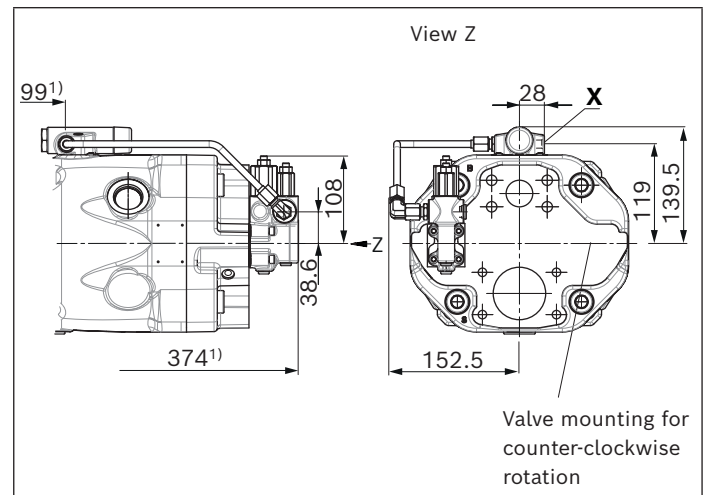
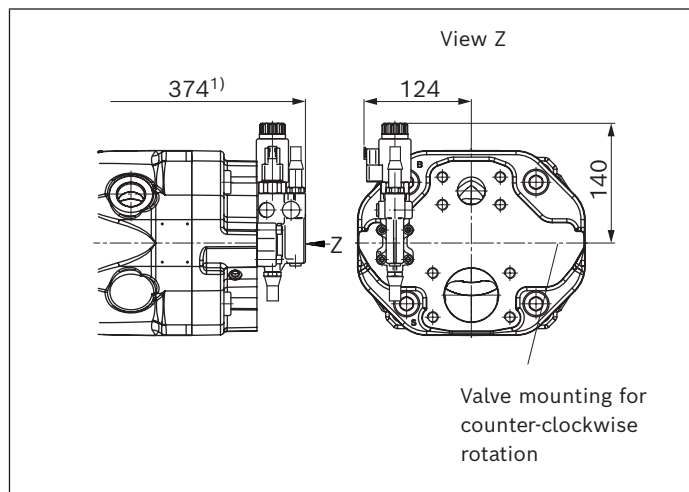
▼ **Splined shaft 1 1/2 in (38-4, ISO 3019-1)**



Port plate ports 11, 12, 22 and 32		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series)	ISO 6162-2	1 1/4 in	350 (5100)	O
	Fastening thread	DIN 13	M14 x 2 ⁸⁾ ; 19 (0.75) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 1/2 in	10 (145)	O
	Fastening thread	DIN 13	M12 x 1.75; 17 (0.67) deep		
Port plate ports 61, 62, 72 and 82		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
B	Working port (high-pressure series)	ISO 6162-2	1 1/4 in	350 (5100)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 19 (0.75) deep		
S	Suction port (standard pressure series)	ISO 6162-1	2 1/2 in	10 (145)	O
	Fastening thread	ASME B1.1	1/2-13 UNC-2B; 24 (0.94) deep		
Other ports		Standard	Size	$p_{\max}$ [bar (psi)] ⁴⁾	State ⁷⁾
L	Drain port	ISO 11926 ⁵⁾	1 5/16-12 UN-2B; 20 (0.79) deep	2 (30)	O ⁷⁾
L₁	Drain port	ISO 11926 ⁵⁾	1 5/16-12 UN-2B; 20 (0.79) deep	2 (30)	X ⁷⁾
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 11.5 (0.45) deep	350 (5100)	O
M_B	Measuring pressure B (only with port plates 22/72 and 32/82)	DIN 3852-2 ⁵⁾	G 1/4 in; 12 (0.47) deep	350 (5100)	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 SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

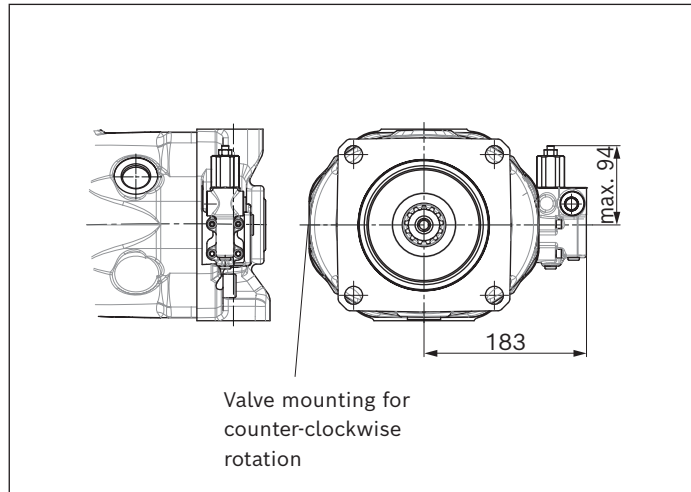
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
8) Fastening thread M14 deviating from standard ISO 6162-2.

Port plate 11/61**▼ DR – Pressure controller****▼ LA.DS – Pressure, flow and power controller****▼ DRG – Pressure controller, remote controlled****▼ LA.DG – Power controller; with pressure cut-off, remote controlled****▼ ED7./ER7. – Pressure controller, electric**

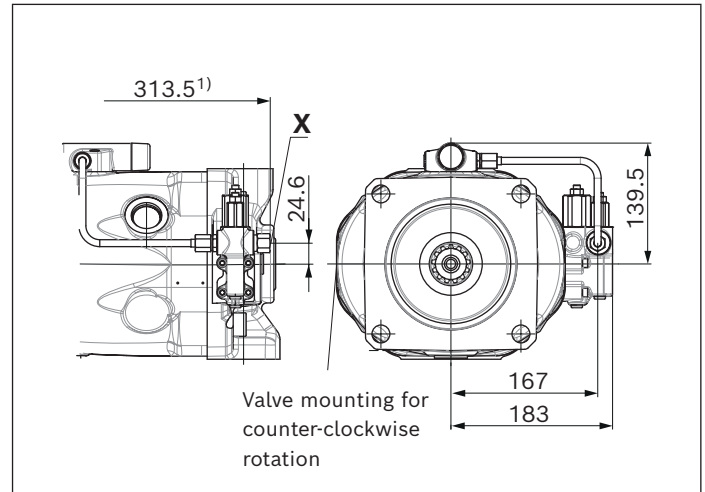
1) To mounting flange

Port plate 12/62

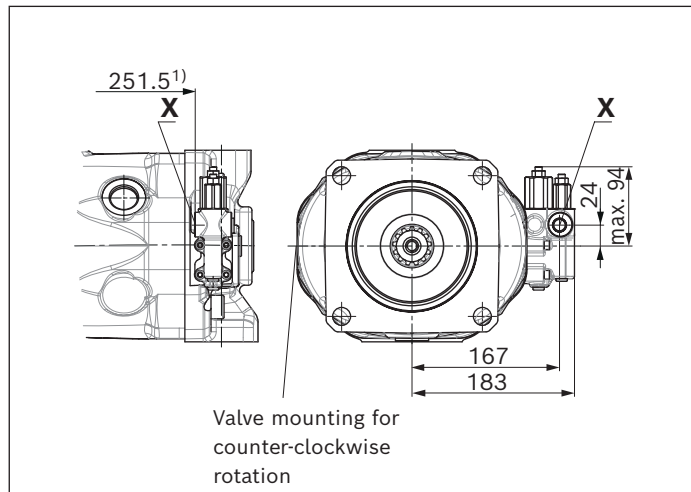
▼ DR – Pressure controller



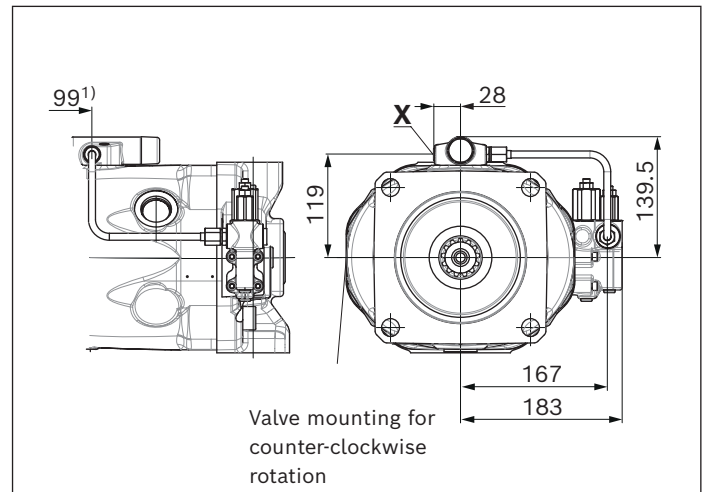
▼ LA.DS – Pressure, flow and power controller



