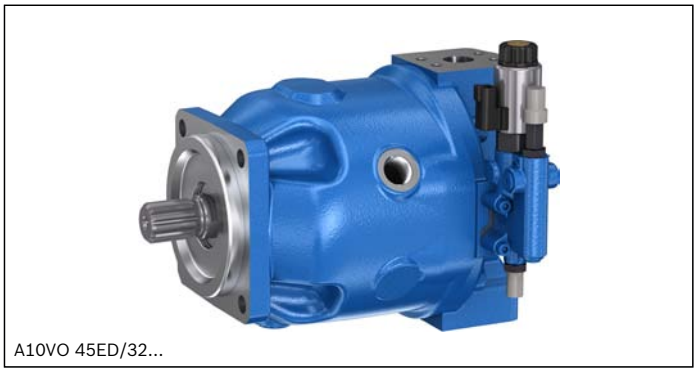
RE 92705/2019-03-25
Replaces: 06.2016

rexroth
A Bosch Company

Axial piston variable pump A10VO Series 32



A10VO 45ED/32...

- Optimized medium pressure pump for high power machines
- Sizes 45 to 180
- Nominal pressure 280 bar
- Maximum pressure 350 bar
- 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.
- Flow can be infinitely varied by controlling the swashplate angle.
- Hydrostatically unloaded cradle bearing
- Port for measurement sensor on high pressure port for all sizes with port plate 22 and 32
- Low noise level
- Increased functional reliability
- High efficiency
- Good power to weight ratio
- Universal through drive for all sizes with port plate 22 and 32
- Optional pulsation damping

Contents

Type code

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

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10V**

Operating mode

02	Pump, open circuit	**O**

Sizes (NG)

03	Geometric displacement, see technical data on page 7	**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	remotely controlled			●	●	●	●	●	**DRG**
		electric	negative control		*U* = 12 V	●	●	●	●	●	**ED71**
					U = 24 V	●	●	●	●	●	**ED72**
		electric	positive control		*U* = 12 V	●	●	●	●	●	**ER71[1)]**
					U = 24 V	●	●	●	●	●	**ER72[1)]**
	Differential pressure control	electric	negative control	see data sheet 92709		●	●	●	●	○	**EF.**
	Power controller with										
	Pressure cut-off	hydraulic	Beginning of control	to	50 bar	●	●	●	●	●	**LA5D**
				from	51 to 90 bar	●	●	●	●	●	**LA6D**
					91 to 160 bar	●	●	●	●	●	**LA7D**
					161 to 240 bar	●	●	●	●	●	**LA8D**
				above	240 bar	●	●	●	●	●	**LA9D**
	Pressure cut-off and flow control	hydraulic	Beginning of control	see LA.D		●	●	●	●	●	**LA.DS**
	pressure cut-off Remotely controlled	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**

Directions of rotation

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

Seal

07	FKM (fluoroelastomer)	**V**

Drive shaft

08	Splined shaft	Standard shaft	●	●	●	●	●	**S**
	ANSI B92.1a	same as shaft "S", but for higher torque	●	●	–	–	–	**R**
		reduced diameter, limited suitability for through drive (see the table of values, page 8)	●	●	●	●	–	**U**
		same as shaft "U", but for higher torque, limited suitability for through drive (see table of values, page 8)	○	●	●	●	●	**W**

1) Note the project planning notes on page 17

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

Mounting flange

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

Working port

10	SAE flange ports (Port plates and through drive assignment, see position 11)	rear, metric fastening thread (only without through drive "N00")	●	●	●	●	●	**11**
		at top, at bottom, on opposite side, metric fastening thread	●	●	●	●	●	**12**
		at top, at bottom, on opposite side, metric fastening thread, with universal through drive U..; **without** pulsation damping	●	●	●	●	●	**22**[1]
		at top, at bottom, on opposite side, metric fastening thread, with universal through drive U..; **with** pulsation damping	○	●	○	○	●	**32**[1]

Through drive (for mounting options, see page 61)

	Flange ISO 3019-1		Hub for splined shaft[2]						
11	Diameter	Attachment[4]	Diameter		45	71	100	140	180	
	without through drive	(**Only for port plate 12**)			●	●	●	●	●	**N00**
	82-2 (A)		5/8 in	9T 16/32DP	●	●	●	●	–	**K01**
			3/4 in	11T 16/32DP	●	●	●	●	–	**K52**
	101-2 (B)		7/8 in	13T 16/32DP	●	●	●	●	–	**K68**
			1 in	15T 16/32DP	●	●	●	●	–	**K04**
	127-2 (C)		1 1/4 in	14T 12/24DP	–	●	●	●	–	**K07**
			1 1/2 in	17T12/24DP	–	–	●	●	–	**K24**
	127-4 (C)		1 1/4 in	14T 12/24DP	–	○	●	●	–	**K15**
	152-4 (D)		1 3/4 in	13T 8/16DP	–	–	–	●	–	**K17**
	without through drive[3]	(**Only for port plates 22 and 32**)			●	●	●	●	●	**U00**
	82-2 (A)		5/8 in	9T 16/32DP	○	●	●	●	●	**U01**
			3/4 in	11T 16/32DP	●	●	●	●	●	**U52**
	101-2 (B)		7/8 in	13T 16/32DP	●	●	●	●	●	**U68**
			1 in	15T 16/32DP	○	●	●	●	●	**U04**
	127-2 (C)		1 1/4 in	14T 12/24DP	–	●	●	●	●	**U07**
			1 1/2 in	17T 12/24DP	–	–	●	●	●	**U24**
	127-4 (C)		1 in	15T 16/32DP	○	○	●	●	○	**UE2**
			1 1/4 in	14T 12/24DP	–	–	●	●	●	**U15**
	152-4 (D)		1 3/4 in	13T 8/16DP	–	–	–	●	●	**U17**

Connectors for solenoids[5]

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

● = Available ○ = On request – = Not available

Notes

- ▶ Note the project planning notes on page 67.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.

1) Only with mounting flange (type code position 09) D or U
2) According to ANSI B92.1a (splined shafts according to SAE J744)
3) With through-drive shaft, without hub, without intermediate flange, closed on a functionally reliable basis with cover. For mounting kits, see data sheet 95581.
4) Mounting holes pattern viewed from through drive with control at top.
5) Connectors for other electric components may deviate.

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

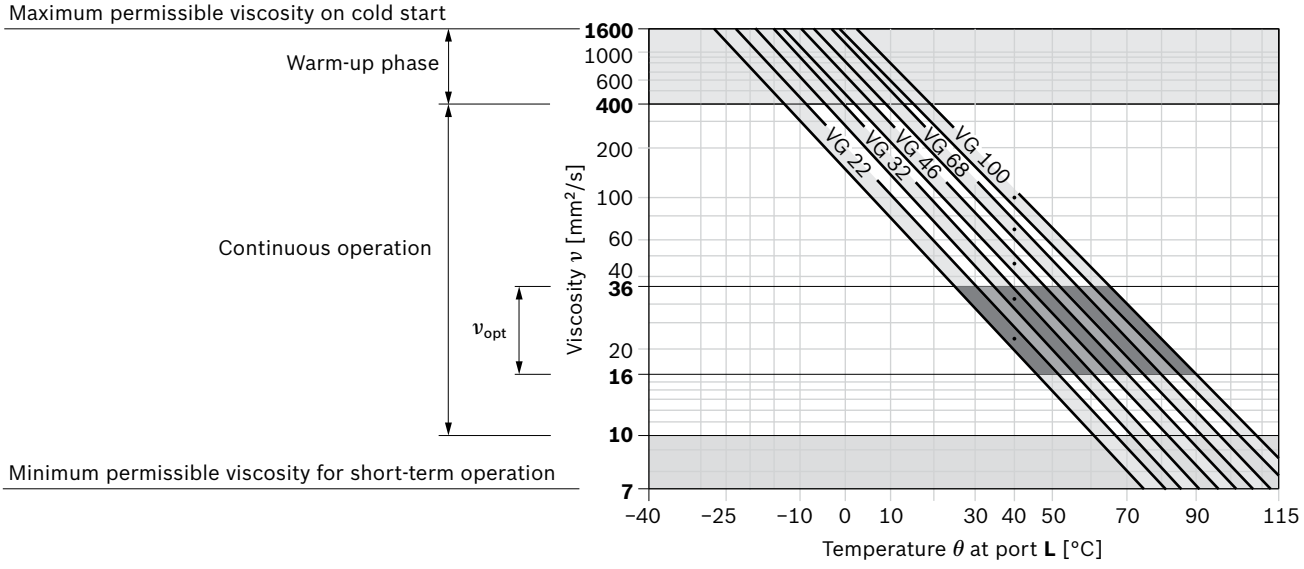
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The hydraulic fluid should be selected 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[3]	Comment
Cold start	v_{max} ≤ 1600 mm²/s	NBR[2]	θ_{St} ≥ –40 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
		FKM	θ_{St} ≥ –25 °C	
Warm-up phase	v = 1600 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Continuous operation	v = 400 ... 10 mm²/s[1]	NBR[2]	θ ≤ +85 °C	measured at port **L**
		FKM	θ ≤ +110 °C	
	v_{opt} = 36 ... 16 mm²/s			optimal operating viscosity and efficiency range
Short-term operation	v_{min} = 10 ... 7 mm²/s	NBR[2]	θ ≤ +85 °C	t ≤ 3 min, p ≤ 0.3 × p_{nom} , measured at port **L**
		FKM	θ ≤ +110 °C	

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +4°C to +85°C (see selection diagram)

2) Special version, please contact us

3) If the temperature at extreme operating parameters cannot be adhered to, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

A cleanliness level of at least 20/18/15 under ISO 4406 should be maintained.

At a hydraulic fluid viscosity of less than 10 mm^2/s (e.g. due to high temperatures during short-term operation) at the drain port, a minimum cleanliness level of 19/17/14 as defined in ISO 4406 is required.

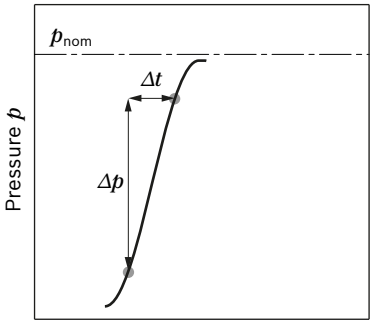
For example, the viscosity 10 mm^2/s at:

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

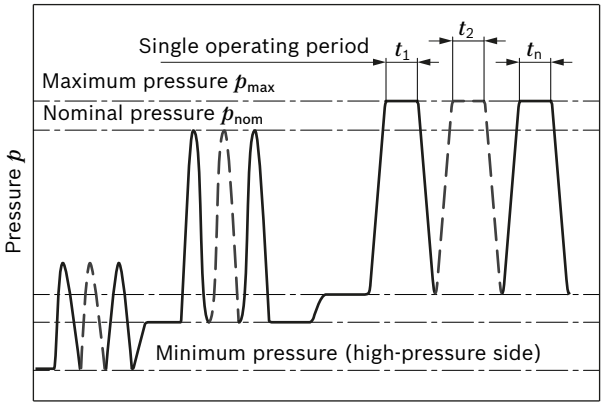
Working pressure range

Pressure at port B			Definition
Nominal pressure p_{nom}		280 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}		350 bar	The maximum pressure corresponds to the maximum working pressure during 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 $p_{B\,abs}$ (high-pressure side)		10 bar[1]	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\,max}$		16000 bar/s	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)			
Minimum pressure $p_{S\,min}$	NG 45 to 100 at 1800 rpm	0.8 bar abs.	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 abs.	
Maximum pressure $p_{S\,max}$		10 bar[2]	
Case pressure at port L_1, L_2			
Maximum pressure $p_{L\,max}$		2 bar[2] abs.	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\,max}$. A drain line to the reservoir is required.

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



▼ **Pressure definition**



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

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

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

Technical data

Size		NG		45	71	100	140	180
Geometric displacement, per revolution		$V_{g\,max}$	cm^3	45	71.1	100	140	180
Maximum rotational speed[1)2)]	at $V_{g\,max}$	n_{nom}	rpm	3000	2550	2300	2200	1800
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	135	181	230	308	324
Power	at n_{nom}, $V_{g\,max}$ and Δp = 280 bar	P	kW	63	85	107	144	151
Torque	at $V_{g\,max}$ and Δp = 280 bar	M	Nm	200	317	446	624	802
	at $V_{g\,max}$ and Δp = 100 bar	M	Nm	72	113	159	223	286
Rotary stiffness Drive shaft	S	c	Nm/rad	37500	71884	121142	169537	171107
	R	c	Nm/rad	41025	76545	–	–	–
	U	c	Nm/rad	30077	52779	91093	on request	–
	W	c	Nm/rad	34463	57460	101847	165594	–
Moment of inertia of the rotary group		J_{TW}	kgm^2	0.0035	0.0087	0.0167	0.0242	0.033
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
Weight (11N00 and 12N00 without through drive) approx.		m	kg	25.8	40.4	56.4	70.5	75.2
Weight (12Kxx) approx.		m	kg	27.4	43.3	62.6	79.5	–
Weight (22Uxx/32Uxx) approx.		m	kg	32.6	51.8	76	90.2	89.4

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

Key

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

Notice

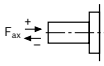
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommend testing the load by means of experiment or calculation/simulation and comparison with the permissible values.