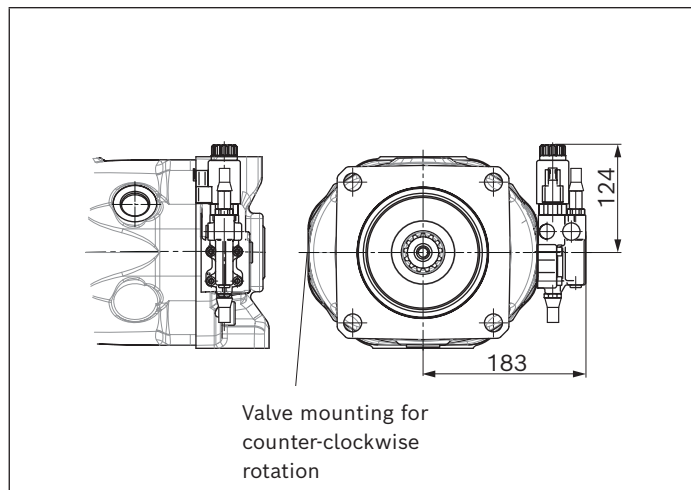
▼ DRG – Pressure controller, remote controlled



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



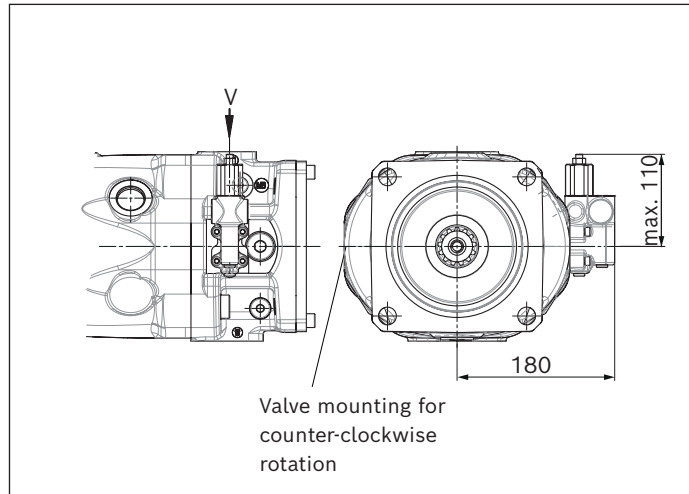
▼ ED7./ER7. – Pressure controller, electric



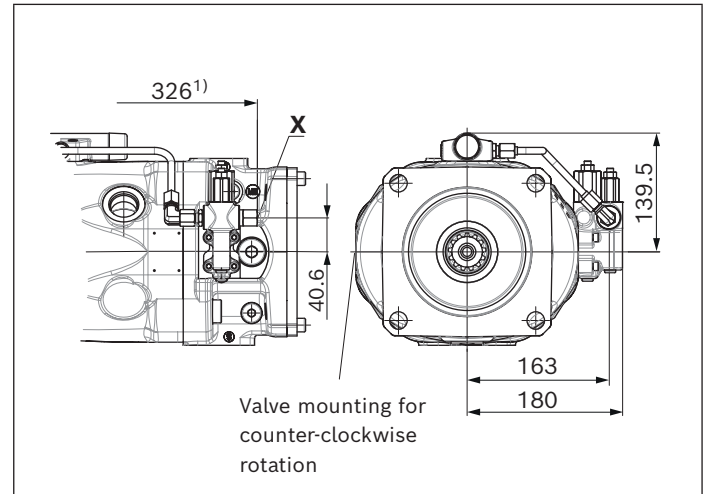
1) To mounting flange

Port plate 22/72 and 32/82

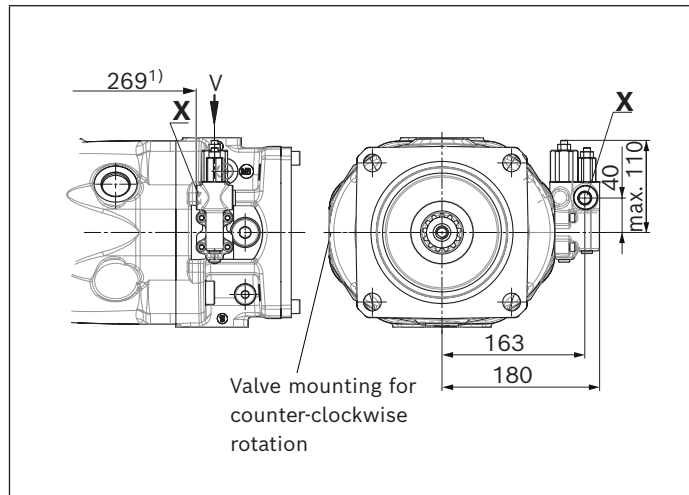
▼ DR – Pressure controller



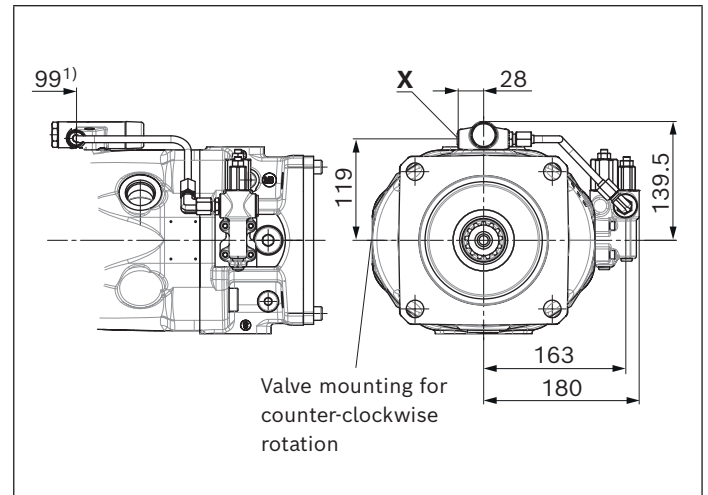
▼ LA.DS – Pressure, flow and power controller



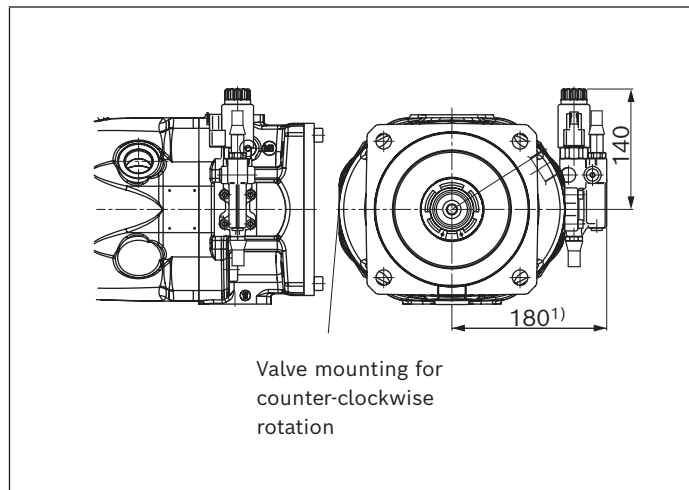
▼ DRG – Pressure controller, remote controlled



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



▼ ED7./ER7. – Pressure controller, electric



1) To mounting flange

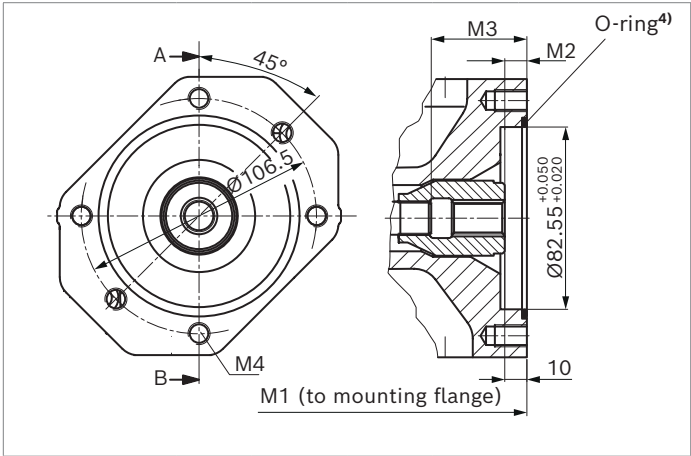
Dimensions for through drives

For flanges and 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)	⌀, ⌀, ∞	5/8 in	9T 16/32DP	●	●	●	●	-	K01
	⌀, ⌀, ∞	5/8 in	9T 16/32DP	○	●	●	●	●	U01

● = Available ○ = On request - = Not available

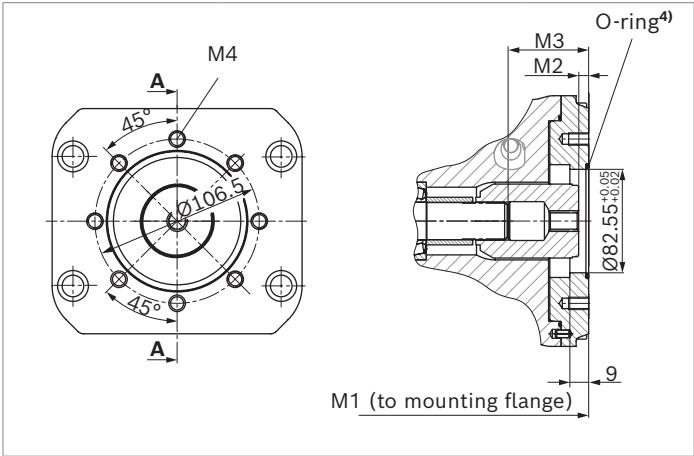
▼ 82-2 (A)



K01 (16-4 (A))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	229	10.1	52.7	M10;
		(9.02)	(0.49)	(2.07)	16 (0.63) deep
	71	267	11.2	60.6	M10;
		(10.5)	(0.44)	(2.39)	20 (0.79) deep
	100	338	8.8	33.1	M10;
		(13.31)	(0.35)	(1.30)	16 (0.63) deep
	140 ⁵⁾	350	10.1	76.6	M10;
		(13.78)	(0.49)	(3.01)	16 (0.63) deep
	140 ⁶⁾	376			
		(14.80)			

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.

▼ 82-2 (A)



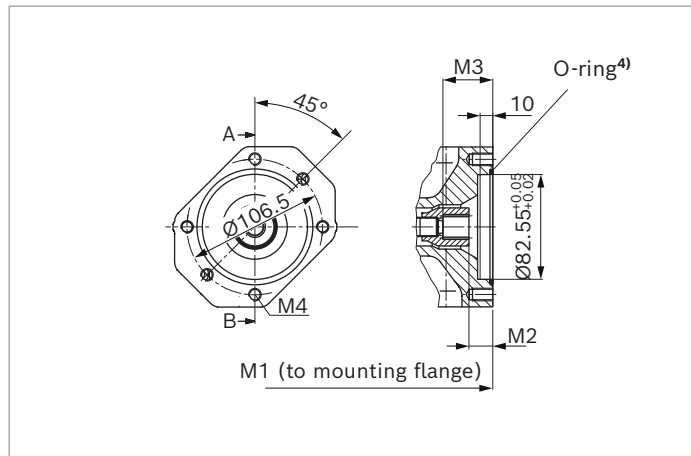
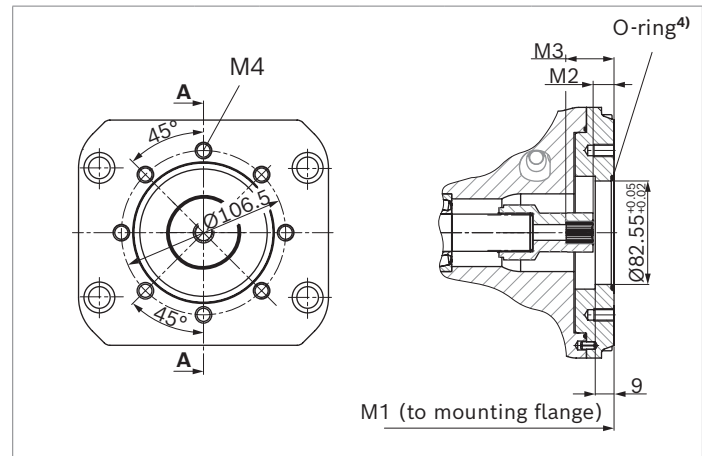
U01 (16-4 (A))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	71	299	8.4	60.6	M10;
		(11.78)	(0.33)	(2.37)	16 (0.63) deep
	100	360	9.2	33.5	M10;
		(14.17)	(0.36)	(1.32)	16 (0.63) deep
	140	377	On request		
		(14.84)			
	180	387	10.8	77.1	M10;
		(15.23)	(0.42)	(3.04)	16 (0.63) deep

4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and 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)	⌀, ♂, ∞	3/4 in	11T 16/32DP	●	●	●	●	–	K52
	⌀, ♂, ∞	3/4 in	11T 16/32DP	●	●	●	●	●	U52

● = Available ∞ = On request – = Not available

▼ 82-2 (A)**▼ 82-2 (A)**

K52 (19-4 (A-B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	229	18.4	38.8	M10;
		(9.02)	(0.72)	(1.53)	16 (0.63) deep
	71	267	20.8	41.2	M10;
		(10.51)	(0.82)	(1.62)	20 (0.79) deep
	100	338	18.6	39.6	M10;
		(13.31)	(0.73)	(1.56)	16 (0.63) deep
	140 ⁵⁾	350	18.4	39.4	M10;
		(13.78)	(0.72)	(1.55)	16 (0.63) deep
	140 ⁶⁾	376			
		(14.80)			

U52 (19-4 (A-B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	264	19.0	39.4	M10;
		(10.39)	(0.75)	(1.55)	16 (0.63) deep
	71	299	20.8	41.2	M10;
		(11.77)	(0.82)	(1.62)	20 (0.79) deep
	100	360	19.0	40.0	M10;
		(14.17)	(0.75)	(1.58)	16 (0.63) deep
	140	377	18.6	39.6	M10;
		(14.84)	(0.73)	(1.56)	20 (0.79) deep
	180	387	18.9	39.9	M10;
		(15.24)	(0.74)	(1.57)	16 (0.63) deep

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) With D-flange

6) With C-flange

7) Minimum dimension

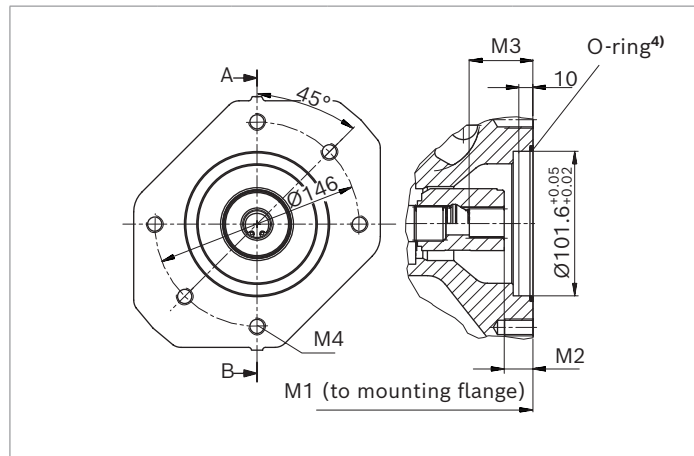
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and shafts according to ISO 3019-1

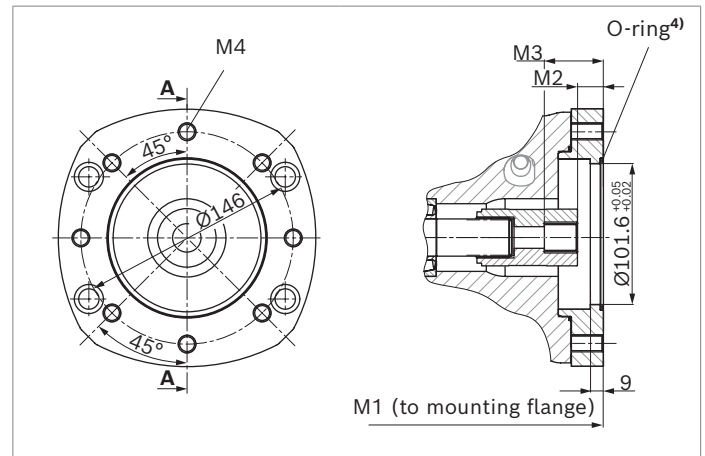
Flange Diameter	Mounting ²⁾	Hub for splined shaft ¹⁾		Availability across sizes					Code
		Diameter		45	71	100	140	180	
101-2 (B)	⌀, ⌀, ∞	7/8 in	13T 16/32DP	●	●	●	●	-	K68
	⌀, ⌀, ∞	7/8 in	13T 16/32DP	●	●	●	●	●	U68