1) The following values apply:
– at an absolute pressure p_{abs} = 1.0 bar at the suction port **S**
– for the optimum viscosity range from v_{opt} = 36 to 16 mm^2/s
– with hydraulic fluid on the basis of 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 rotary frequency; cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

Permissible radial and axial loading of the drive shaft

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

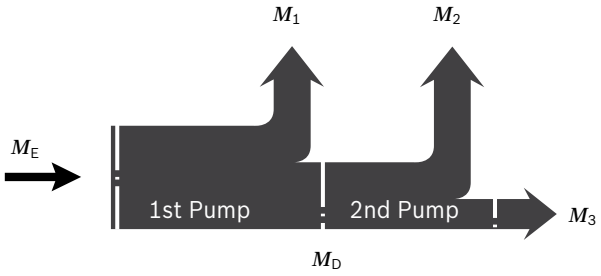
Notice

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

Permissible input and through-drive torques

Size				45	71	100	140	180
Torque at $V_{g\,max}$ and Δp = 280 bar[1]		M_{max}	Nm	200	316	446	624	802
Maximum input torque on drive shaft[2]								
	S	$M_{E\,max}$	Nm	319	626	1104	1620	1834
		Ø	in	1	1 1/4	1 1/2	1 3/4	1 3/4
	R	$M_{E\,max}$	Nm	400	644	–	–	–
		Ø	in	1	1 1/4	–	–	–
	U	$M_{E\,max}$	Nm	188	300	595	on request	–
		Ø	in	7/8	1	1 1/4	1 1/2	–
	W	$M_{E\,max}$	Nm	–	394	636	1220	1488
		Ø	in	–	1	1 1/4	1 1/2	1 1/2
Maximum through-drive torque								
	S	$M_{D\,max}$	Nm	319	492	778	1266	1266
	R	$M_{D\,max}$	Nm	365	548	–	–	–
	U	$M_{D\,max}$	Nm	188	300	595	on request	–
	W	$M_{D\,max}$	Nm	–	–	636	1220	1266

▼ **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	<	$M_{D\,max}$

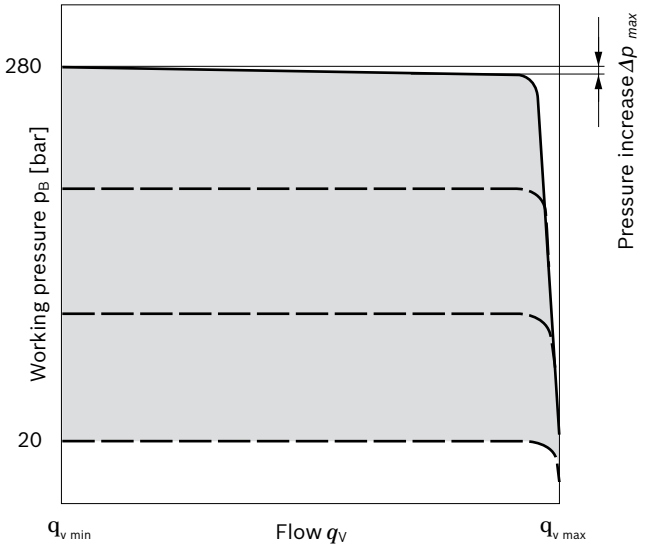
1) Efficiency not considered
2) For drive shafts with no radial force

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.

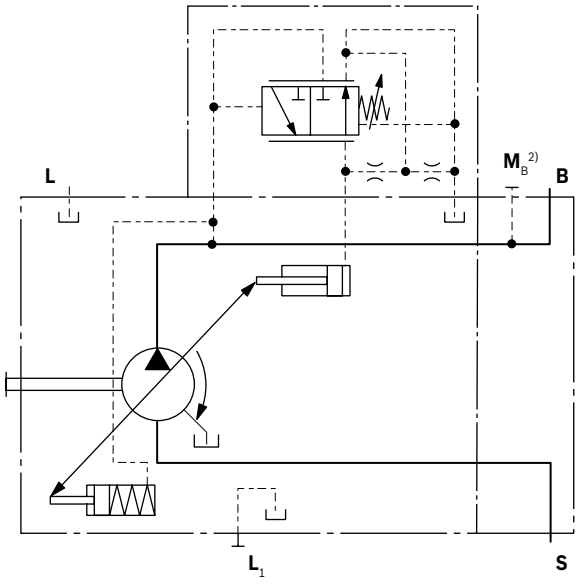
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] for pressure control 20 to 280 bar. Standard is 280 bar.

▼ **Characteristic curve DR**



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

▼ **Circuit diagram DR**



Controller data

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

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) Only with port plates 22 and 32

DRG – Pressure controller, remotely controlled

For the remotely controlled pressure controller, the LS 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 9.
A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control.
A differential pressure of 20 bar Δp (standard setting) results in a pilot oil flow of approx. 1.5 l/min at port **X**. If another setting is required (range from 10 - 22 bar) please state in plain text.
As a separate pressure relief valve (**1**) we recommend:

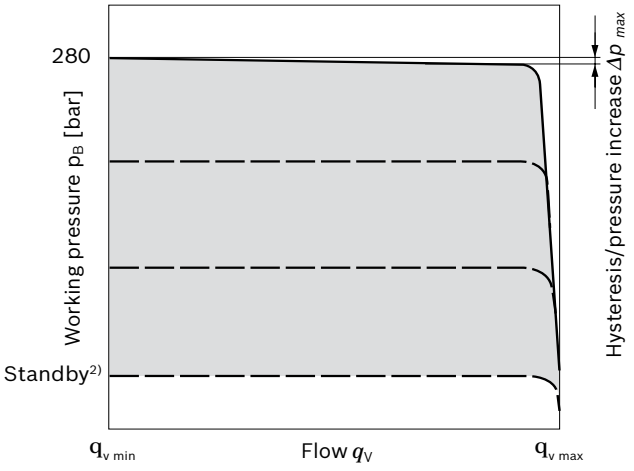
- A direct operated, hydraulic or electric proportional one, suitable for the control fluid mentioned above.

The maximum line length should not exceed 2 m.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 20 to 280 bar **(3).** Standard is 280 bar.
- Setting range for differential pressure 10 - 22 bar (**2**) Standard is 20 bar.

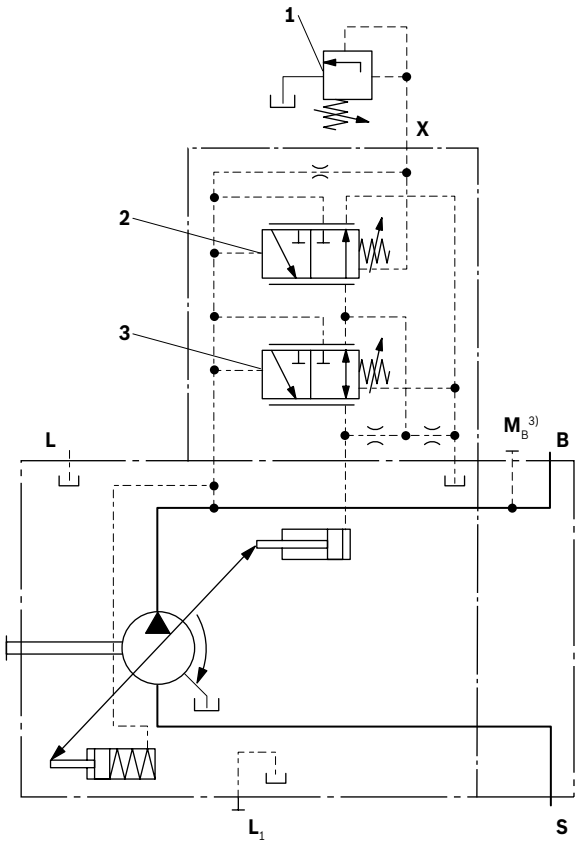
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar higher than the defined differential pressure Δp, however system influences are not taken into account.

▼ **Characteristic curve DRG**



Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50°C.

▼ **Circuit diagram DRG**



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

Controller data

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

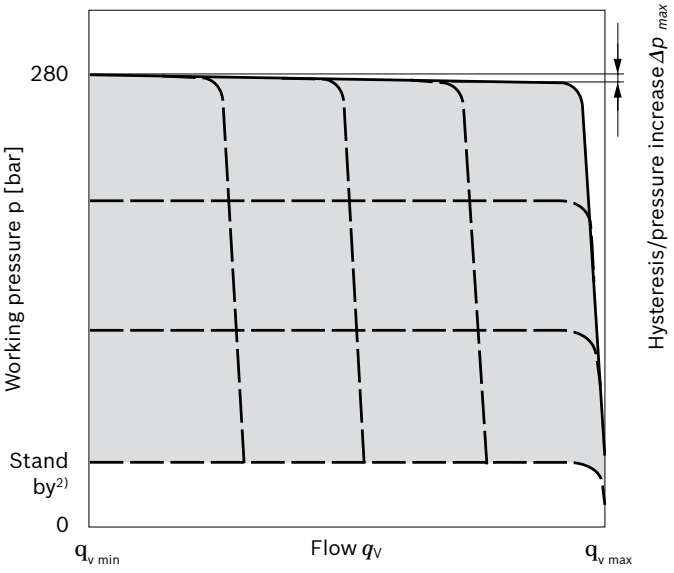
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting Δp on controller (**2**)
3) Only with port plates 22 and 32

DRF/DRS/DRSC – Pressure flow controller

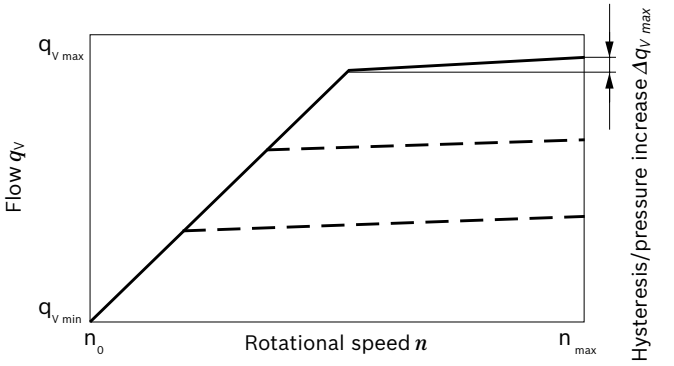
In addition to the pressure controller function (see page 9), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the V_g reduction has priority.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] to 280 bar.
  Standard is 280 bar.
- DR pressure controller data see page 9

▼ **Characteristic curve DRF/DRS/DRSC**

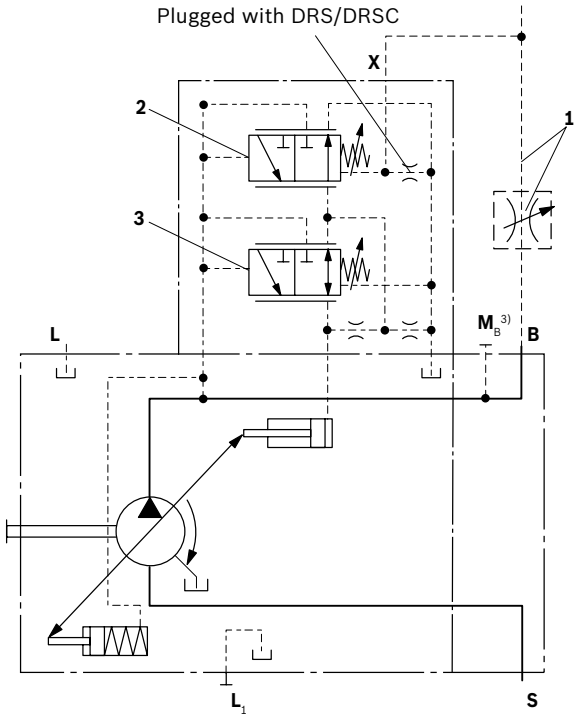


▼ **Characteristic curve at variable rotational speed**



Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50°C.

▼ **Circuit diagram DRF**



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

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 DRSC control valve must be used.

For further information see page 12

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

Differential pressure Δp

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

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

Controller data

DR pressure controller data see page 9
Maximum flow deviation measured at drive speed n = 1500 rpm.

NG		45	71	100	140	180
Flow deviation	$\Delta q_{V\,max}$ [l/min]	1.8	2.8	4.0	6.0	8.0
Hysteresis and repeatability	Δp [bar]	maximum 3				
Pilot fluid consumption	l/min	maximum approx. 3 to 4.5 (DRF) maximum approx. 3 (DRS/DRSC)				

LA... – Pressure, flow and power controller

Pressure controller equipped as DR(G),
see page 9 (10).
Equipment of the flow controller like DRS, see page 11.
In order to achieve a constant drive torque with varying working pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant. Flow control is possible below the power control curve. When ordering please state the power characteristics to be set at the factory in plain text, e.g. 20 kW at 1500 rpm.

Controller data

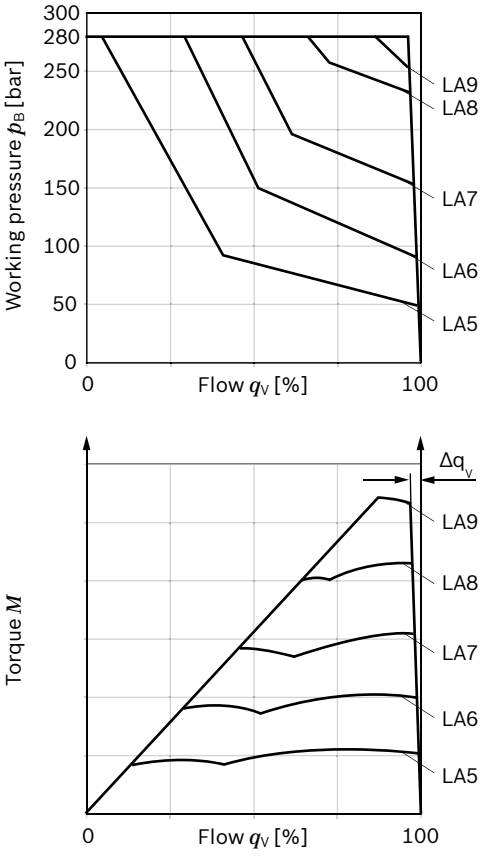
- For technical data of pressure controller DR see page 9.
- For technical data of flow controller FR see page 11.
- Pilot fluid consumption max. approx. 5.5 l/min.