● = Available ○ = On request - = Not available

▼ **101-2 (B)**



▼ **101-2 (B)**



K68 (22-4 (B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	229	17.4	41.8	M12;
		(9.02)	(0.68)	(1.64)	18 (0.71) deep
	71	267	19.8	44.2	M12;
		(10.5)	(0.78)	(1.74)	20 (0.79) deep
	100	338	17.6	41.9	M12;
		(13.31)	(0.69)	(1.65)	20 (0.79) deep
	140 ⁵⁾	350	17.4	41.7	M12;
		(13.78)	(0.68)	(1.63)	20 (0.79) deep
	140 ⁶⁾	376			
		(14.80)			

U68 (22-4 (B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	264	18.0	42.4	M12;
		(10.39)	(0.71)	(1.67)	22 (0.87) deep
	71	299	19.8	44.2	M12;
		(11.77)	(0.78)	(1.74)	22 (0.87) deep
	100	360	18.0	42.3	M12;
		(14.17)	(0.71)	(1.66)	22 (0.87) deep
	140	377	17.6	41.9	M12;
		(14.84)	(0.69)	(1.65)	22 (0.87) deep
	180	387	17.9	42.2	M12;
		(15.24)	(0.70)	(1.67)	22 (0.87) deep

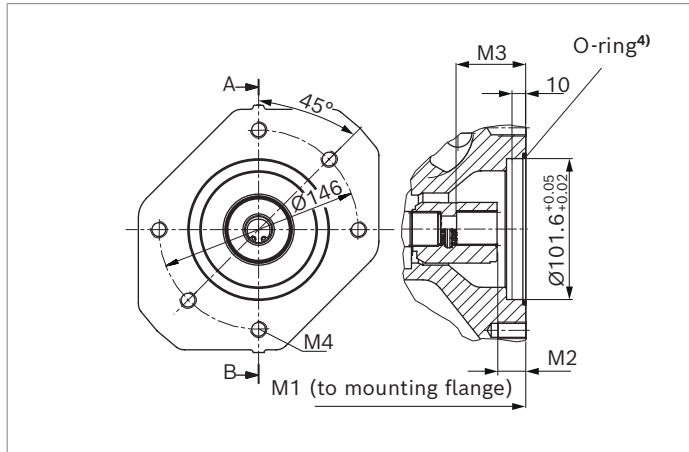
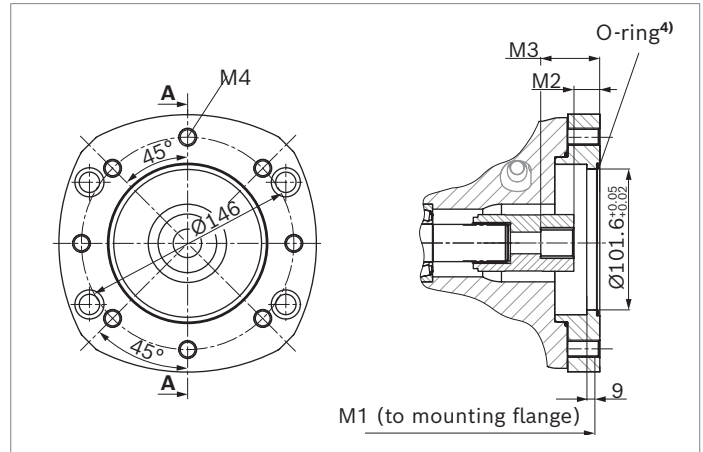
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.

4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and shafts according to ISO 3019-1

Flange		Splined shaft ¹⁾		Availability across sizes					Code
Diameter	Mounting ²⁾	Diameter		45	71	100	140	180	
101-2 (B)	8, 8°, 8°	1 in	15T 16/32DP	●	●	●	●	–	K04
	8, 8°, 8°	1 in	15T 16/32DP	○	●	●	●	●	U04

● = Available ○ = On request – = Not available

▼ 101-2 (B)**▼ 101-2 (B)**

K04 (25-4 (B-B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	45	229 (9.02)	17.9 (0.70)	47.4 (1.87)	M12; 18 (0.71) deep
	71	267 (10.5)	20.3 (0.80)	49.2 (1.94)	M12; 20 (0.79) deep
	100	338 (13.31)	17.8 (0.69)	46.6 (1.83)	M12; 20 (0.79) deep
	140 ⁵⁾	350 (13.78)	17.9 (0.70)	47.4 (1.87)	M12; 20 (0.79) deep
	140 ⁶⁾	376 (14.80)			

U04 (25-4 (B-B))	NG	M1	M2 ⁷⁾	M3 ⁷⁾	M4 ³⁾⁸⁾
	71	299	20.3	49.2	M12;
		(11.77)	(0.80)	(1.94)	22 (0.87) deep
	100	360	18.2	47.0	M12;
		(14.17)	(0.71)	(1.85)	22 (0.87) deep
	140	377	18.1	47.6	M12;
		(14.84)	(0.71)	(1.87)	22 (0.87) deep
	180	387	18.4	47.9	M12;
		(15.24)	(0.72)	(1.88)	22 (0.87) deep

- 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

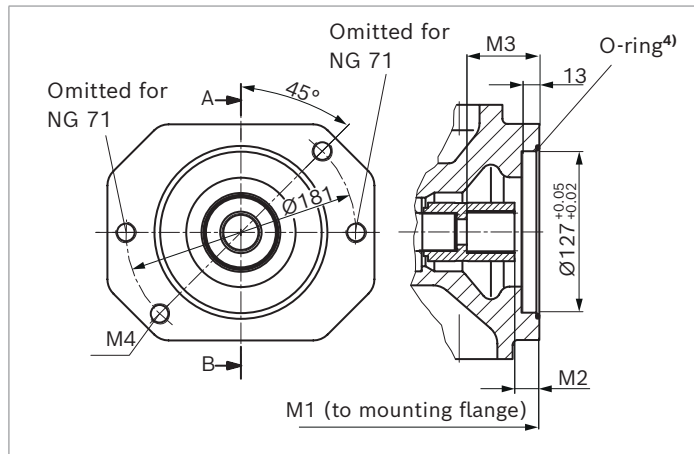
- 4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and shafts according to ISO 3019-1

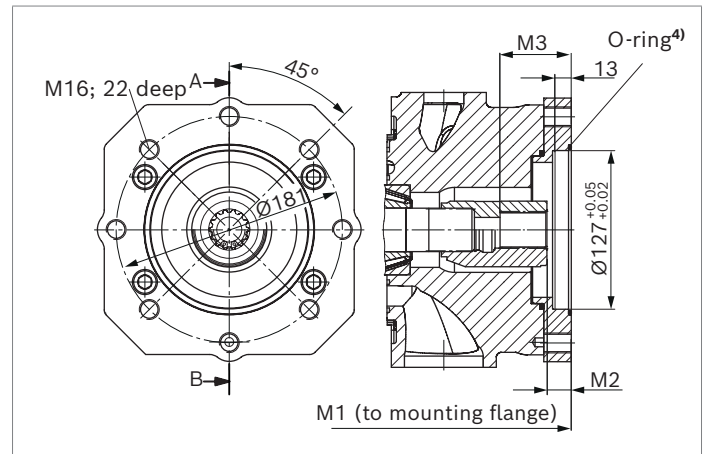
Flange Diameter	Mounting ²⁾	Splined shaft ¹⁾ Diameter	Availability across sizes					Code
			45	71	100	140	180	
127-2 (C)	⌀, ∞	1 1/4 in 14T 12/24DP	-	•	•	•	-	K07
	⌀, ⌀, ∞	1 1/4 in 14T 12/24DP	-	•	•	•	•	U07

• = Available ∅ = On request - = Not available

▼ **127-2 (C)**



▼ **127-2 (C)**



K07 (32-4 (C))	NG	M1	M2⁷⁾	M3⁷⁾	M4³⁾⁸⁾
	71	267 (10.51)	20.3 (0.80)	58.3 (2.29)	M16; continuous
	100	338 (13.31)	19.1 (0.75)	57.1 (2.27)	M16; continuous
	140 ⁵⁾	350 (13.78)	18.9 (0.74)	56.2 (2.21)	M16; 24 (0.94) deep
	140 ⁶⁾	376 (14.80)			

U07 (32-4 (C))	NG	M1	M2⁷⁾	M3⁷⁾	M4³⁾⁸⁾
	71	299 (11.77)	20.3 (0.80)	58.3 (2.29)	M16; 22 (0.87) deep
	100	360 (14.17)	19.5 (0.77)	57.5 (2.26)	M16; 22 (0.87) deep
	140	377 (14.84)	19.1 (0.75)	56.4 (2.22)	M16; 22 (0.87) deep
	180	387 (15.24)	19.4 (0.76)	56.7 (2.23)	M16; 22 (0.87) deep