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

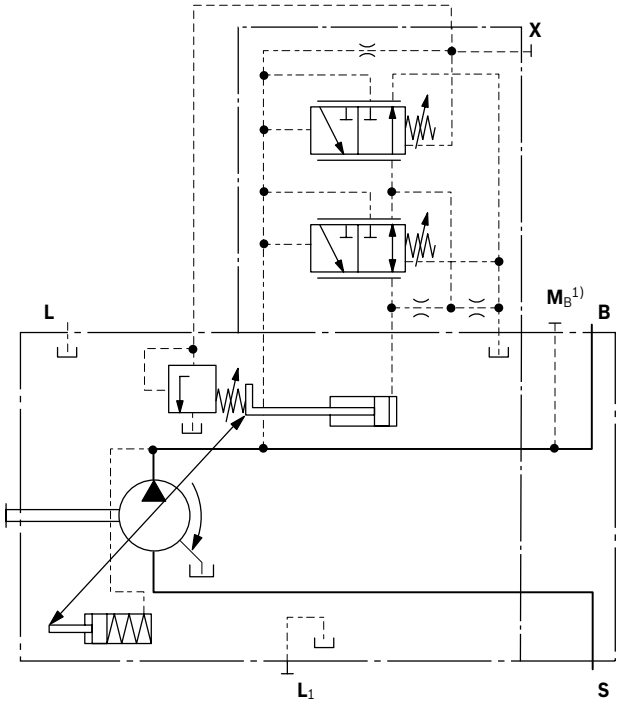
Conversion of the torque values in power [kW]

$P = \frac{M}{6.4}$ [kW] (at 1500 rpm) or $P = \frac{2\pi \times M \times n}{60000}$ [kW] (For rotational speeds see page 7)

▼ **Characteristic curve LA.**



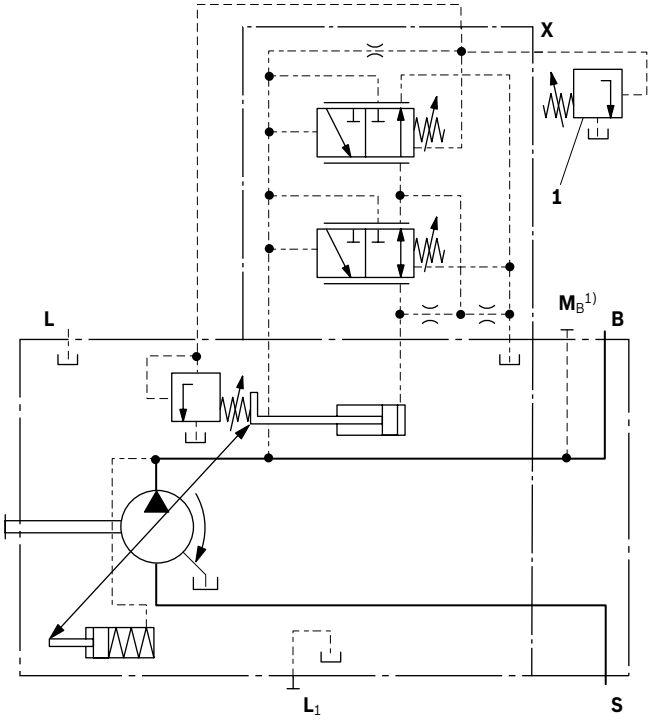
▼ **Circuit diagram LA.D** with pressure cut-off
(for further combination options with LA.. see page 14)



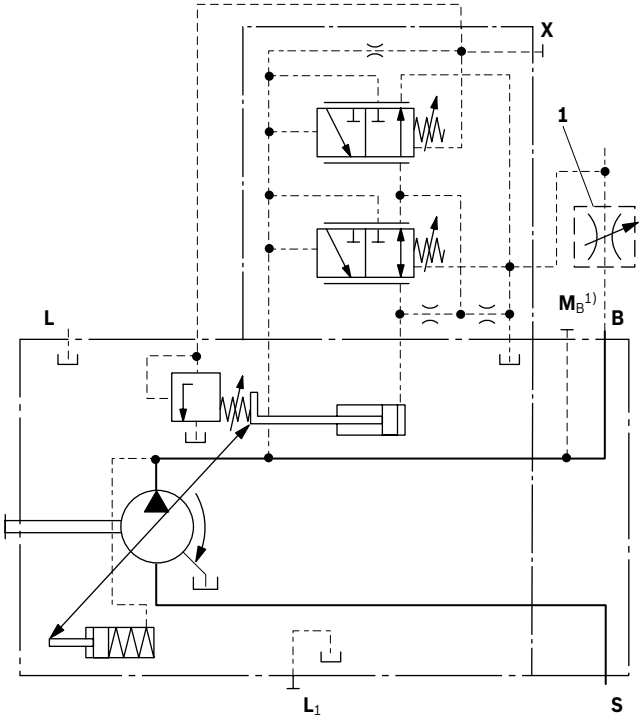
1) Only with port plates 22 and 32

LA... – Variations

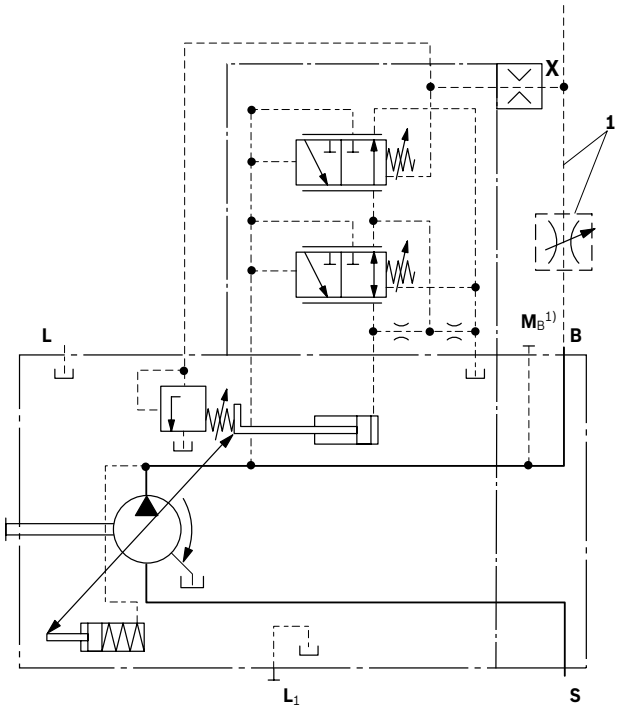
▼ **Circuit diagram LA.DG** with pressure cut-off, remotely controlled



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



▼ **Circuit diagram LA.DS**



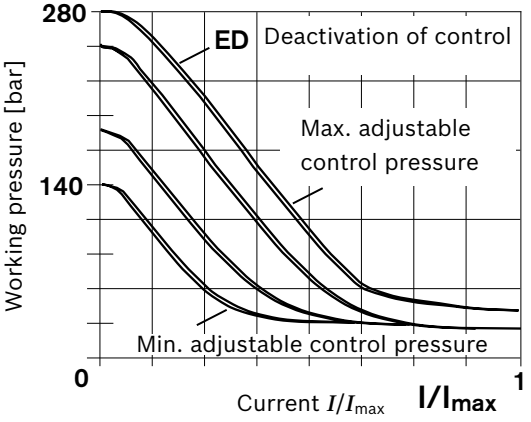
1 The metering orifice and the pressure relief valve and line are not included in the scope of delivery.

1) Only with port plates 22 and 32

ED – Electrohydraulic pressure control

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

▼ **Current/pressure characteristic curve ED**
(negative characteristic curve, measured with pump in zero stroke)

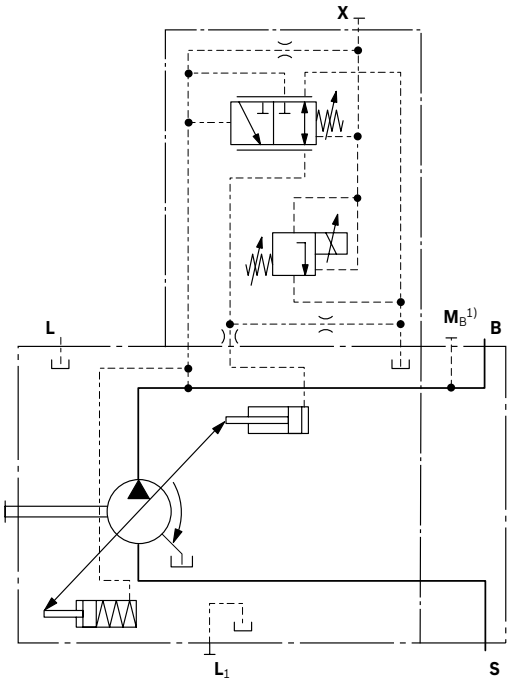


Hysteresis static current-pressure characteristic curve < 3 bar.

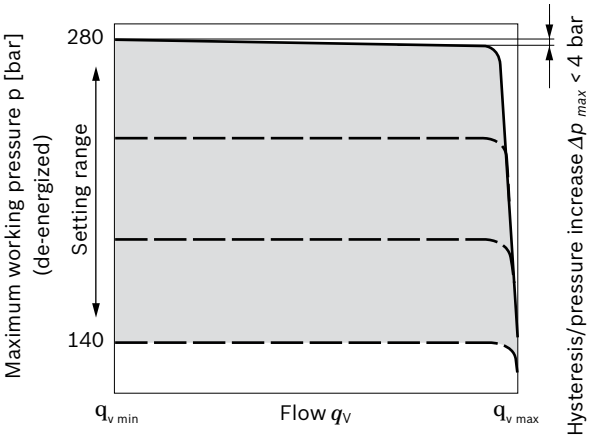
Technical data, solenoids	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{max}	100 mA	50 mA
End of control at p_{min}	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100%	100%
Control and type of protection see connector version page 63		
Operating temperature range at valve –20 °C to +115 °C		

For circuit diagram and more characteristic curves see page 16

▼ **Circuit diagram ED71/ED72**

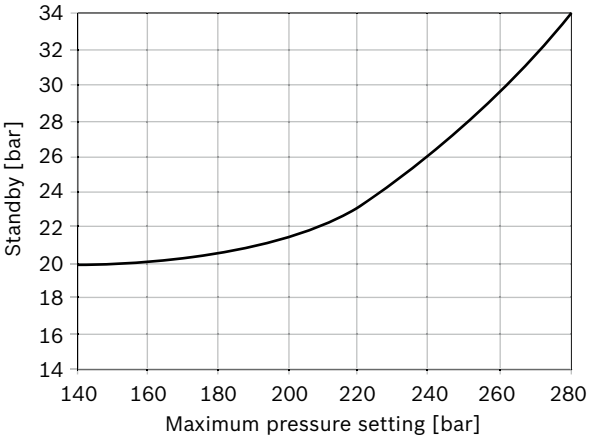


▼ **Flow-pressure characteristic curve**



Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50°C.
Pilot fluid consumption: 3 to 4.5 l/min.

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



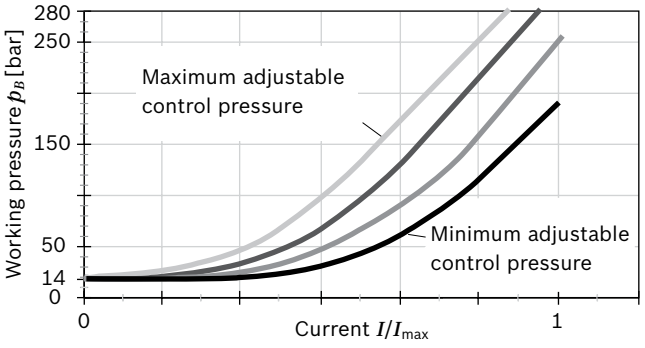
Standby standard setting, other values on request.

1) Only with port plates 22 and 32

ER – Electrohydraulic pressure control

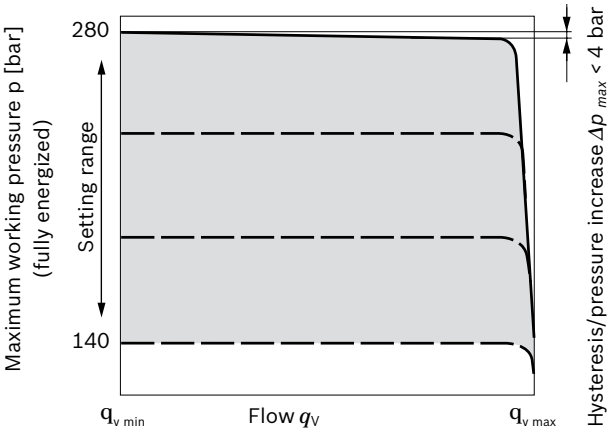
The ER valve is set to a certain pressure by a specified variable solenoid current.
When a change is made at the consumer (load pressure), the position of the control spool will shift.
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.
As the solenoid current signal drops towards zero, the pressure will be limited to p_{min} (stand by).

▼ **Current/pressure characteristic curve ED**
(positive characteristic curve measured with pump in zero stroke)



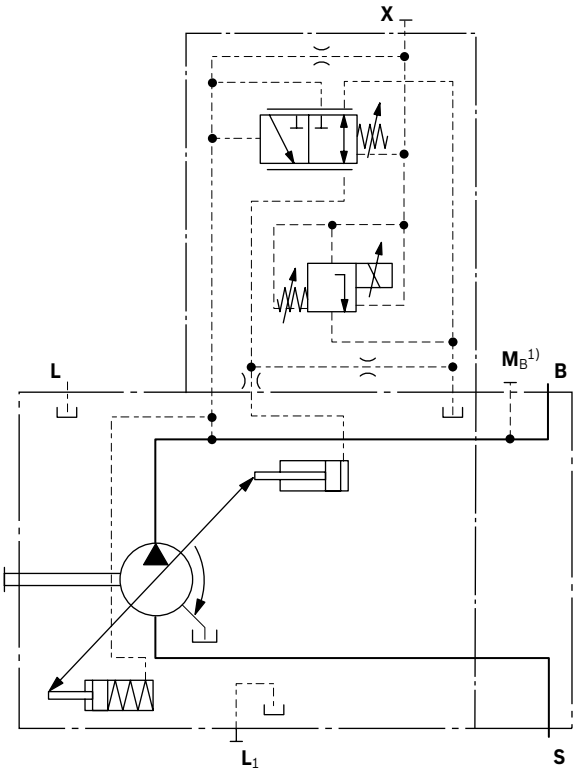
Hysteresis static current-pressure characteristic curve < 3 bar.

▼ **Flow-pressure characteristic curve**



Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50°C.
Pilot fluid consumption: 3 to 4.5 l/min.
Standby standard 14 bar. Other values on request.
Influence of pressure setting on standby ± 2 bar.

▼ **Circuit diagram ER71/ER72**



Technical data, solenoids	ER71	ER72
Voltage	12 V (±20%)	24 V (±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)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100%	100%
Control and type of protection see connector version page 63		
Operating temperature range at valve –20 °C to +115 °C		

Project planning note!
Excessive current levels (I > 1200 mA at 12 V or I > 600 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.
- An intermediate plate pressure controller can be used to protect the pump in the event of excessive current levels.

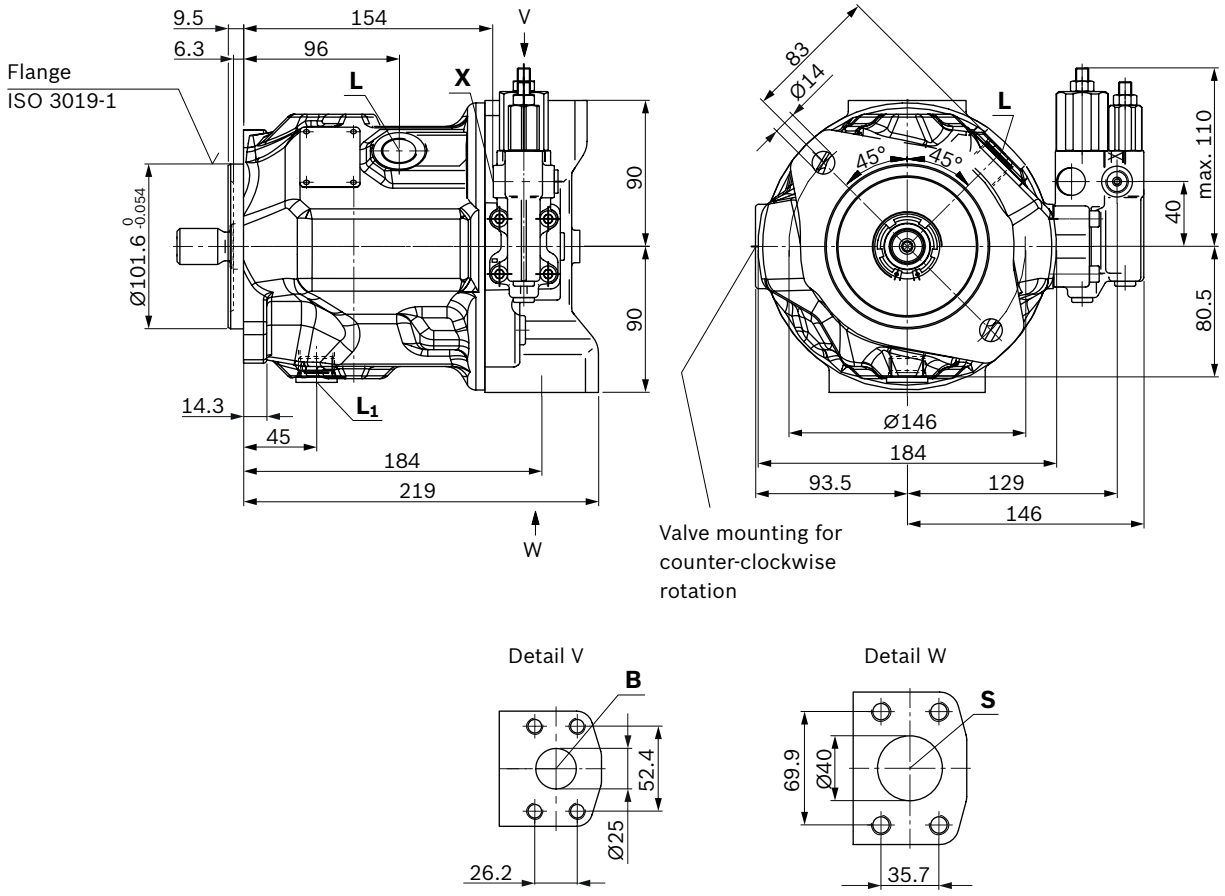
An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

1) Only with port plates 22 and 32

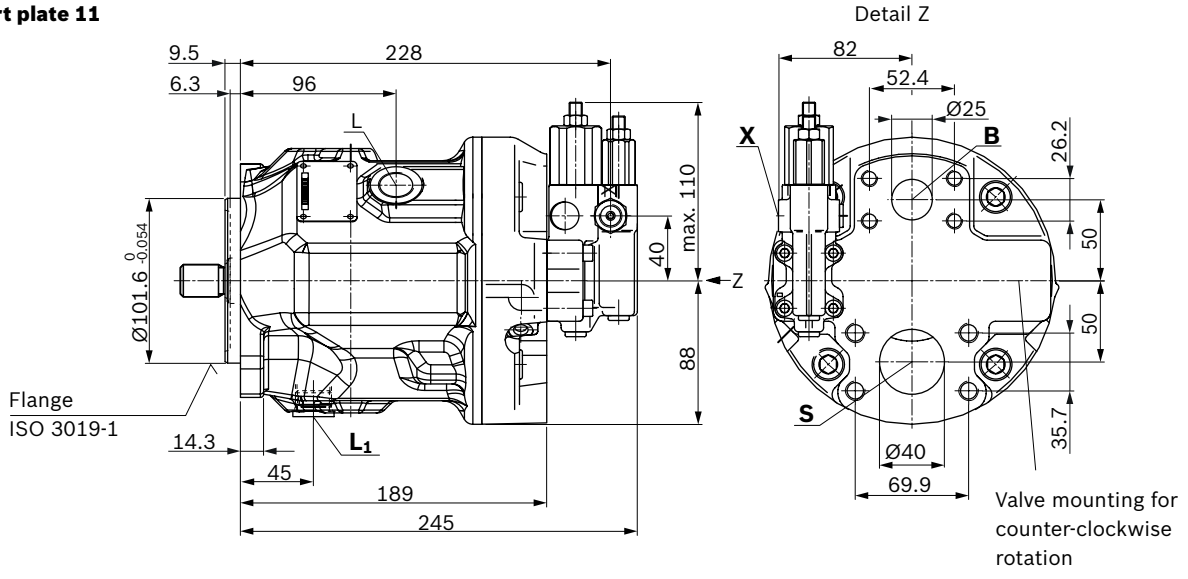
Dimensions, size 45

DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-B; 101-2)

▼ **Port plate 12**

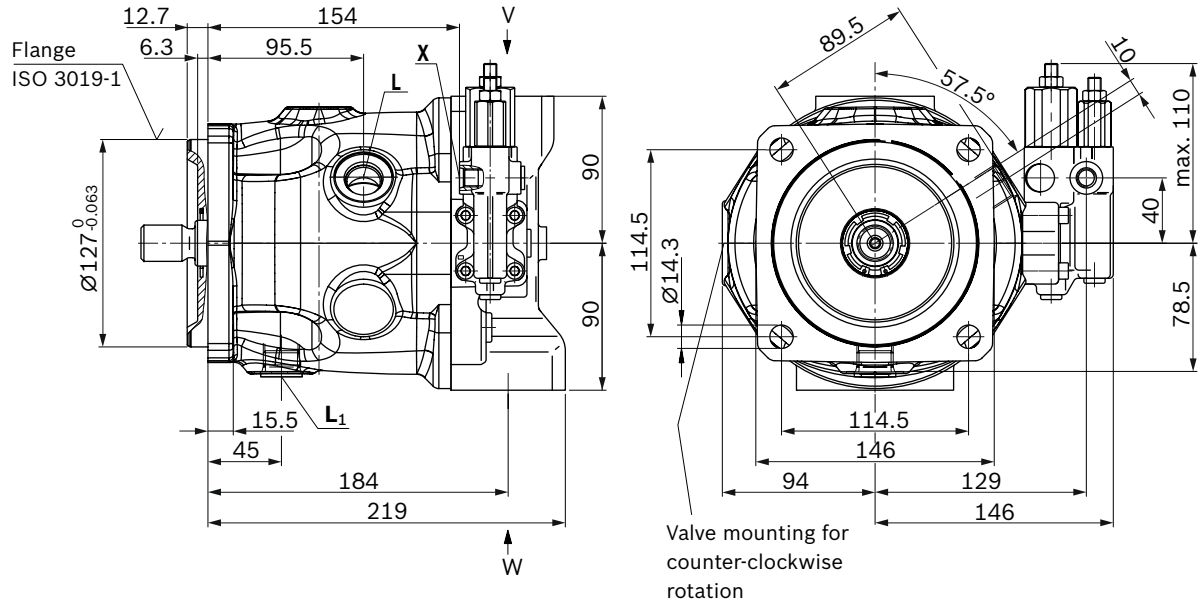


▼ **Port plate 11**

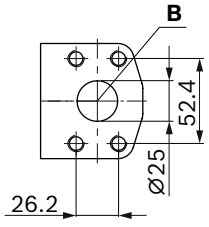


DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange D (SAE-C; 127-4)