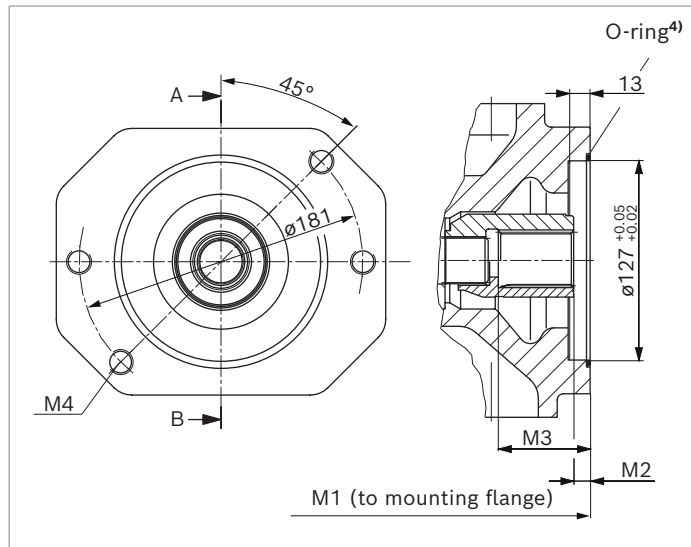
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.

4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and 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 1/2 in 17T 12/24DP	-	-	●	●	-	K24
	♀, ♂, ∞	1 1/2 in 17T 12/24DP	-	-	●	●	●	U24

● = Available ○ = On request - = Not available

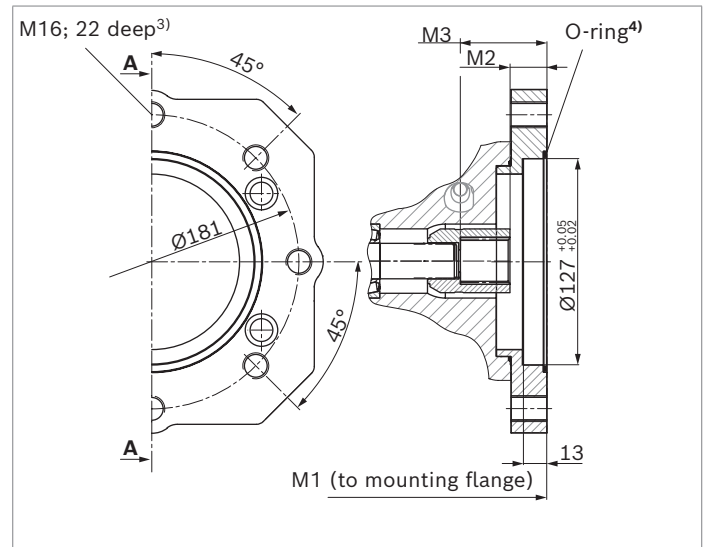
▼ 127-2 (C)

K24 (38-4 (C-C))	NG	M1	M2⁷⁾	M3⁷⁾	M4³⁾⁸⁾
	100	323 (12.72)	10.0 (0.39)	64.3 (2.53)	M16; continuous
	140 ⁵⁾	350 (13.78)	9.4 (0.37)	68.4 (2.69)	M16; 24 (0.94) deep
	140 ⁶⁾	376 (14.80)			

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.

▼ 127-2 (C)

U24 (38-4 (C-C))	NG	M1	M2⁷⁾	M3⁷⁾	M4³⁾⁸⁾
	100	360 (14.17)	21.0 (0.83)	63.0 (2.48)	M16; 22 (0.87) deep
	140	377 (14.84)	9.6 (0.38)	68.6 (2.70)	M16; 22 (0.87) deep
	180	387 (15.24)	9.9 (0.39)	68.9 (2.71)	M16; 22 (0.87) deep

4) O-ring included in the scope of delivery

5) With D-flange

6) With C-flange

7) Minimum dimension

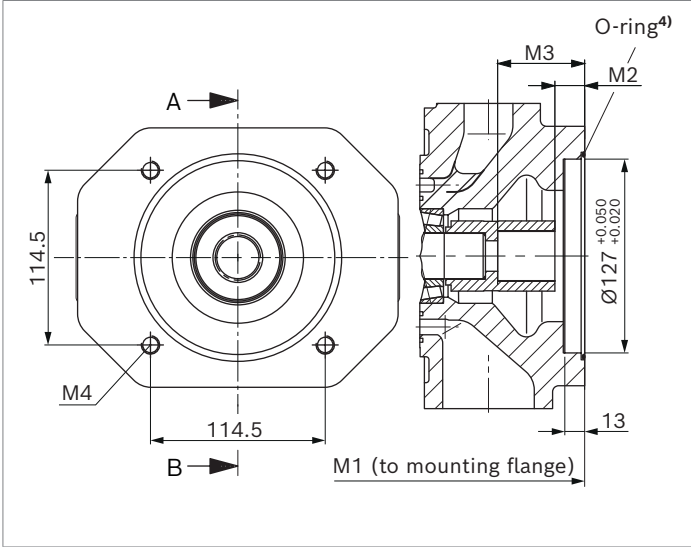
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

For flanges and shafts according to ISO 3019-1

Flange		Splined shaft ¹⁾	Availability across sizes					Code
Diameter	Mounting ²⁾		45	71	100	140	180	
127-4 (C)		1 1/4 in 14T 12/24DP	-	o	•	•	-	K15
		1 1/4 in 14T 12/24DP	-	-	•	•	•	U15

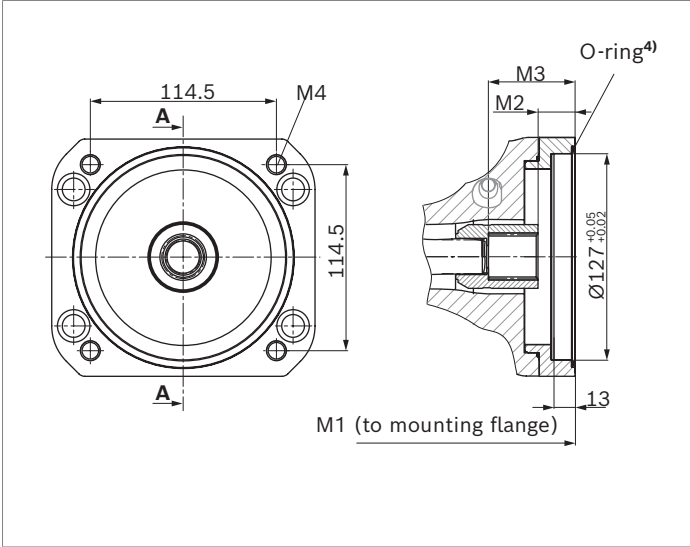
• = Available o = On request - = Not available

▼ 127-4 (C)



K15 (32-4 (C))	NG	M1	M2 ⁵⁾	M3 ⁵⁾	M4 ³⁾⁶⁾
	100	338	19.1 (13.31)	57.1 (2.25)	M12; 22 (0.87) deep
	140	350	18.9 (13.78)	56.2 (2.21)	M12; 22 (0.87) deep

▼ 127-4 (C)



U15 (32-4 (C))	NG	M1	M2 ⁵⁾	M3 ⁵⁾	M4 ³⁾⁶⁾
	100	360	19.5 (14.17)	57.5 (2.26)	M12; 22 (0.87) deep
	140	377	19.1 (14.84)	56.4 (2.22)	M12; 22 (0.87) deep
	180	387	19.4 (15.24)	56.7 (2.23)	M12; 22 (0.87) deep

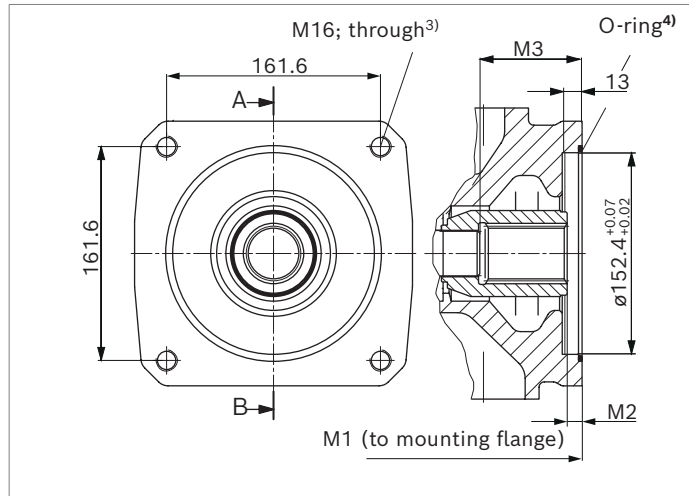
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top