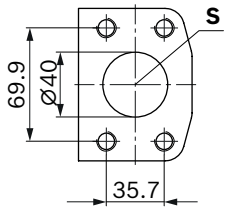
▼ **Port plate 12**



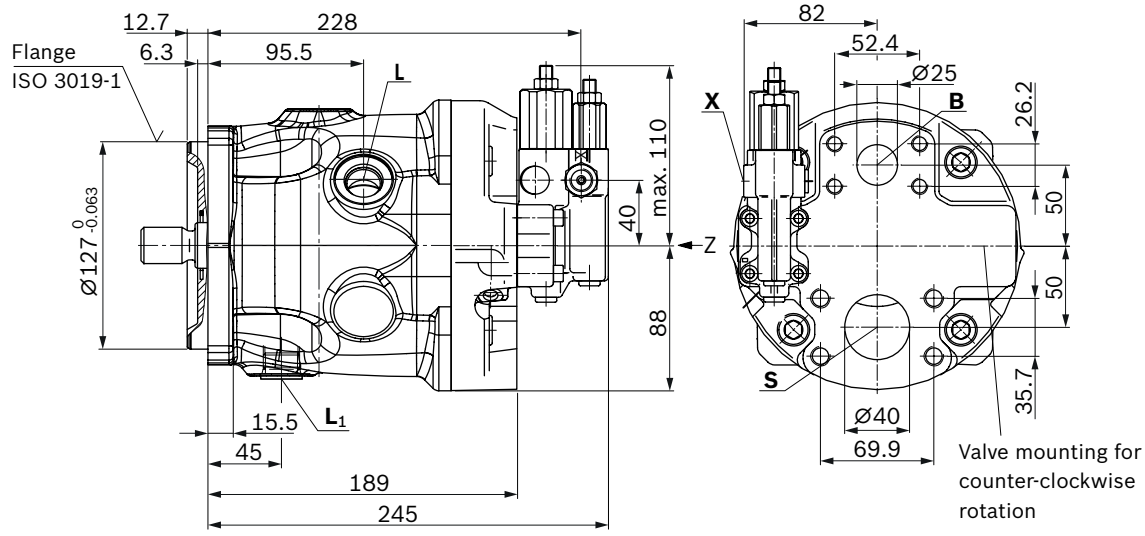
Detail V



Detail W



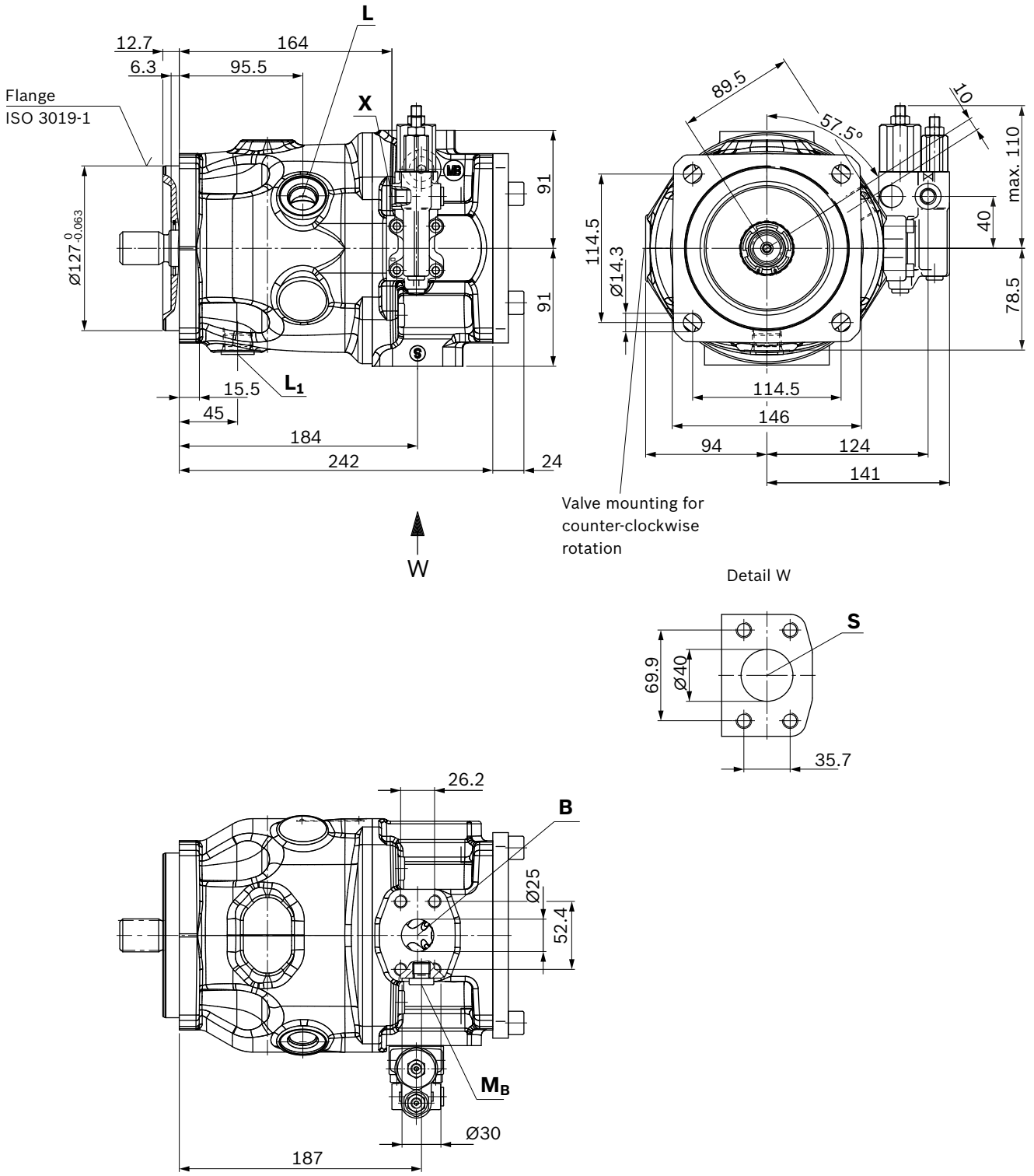
▼ **Port plate 11**



Detail Z

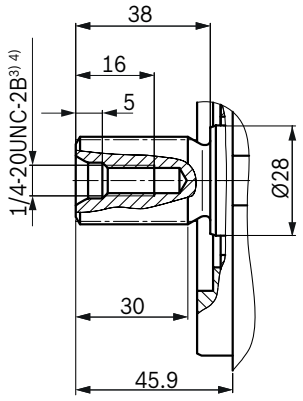
DRF, DRS, DRSC – Pressure flow controller, port plate 22; mounting flange D (SAE-C; 127-4)

▼ **Port plate 22**



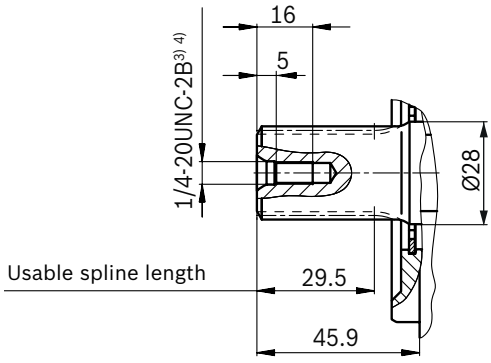
▼ **Splined shaft 1 in (SAE J744)**

S – 15T 16/32DP[1)]



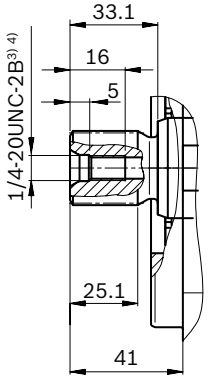
▼ **Splined shaft 1 in (SAE J744)**

R – 15T 16/32DP[1)2)]



▼ **Splined shaft 7/8 in (SAE J744)**

U – 13T 16/32DP[1)]

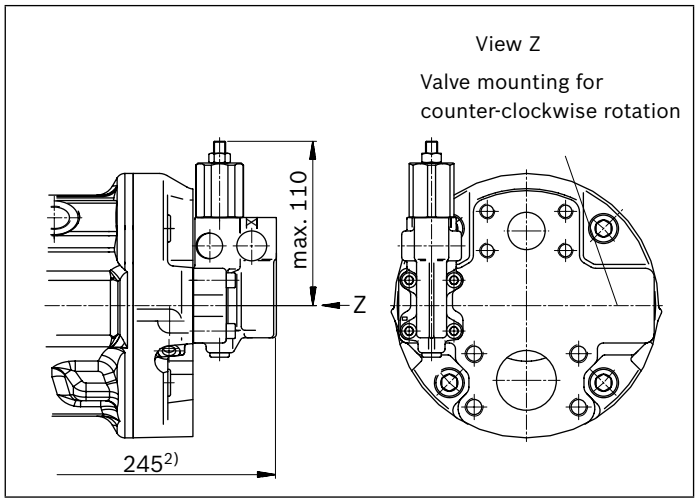


Ports		Standard	Size	p_{max} [bar][4)]	State[8)]
B	Working port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/2 in M12 x 1.75; 20 deep	10	O
L	Drain port	ISO 11926[6)]	7/8-14UNF-2B; 17 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	7/8-14UNF-2B; 17 deep	2	X[7)]
X	Pilot pressure	ISO 11926	7/16-20 UNF-2A; 12 deep	350	O
M_B	Measuring pressure **B** (only with port plates 22 and 32)	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

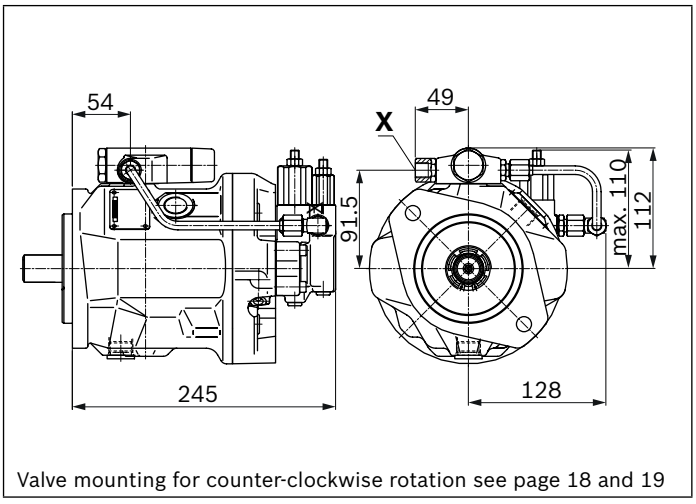
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur.
   Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 64).
8) O = Must be connected (comes plugged)
   X = Plugged (in normal operation)

Port plate 11

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

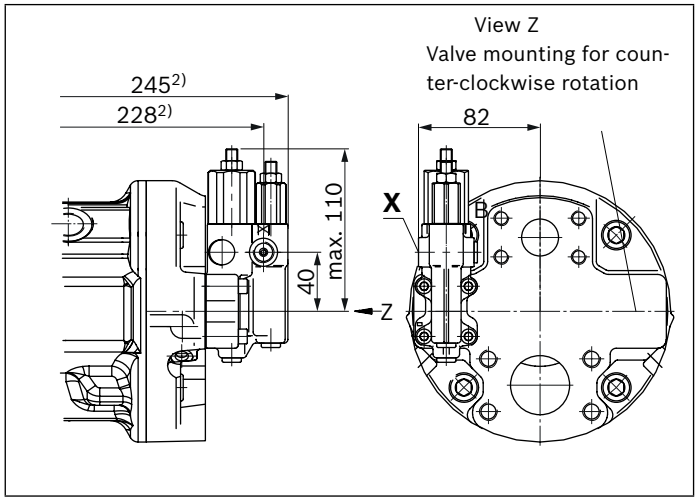


▼ **LA.DS – Pressure, flow and power controller; mounting flange C**

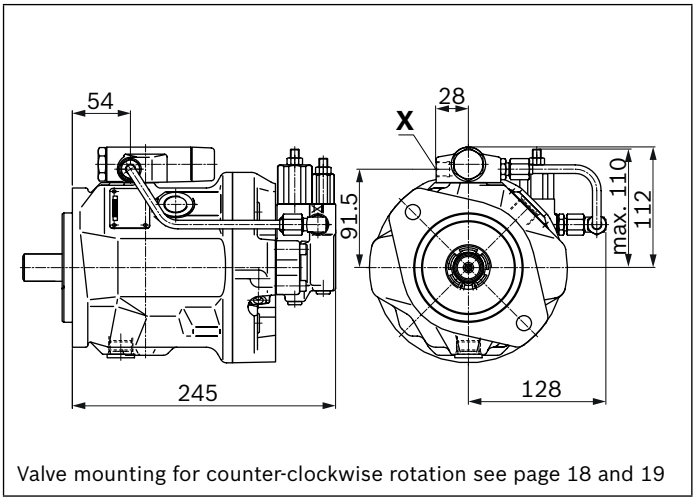


Valve mounting for counter-clockwise rotation see page 18 and 19

▼ **DRG – Pressure controller, remotely controlled; mounting flange C**

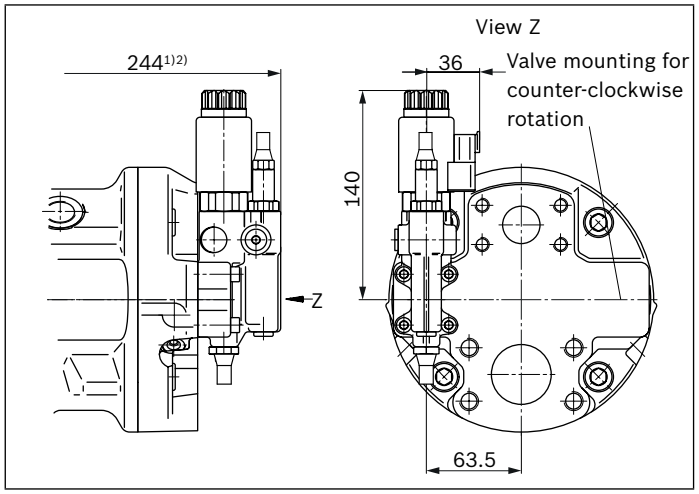


▼ **LA.DG – Power controller; with pressure cut-off remotely controlled; mounting flange C**



Valve mounting for counter-clockwise rotation see page 18 and 19

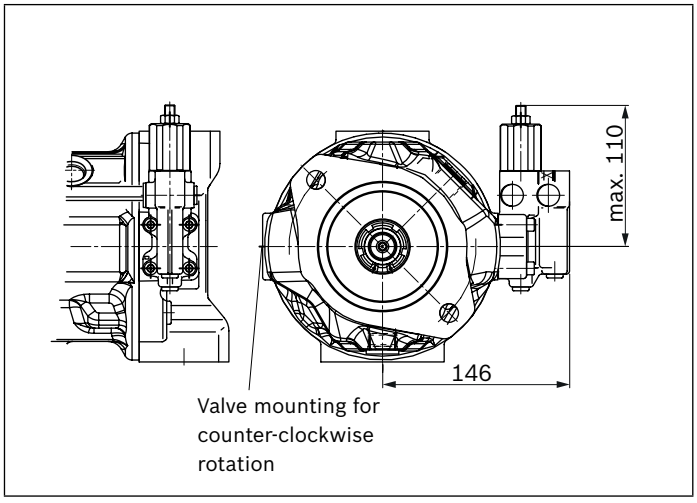
▼ **ED7./ER7. – Pressure controller, electric; mounting flange C**



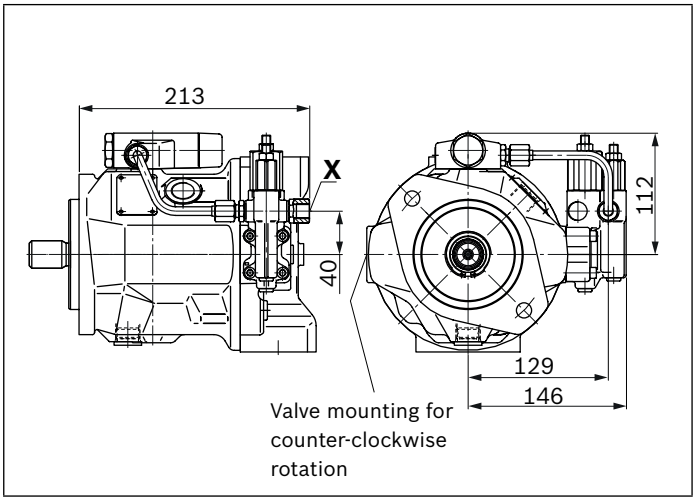
1) ER7. 279 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 12

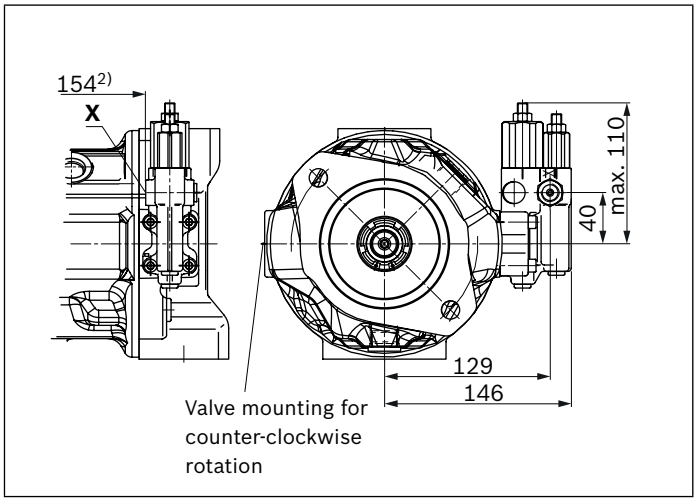
▼ **DR – Pressure controller; mounting flange C**



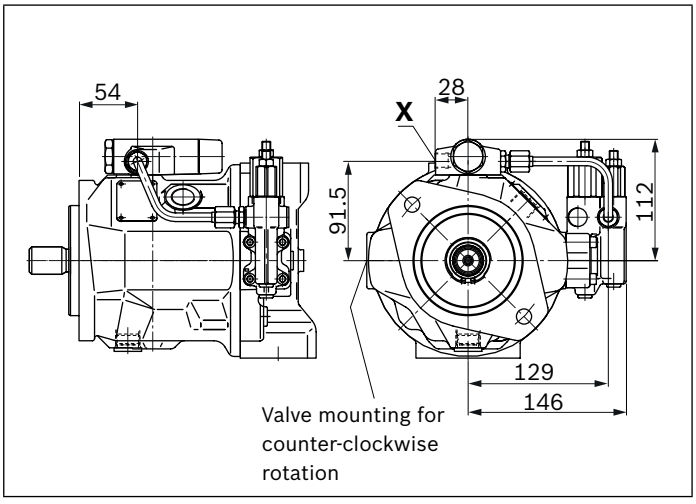
▼ **LA.DS – Pressure, flow and power controller; mounting flange C**



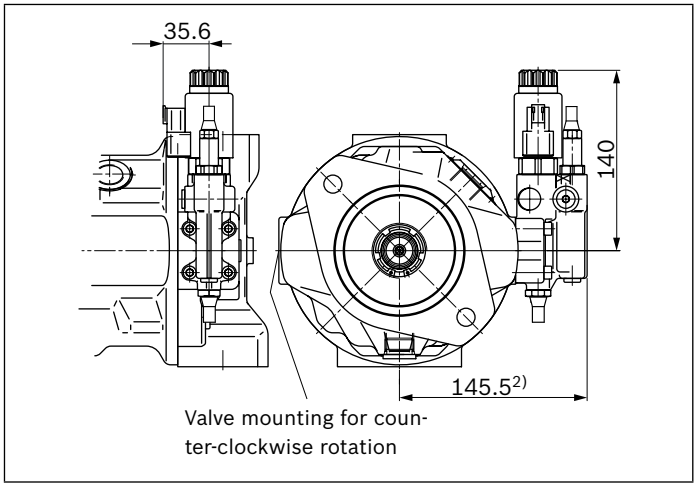
▼ **DRG – Pressure controller, remotely controlled; mounting flange C**



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



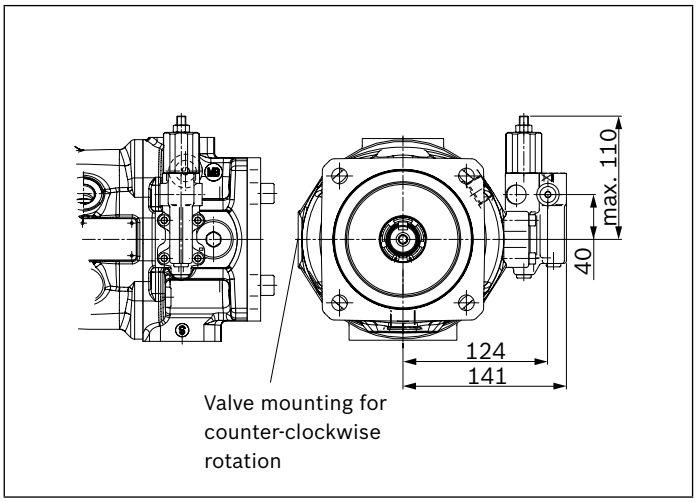
▼ **ED7./ER7. – Pressure controller, electric; mounting flange C**



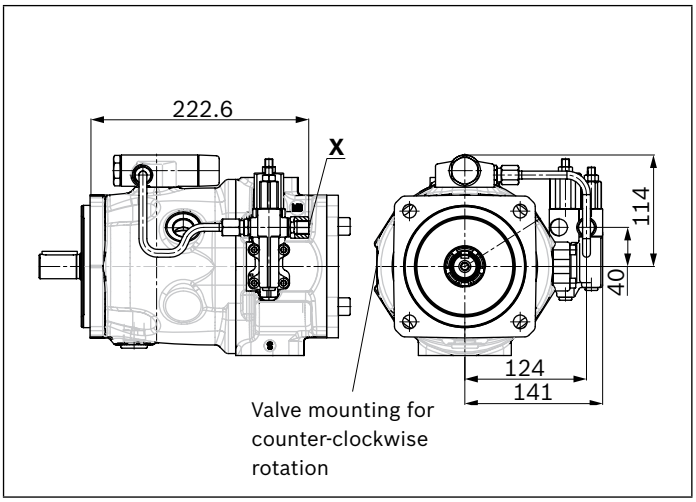
1) ER7. 180.5 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 22

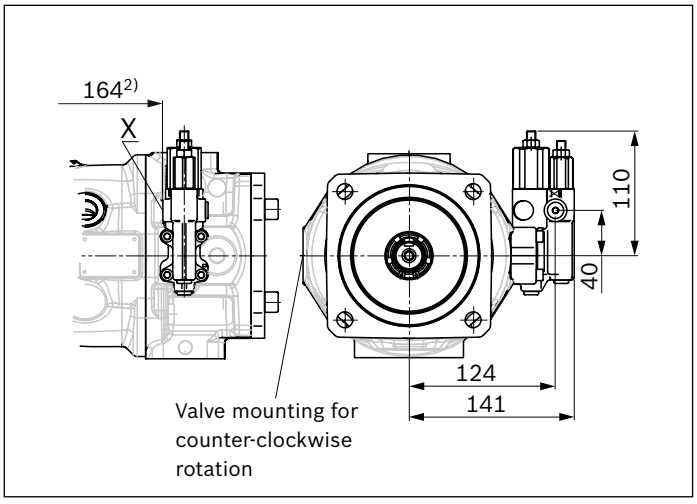
▼ **DR – Pressure controller; mounting flange D**



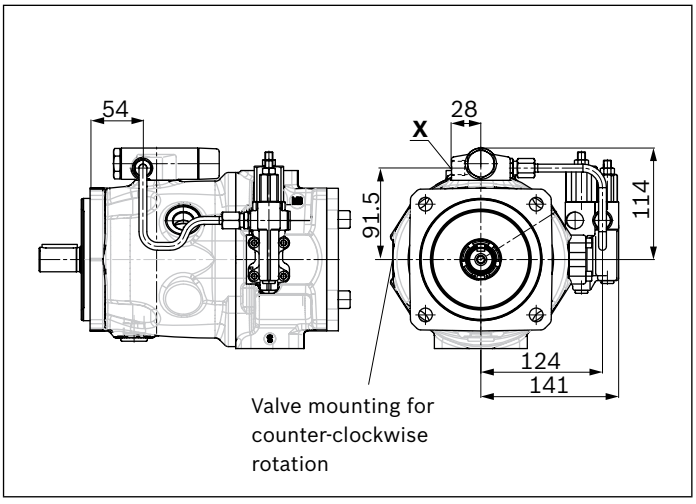
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



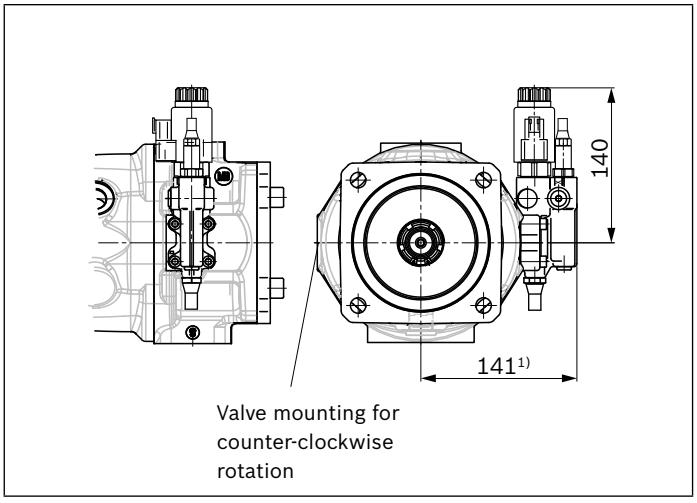
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



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

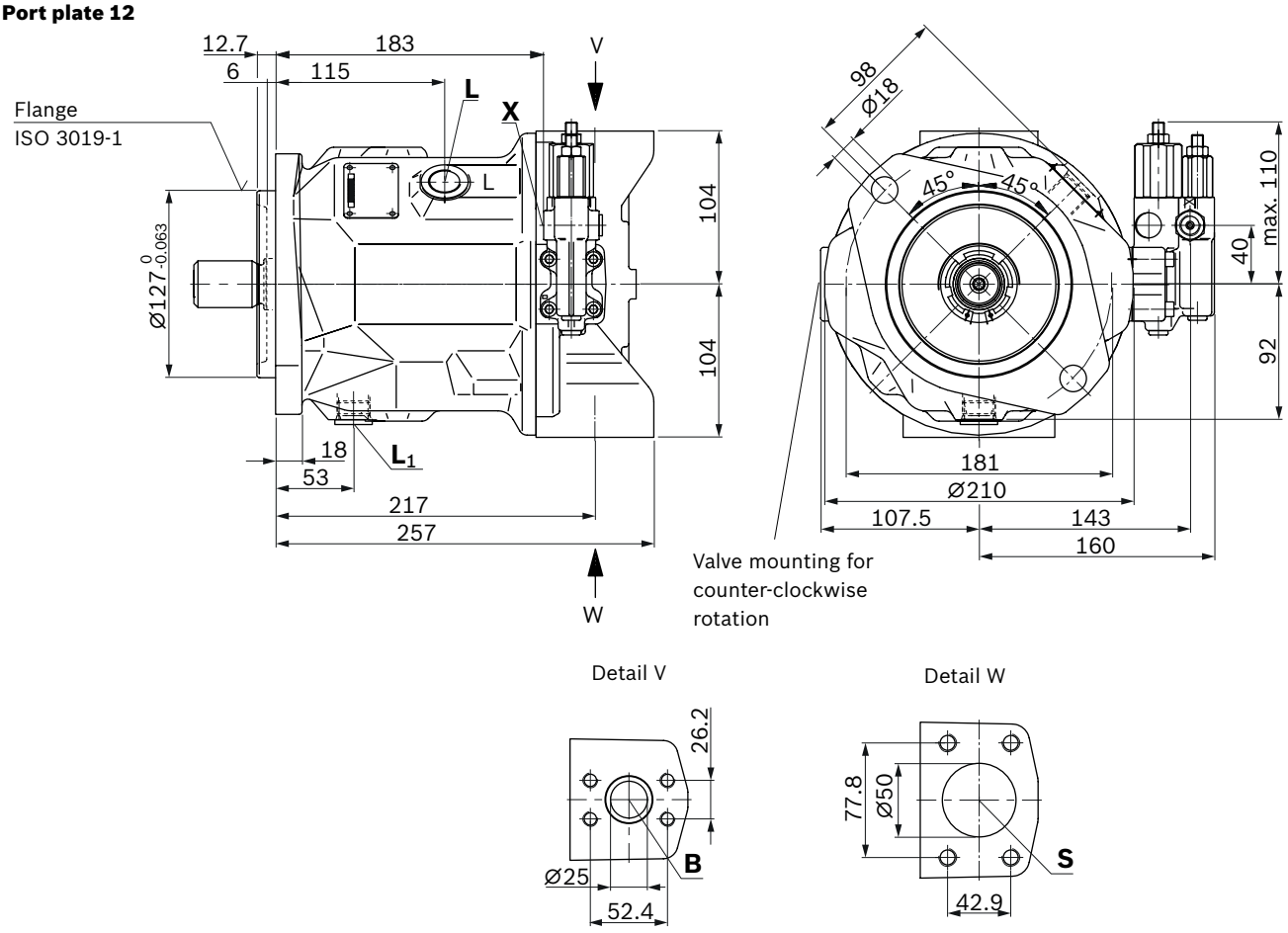


1) ER7. 176 mm if using an intermediate plate pressure controller
2) To mounting flange