3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) Minimum dimensions
6) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

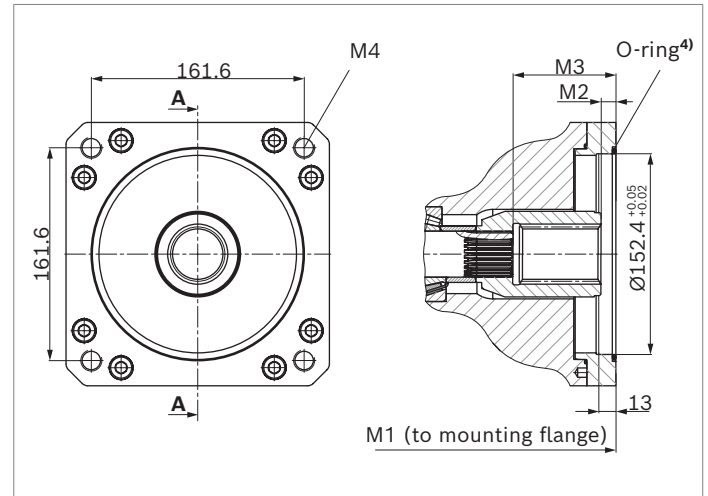
For flanges and shafts according to ISO 3019-1

Flange		Splined shaft ¹⁾	Availability across sizes					Code
Diameter	Mounting ²⁾		45	71	100	140	180	
152-4 (D)		1 3/4 in 13T 8/16DP	-	-	-	●	-	K17
		1 3/4 in 13T 8/16DP	-	-	-	●	●	U17

● = Available ○ = On request - = Not available

▼ **152-4 (D)**

K17 (152-4 (D))	NG	M1⁵⁾	M2⁵⁾	M3
	140	350 (13.78)	9.7 (0.38)	76.3 (3.00)

▼ **152-4 (D)**

U17 (152-4 (D))	NG	M1	M2⁵⁾	M3⁵⁾	M4³⁾⁶⁾
	140	377 (14.84)	9.3 (0.37)	75.9 (2.99)	M16; 22 (0.87) deep
	180	387 (15.24)	10.4 (0.41)	76.4 (3.01)	M16; 22 (0.87) deep

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 dimensions

6) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Overview of mounting options

Through drive Flange (SAE) ISO 3019-1	Hub for splined shaft	Code ¹⁾	Mounting options – 2nd pump			External gear pump
			A10VO/31 and 32 NG (shaft)	A10VO/52 and 53 NG (shaft)	A10VO/60 NG (shaft)	
82-2 (A)	5/8 in	(K)(U)01	18 (U)/31	10 (U), 18 (U)		Design F
	3/4 in	(K)(U)52	18 (S, R)/31	10 (S) 18 (S, R)		
101-2 (B)	7/8 in	(K)(U)68	28 (S, R)/31 45 (U, W)	28 (S, R) 45 (U, W)	45 (S4)	Design N/G
	1 in	(K)(U)04	45 (S, R)	45 (S, R) 60, 63 (U, W) ²⁾ 72 (U, W) ²⁾	45 (S5)	
127-2 (C)	1 1/4 in	(K)(U)07	71 (S, R) 88 (S, R)/31 100 (U) ³⁾	60, 63 (S, R) 72 (S, R) 85 (U) 100 (U) ³⁾		–
	1 1/2 in	(K)(U)24	100 (S) 140 (W)/32	85 (S) 100 (S)		
127-4 (C)	1 in	UE2	45 (S, R)/32	60, 63 (U, W) 72 (U, W)		–
	1 1/4 in	(K)(U)15	71 (S, R)/32	60, 63 (S, R) 72 (S, R) 85 (U) 100 (U)		
152-4 (D)	1 3/4 in	(K)(U)17	140 (S); 180 (S)/32	–		–

Mounting flange C, D and U (see order item 09 in the type code) and port plate with a K.. or U.. Through drive (see or items 10 and 11 in the type code) directly connected by the static and dynamic loading when installed.

The following table shows the version to be selected:

Mounting flange	C	D	U
Port plate	12(62)	22/32 72/82	22/32 72/82
Through drive	K..	U..	U..

¹⁾ 1st pump only with mounting flanges D or U for Uxx through drives (for more information, see also type code on page 3).

²⁾ Not for main pump NG45 with K/U04

³⁾ Not for main pump NG71 with K/U07

Combination pumps A10VO + A10VO

By using combination pumps, the user can also have independent circuits without the need for splitter gearboxes.
When ordering combination pumps the type designations for the 1st and the 2nd pump must be joined by a "+".

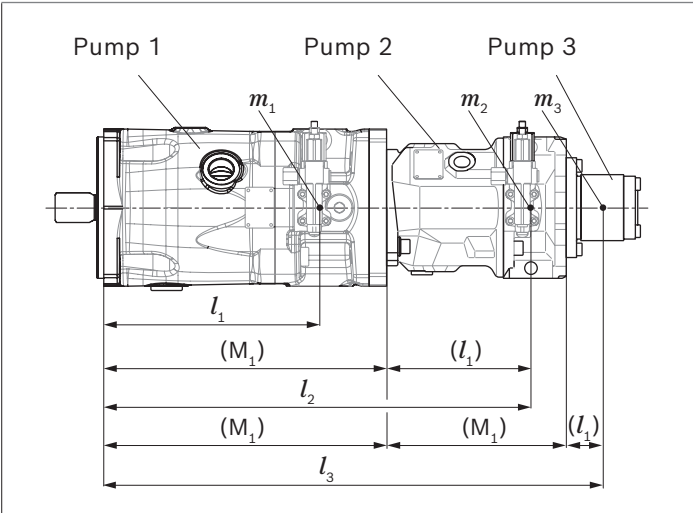
Order example:
A10VO100DR/32R-VSC12K07+
A10VO71DR/32R-VSC12N00

If no further pumps are to be mounted at the factory, the simple type designation is sufficient.
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/s²).

For combination pumps consisting of more than two pumps, the mounting flange must be calculated for the permissible mass torque.
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 assembled parts can be found in data sheet RE 95581.

Please also pay attention to the installation information on page 76.



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

$$M_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102}$$

[Nm (lb-ft)]

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 (from page 60) + l_1 of the 2nd pump
l_3	= Dimension "M1" from through drive drawings from page 60) of the 1st pump + "M1" of the 2nd pump + l_1 of the 3rd pump

Notice
Through drives with installed hub are supplied with a spacer.
The spacer must be removed before installation of the 2nd pump and before commissioning. For information, please refer to the operating instructions 92714-01-B

Permissible moments of inertia

Size			45	71	100	140	180
For 4-hole flange							
static	M_m	Nm	3000	3000	7000	7000	7000
		lb-ft	2213	2213	5163	5163	5163
Dynamic at 10 g (98.1 m/s ²)	M_m	Nm	300	300	700	700	700
		lb-ft	221	221	516	516	516
For 2-hole flange							
static	M_m	Nm	1370	2160	3000	On request ¹⁾	–
		lb-ft	1010	1593	2213		
Dynamic at 10 g (98.1 m/s ²)	M_m	Nm	137	216	300	On request ¹⁾	–
		lb-ft	101	159	221		
Weight with port plate 11/12(61/62)N00 and mounting flange C or D	m	kg	25.8	40.4	56.4	70.5	75.2
		lbs	57	89	124	155	166
Weight with port plate 12(62)K.. and mounting flange C	m	kg	27.4	43.3	62.6	79.5	–
		lbs	60	95	138	175	
Weight with port plate 22/72(32/82)Uxx and mounting flange D or U	m	kg	32.6	51.8	76	90.2	89.4
		lbs	72	144	168	199	197
Distance from center of gravity with 11/12(61/62)N00	l_I	mm	108	120	138	158	159
		inch	4.25	4.72	5.43	6.22	6.26
Distance from center of gravity with 12(62)Kxx	l_I	mm	115	129	153	177	–
		inch	4.53	5.08	6.02	6.97	
Distance from center of gravity at 22/72Uxx; 32/82Uxx	l_I	mm	135	153	184	196	190
		inch	5.31	6.02	7.24	7.72	7.48

¹⁾ Pump combinations permissible only max. as double pump up to the same size.