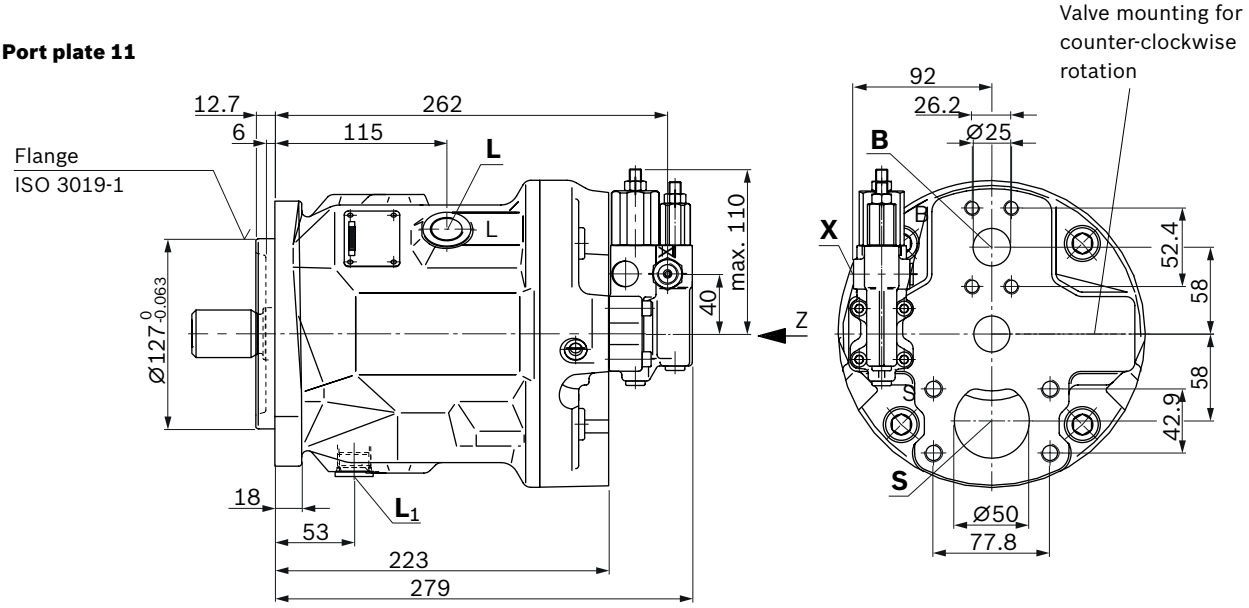
Dimensions, size 71

DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-C; 127-2)

▼ **Port plate 12**

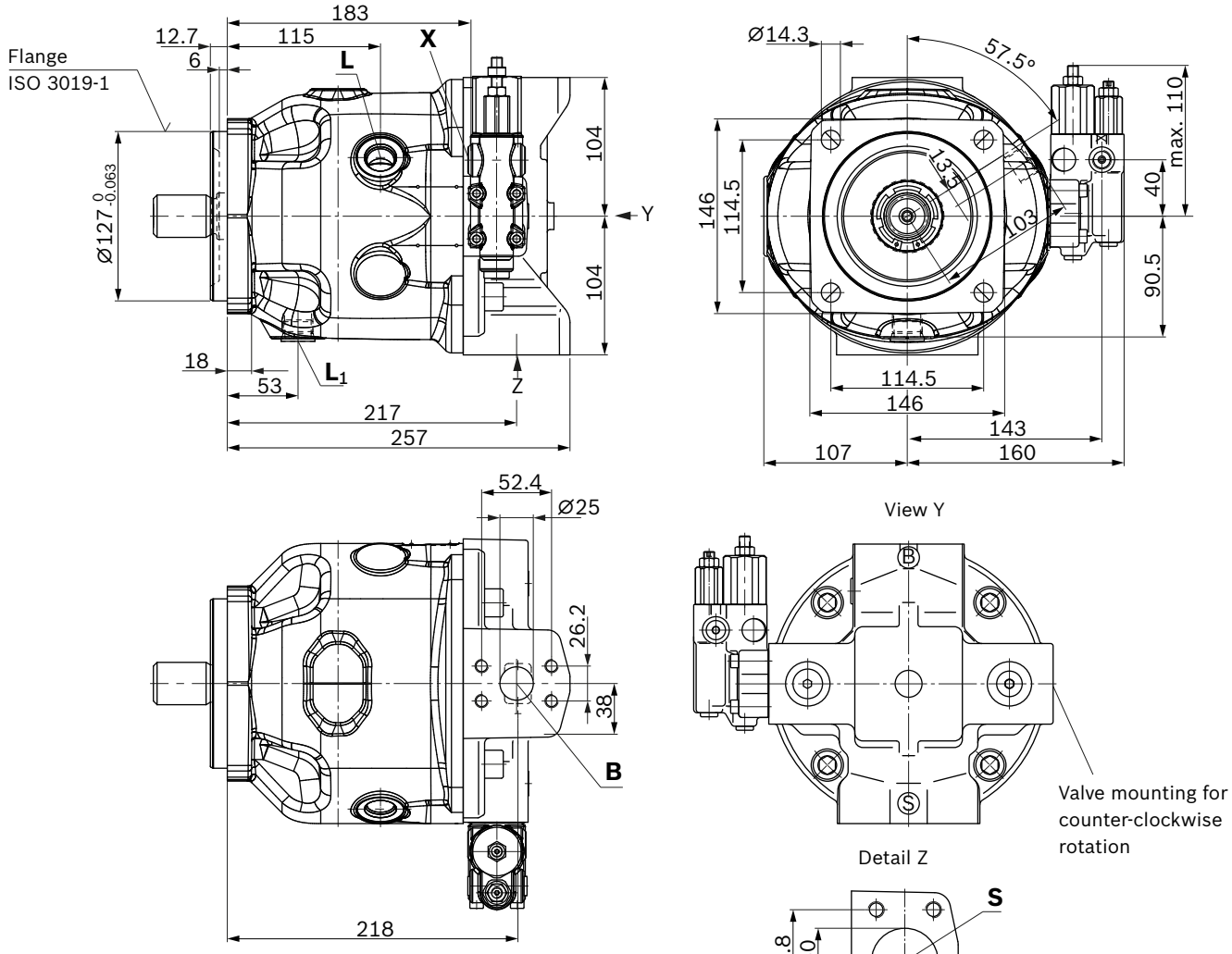


▼ **Port plate 11**

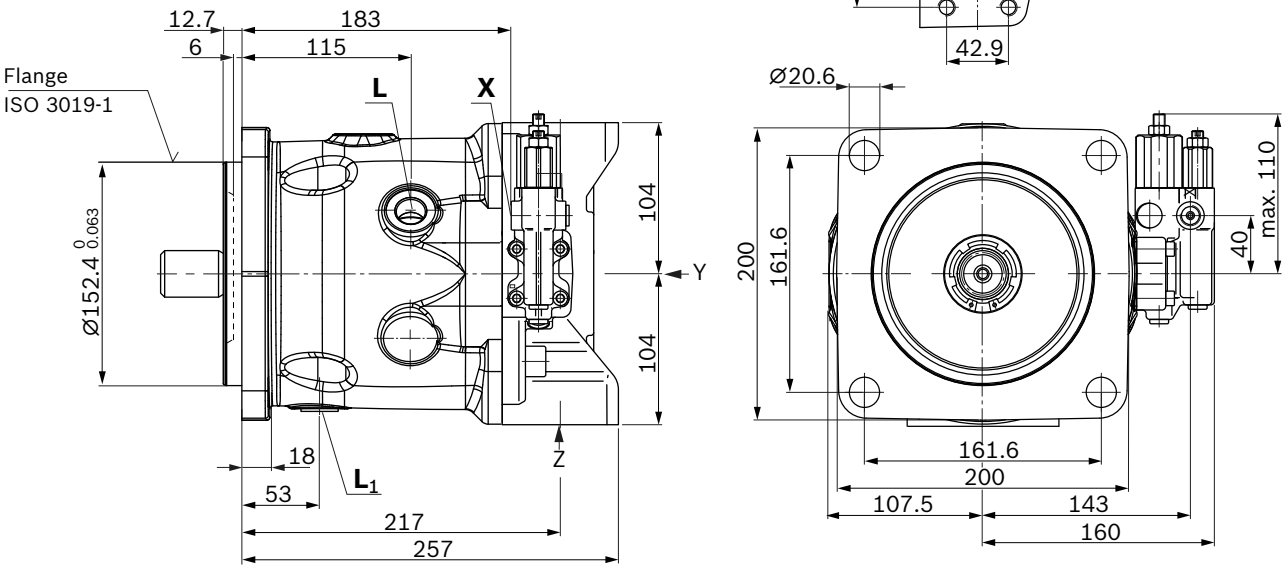


DRF, DRS, DRSC – Pressure flow controller, port plate 12; mounting flange D (SAE-C; 127-4) and U (SAE-D; 152-4)

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

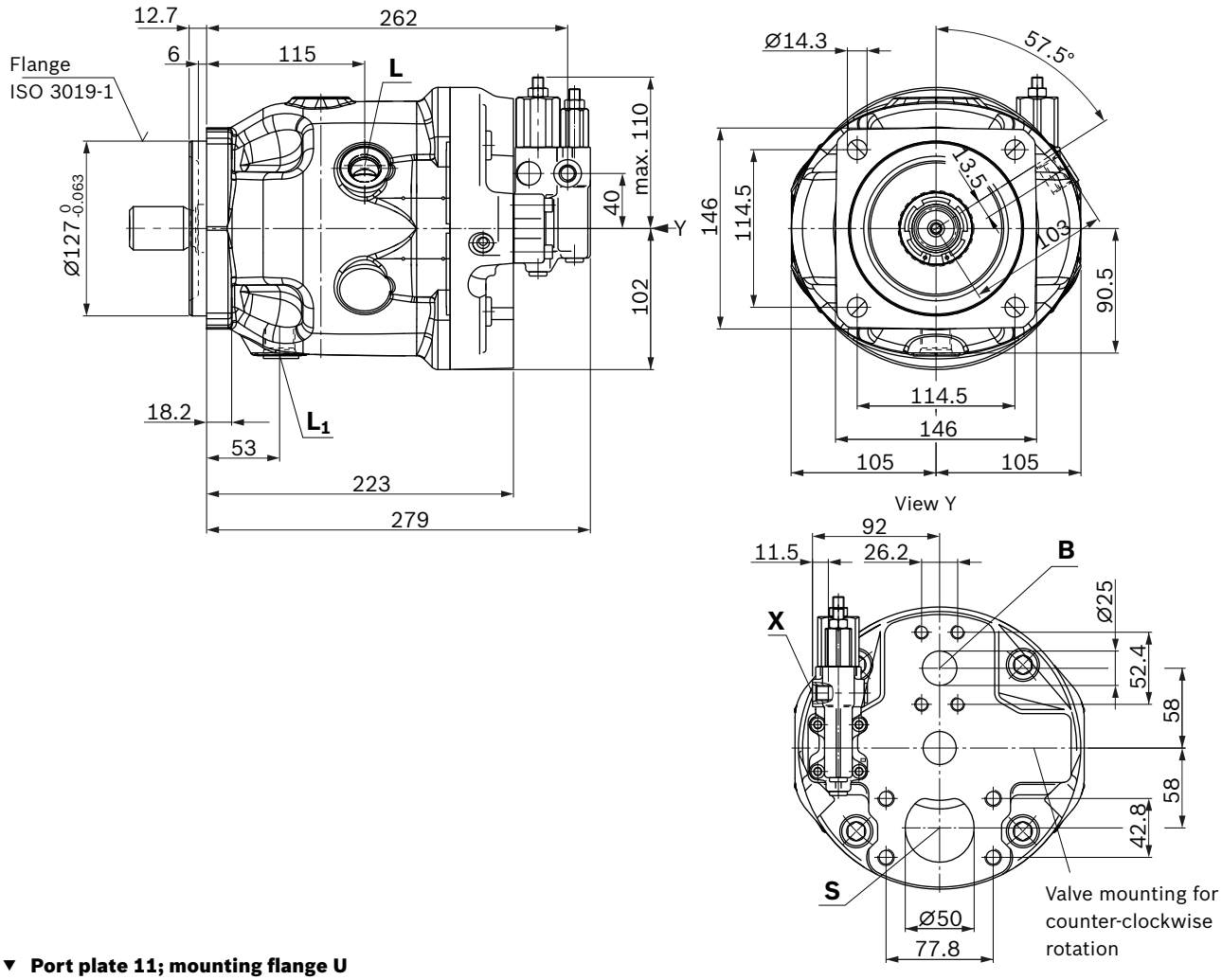


▼ **Port plate 12; mounting flange U**

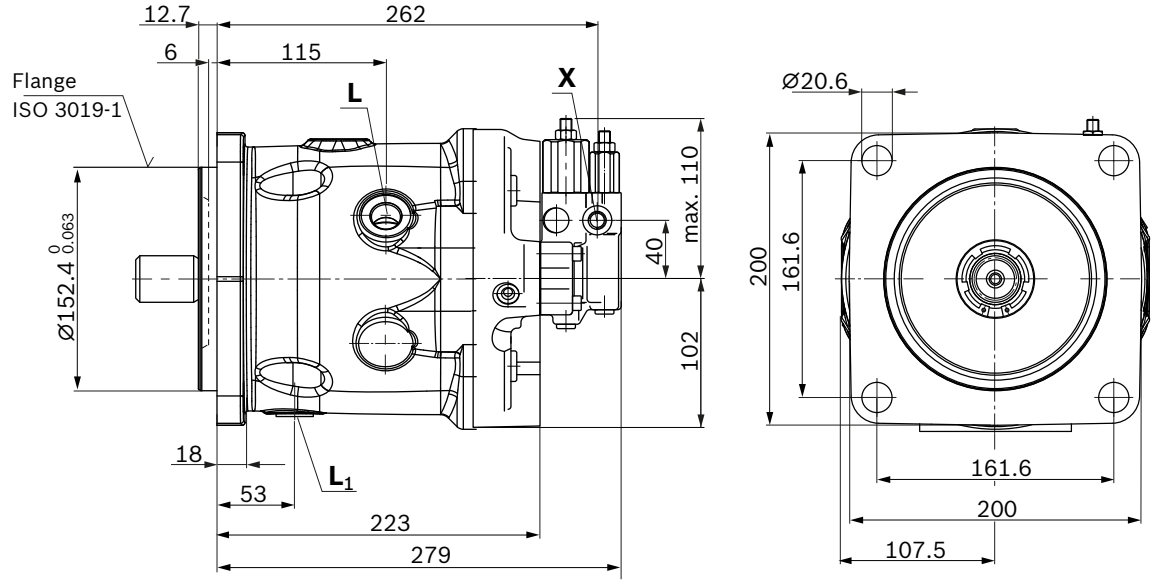


DRF, DRS, DRSC – Pressure flow controller, port plate 11; mounting flange D (SAE-C; 127-4) and U (SAE-D; 152-4)