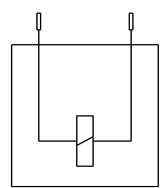
Connector for solenoids

DEUTSCH DT04-2P

Molded, 2-pin, without bidirectional suppressor diode.
The following type of protection ensues with the installed mating connector:

- ▶ IP67 (DIN/EN 60529) and
- ▶ IP69K (DIN 40050-9)

▼ Switching symbol

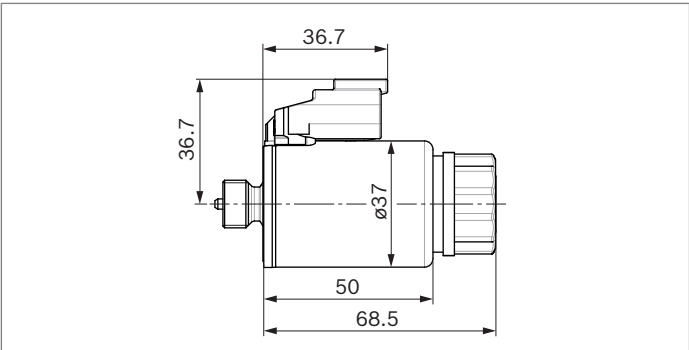


▼ Mating connector DEUTSCH DT06-2S-EP04

Consisting of	DT designation
1 Housing	DT06-2S-EP04
1 Wedge	W2S
2 Sockets	0462-201-16141

The mating connector is not included in the scope of delivery.

This can be supplied by Bosch Rexroth on request (material number R902601804).



Notice

- ▶ If necessary, you can change the position of the connector by turning the solenoid body.
- ▶ This procedure is defined in operating instructions 92714-01-B.
- ▶ Only the dead weight (<1 N (0.22 lbf)) of the connection cable with a length of 150 mm (5.91 inch) may act on the plug-in connection and the solenoid coil with coil nut.
Other forces and vibrations are not permissible.
This can be realized e.g. by fixing the cable to the same vibration system.

Swivel angle sensor

Description

The swivel angle sensor PAL is used for contactless detection of the swivel angle of axial piston units using a Hall effect-based sensor IC. The measured position is converted into electric signals by the redundant swivel angle sensor.

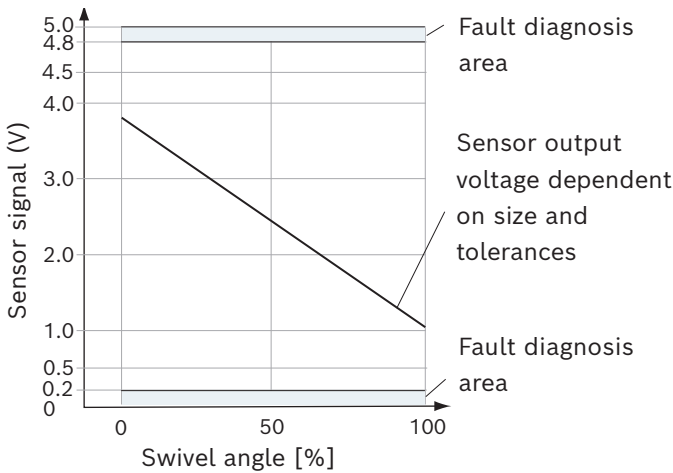
Technical data and safety instructions for the sensor are provided in the relevant data sheet 95161.

Features

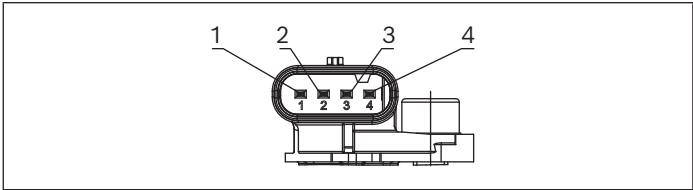
- ▶ High temperature stability of the output signal
- ▶ Shock and vibration resistance
- ▶ Integrated electronic fault detection
- ▶ CE conformity

▼ Output characteristic at pin 4, code H

Swivel angle sensor installation left with view of the shaft; control valve top



Pin assignment



- ▼ Pin assignment analog ratiometric/PWM (order code H)
PAL 2 313A357 CM/10F
 (for further information, see data sheet 95161)

Pin	Connection
1	Sensor signal 2 PWM (active-high; 5 ... 95% on time)
2	Supply voltage U_{supply}
3	Weight GND
4	Sensor signal 1 analog ratiometric (10 ... 90% U_{supply})

▼ Permissible PAL variants

Output signal	Type	Code
Analog ratiometric/PWM	PAL 2 313A357 CM/10F	H
SENT/SENT	PAL 2 313A357 SM/10F	P

Characteristic	
Supply voltage U_{supply}	5 VDC
Maximum supply voltage range U_{supply}	4.5 ... 5.5 VDC
Overvoltage range for 48 h	28 VDC
Overvoltage range for 60 sec ($\tau_{\text{amb}} < 35\text{ }^{\circ}\text{C}$ (95 °F))	37 VDC
Current consumption (I_{DD})	20 to 27 mA
Load resistance	see data sheet 95161
Reverse polarity protection (48h/60sec)	-14 VDC/-18 VDC
Operating temperature	-40 °C (–40 °F) to +125 °C (257 °F)
Type of protection ISO 20653 (with plugged mating connector and cable)	IPx9k, IP6kx, IPX6, and IPX7

Notice

- ▶ Information on environmental and EMC conditions on request.
- ▶ Painting with electrostatic charging of the sensor is not permitted (danger: ESD damage)

- ▼ Pin assignment SENT/SENT (order code P)
PAL 2 313A357 SM/10F
 (for further information, see data sheet 95161)

Pin	Connection
1	Sensor signal 2 SENT format H.1 (two 12-bit fast channels)
2	Supply voltage U_{supply}
3	Weight GND
4	Sensor signal 1 SENT format H.4 (12 bit fast channel and single secure)

Mating connector

The mating connector is not included in the scope of delivery and can be ordered on request from Bosch Rexroth with the material number R917012863. For additional mating connector variants (for other cable diameters, among others), see data sheet 95161.

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. Filling and air bleeding must be carried out completely, particularly in the installation position "drive shaft upwards," 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 available drain port (**L**, **L₁**). 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 avoid the transmission of structure-borne noise, decouple all connecting lines from all vibrating components (e.g. tank, frame parts) using elastic elements.

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 $h_{s \max} = 800 \text{ mm}$ (31.5 inch). The minimum suction pressure at port **S** (see the technical data on page 8) must not be fallen short of during operation and at cold starting either. When designing the reservoir, ensure that there is 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.

Installation position

See the following examples **1** to **9**.

Further installation positions are available upon request. Recommended installation position: **1** and **3**

Key	
L, L₁ (F)	Filling / Air bleeding
S	Suction port
L, L₁	Drain port
SB	Baffle (baffle plate)
$h_{t \min}$	Minimum required immersion depth (200 mm (7.87 inch))
$h_{\min}$	Minimum required distance to reservoir bottom (100 mm (3.94 inch))
$h_{ES \min}$	Minimum height required to prevent axial piston unit from draining (25 mm (0.98 inch))
$h_{S \max}$	Maximum permissible suction height (800 mm (31.5 inch))

Notice

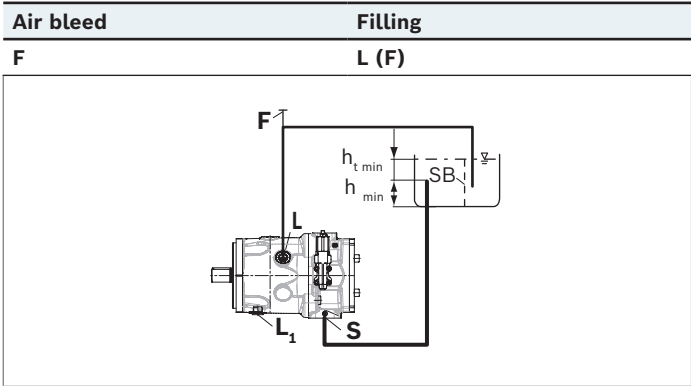
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

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.

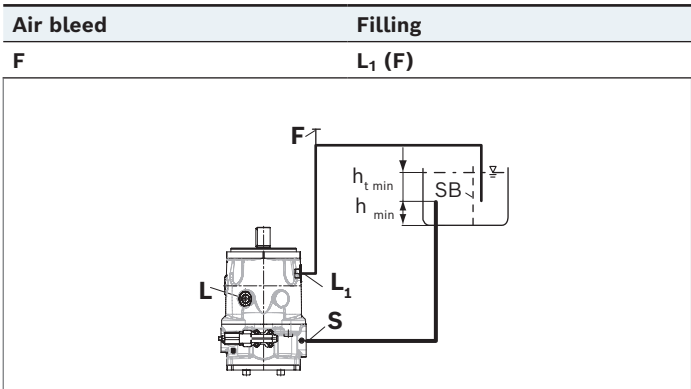
Below-reservoir installation (standard)

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

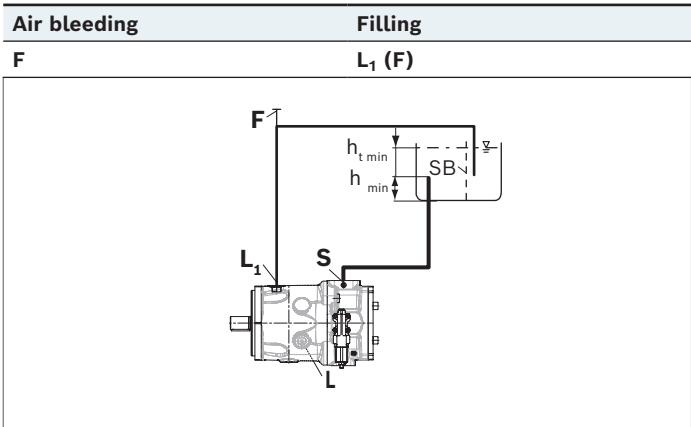
▼ Installation position 1



▼ Installation position 2¹⁾



▼ Installation position 3



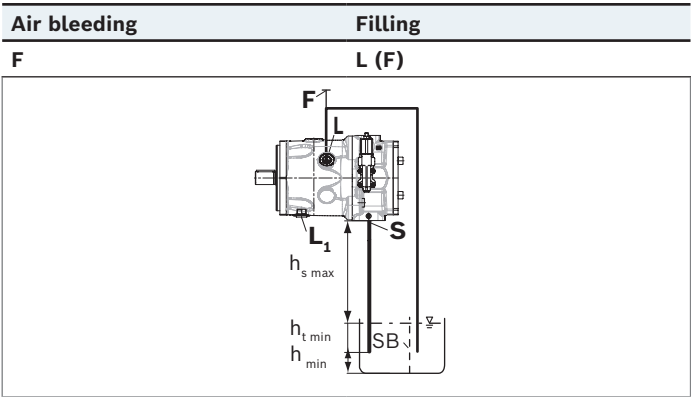
For key, see page 73

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.

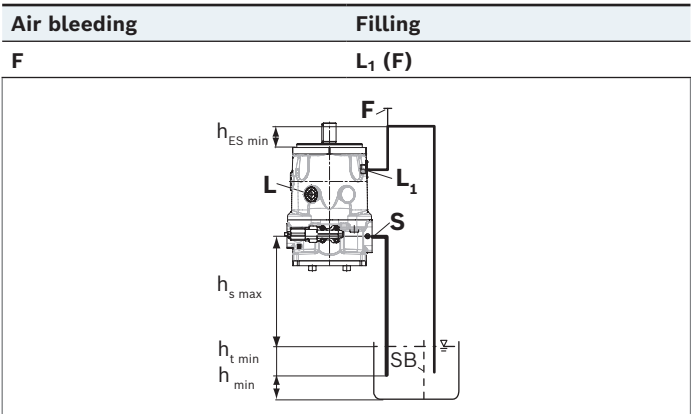
Above-reservoir installation

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, a height difference $h_{ES\ min}$ of at least 25 mm (0.98 inch) is required in position 6. Observe the maximum permissible suction height $h_{S\ max} = 800\ mm\ (31.5\ inch)$. A check valve in the drain line is only permissible in individual cases. Consult us for approval.

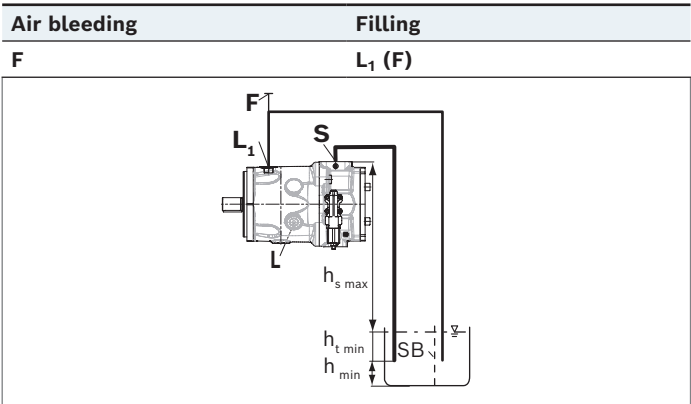
▼ Installation position 4



▼ Installation position 5¹⁾



▼ Installation position 6



Inside-reservoir installation

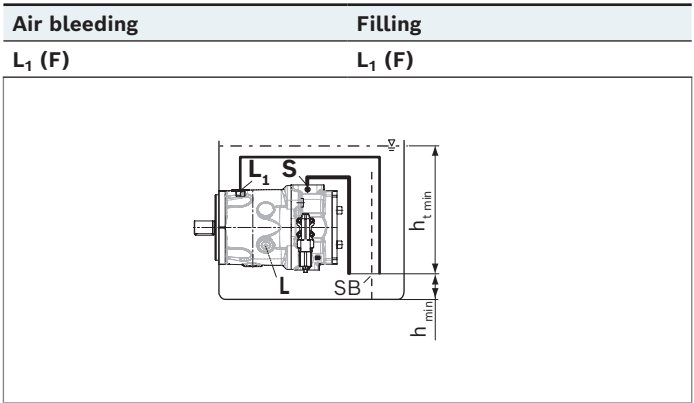
Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

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

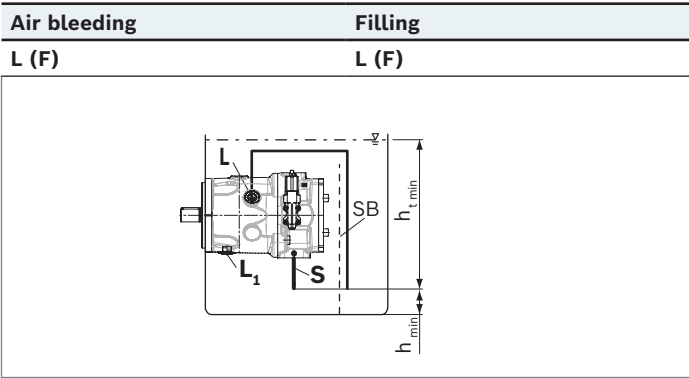
Notice

- Our advice is to fit a suction pipe to the suction port **S** and to fit a pipe to case drain port **L** or **L₁**. In this case, the other drain port must be plugged. The housing of the axial piston unit is to be filled via **L** or **L₁** (see installation position 7 to 9) before the pipework is fitted and the reservoir is filled with hydraulic fluid.

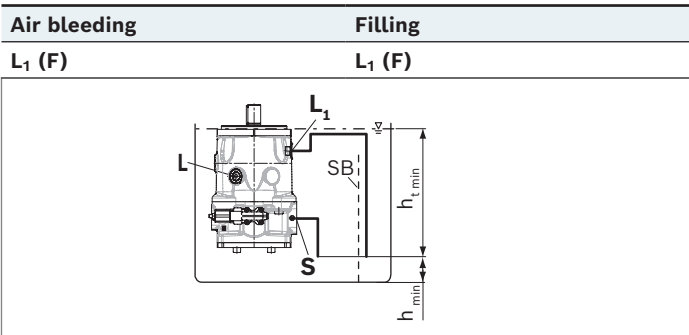
▼ **Installation position 9**



▼ **Installation position 7**



▼ **Installation position 8¹⁾**



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 A10VO axial piston variable pump is intended to be used in an open circuit.
- ▶ 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 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 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 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). 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 control (hydraulic or electronic) is not an adequate safeguard against pressure overload. A pressure relief valve should therefore be provided in the hydraulic system. In this connection, observe the technical limits of the pressure relief valve.
- ▶ 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 information regarding the tightening torques of port threads and other screw connections in the operating instructions.
- ▶ The ports and fastening threads are designed for the permissible pressures $p_{\max}$ of the respective ports, see the connection tables. The machine or system manufacturer must ensure 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.

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.

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.

Related documentation

Product-specific documentation

Document type	Title	Document number
Data sheet	Swivel angle sensor PAL	95161
	BODAS controller RC4-5 series 30	95205
	BODAS controller RC5-6 series 40	95207
	BODAS controller RC18-12 series 40, RC27-18 series 40	95208
	Application software eOC BODAS pump control	95345
	Storage and preservation of axial piston units	90312
Operating instructions	Axial piston variable pump A10VO series 32	92714-01-B

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)	90222
	Rating of hydraulic fluids used in Rexroth hydraulic components (pumps and motors)	90235
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245

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