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

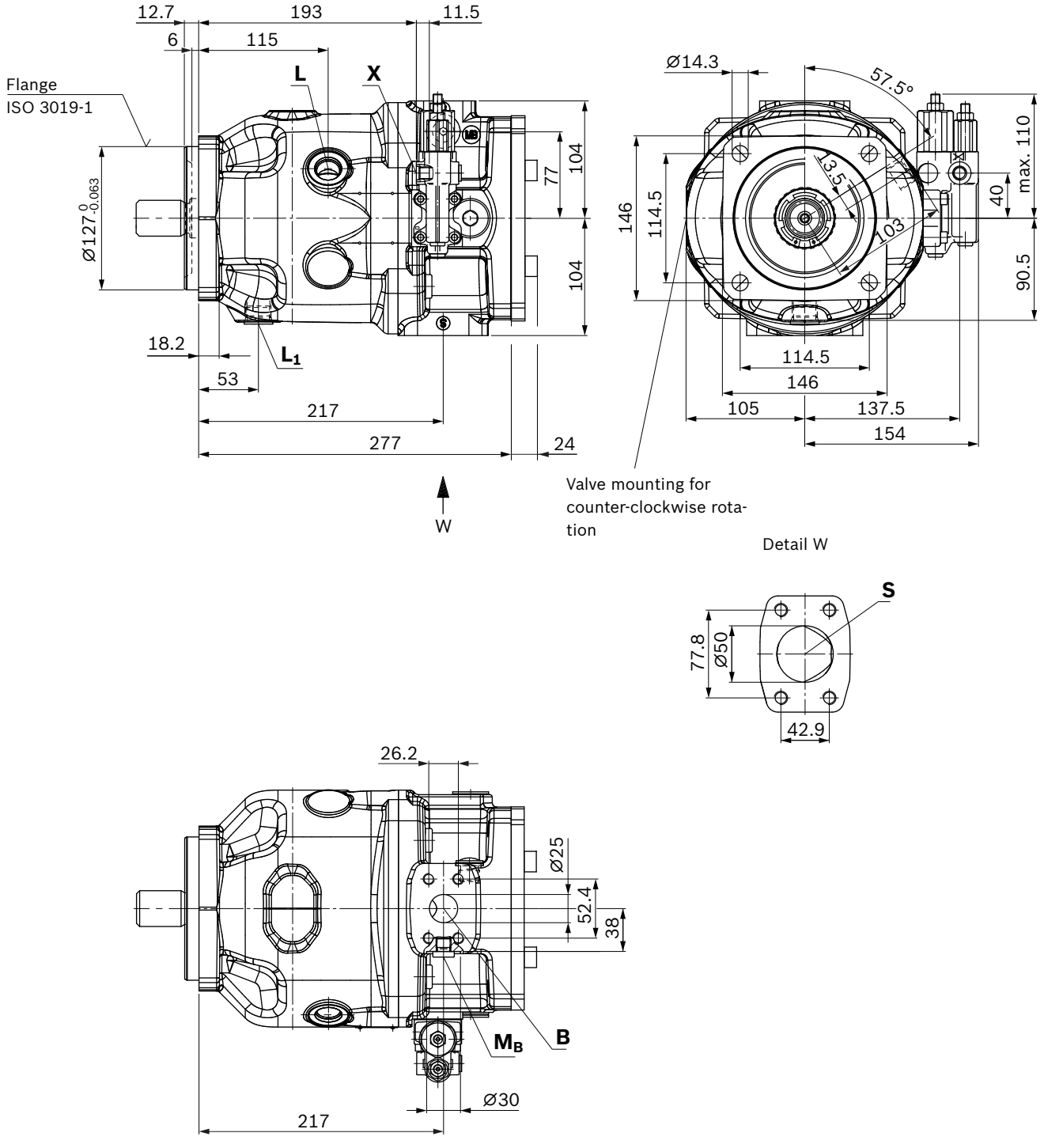


▼ **Port plate 11; mounting flange U**



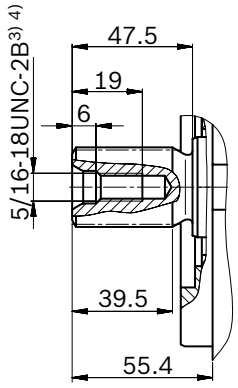
DRF, DRS, DRSC – Pressure flow controller, port plate 22 and 32; mounting flange D (SAE-C; 127-4)

▼ **Port plate 22 and 32**



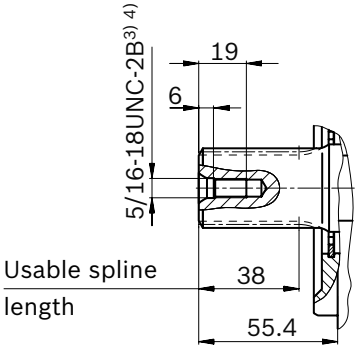
▼ **Splined shaft 1 1/4 in (SAE J744)**

S – 14T 12/24DP[1)]



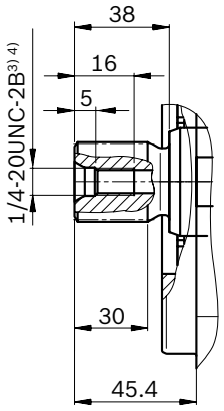
▼ **Splined shaft 1 1/4 in (SAE J744)**

R – 14T 12/24DP[1)2)]



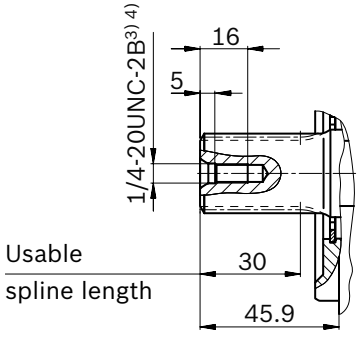
▼ **Splined shaft 1 in (SAE J744)**

U – 15T 16/32DP[1)]



▼ **Splined shaft 1 in (SAE J744)**

W – 15T 16/32DP[1)]

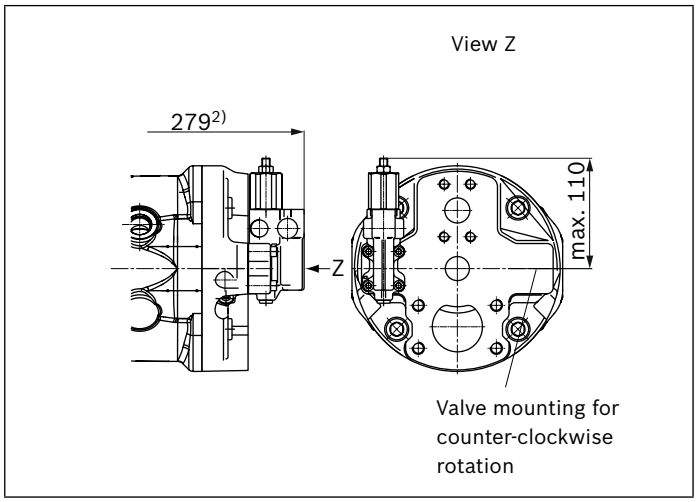


Ports		Standard	Size	$p_{max\ abs}$ [bar][4)]	State[8)]
B	Working port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	2 in M12 x 1.75; 20 deep	10	O
L	Drain port	ISO 11926[6)]	7/8-14 UNF-2B; 17 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	7/8-14 UNF-2B; 17 deep	2	X[7)]
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 12 deep	350	O
M_B	Measuring pressure **B** (only with port plates 22 and 32)	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

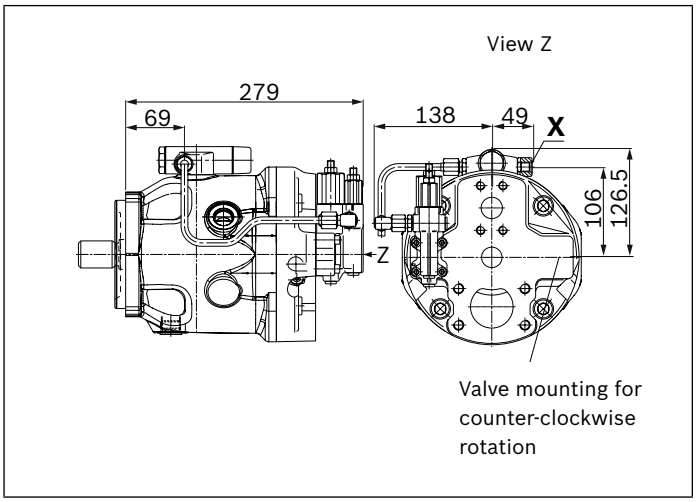
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur.
   Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page64).
8) O = Must be connected (comes plugged)
   X = Plugged (in normal operation)

Port plate 11

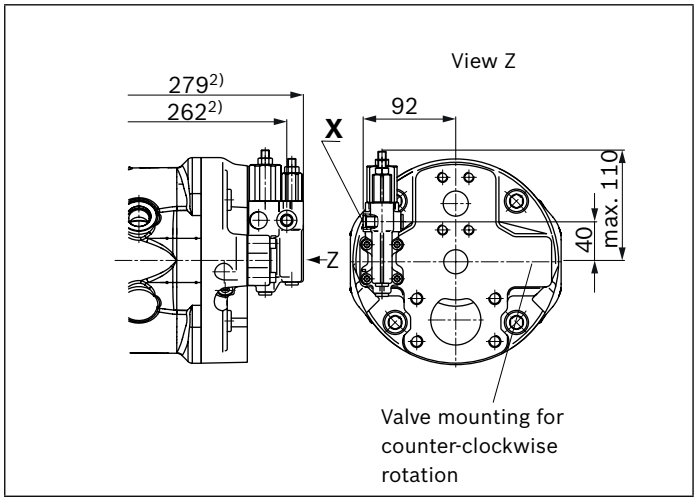
▼ **DR – Pressure controller; mounting flange D**



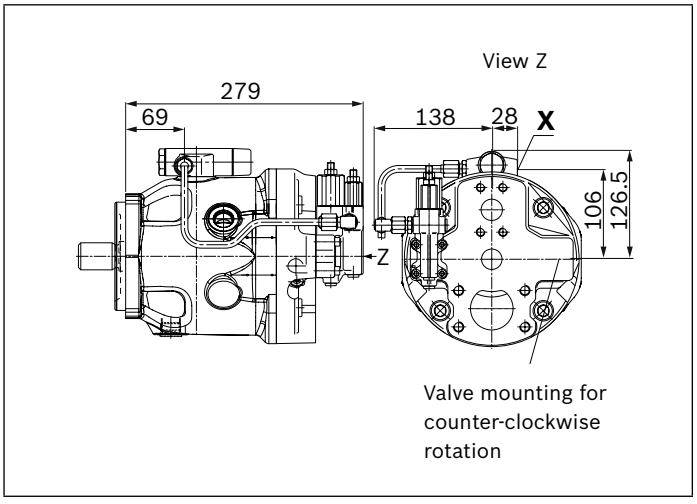
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



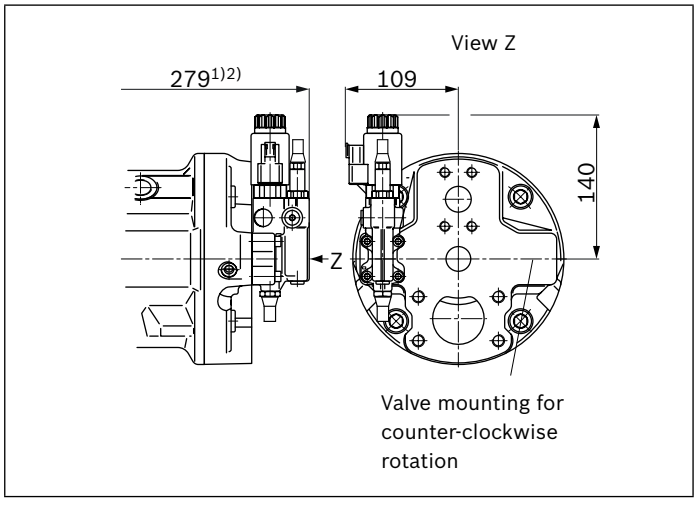
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



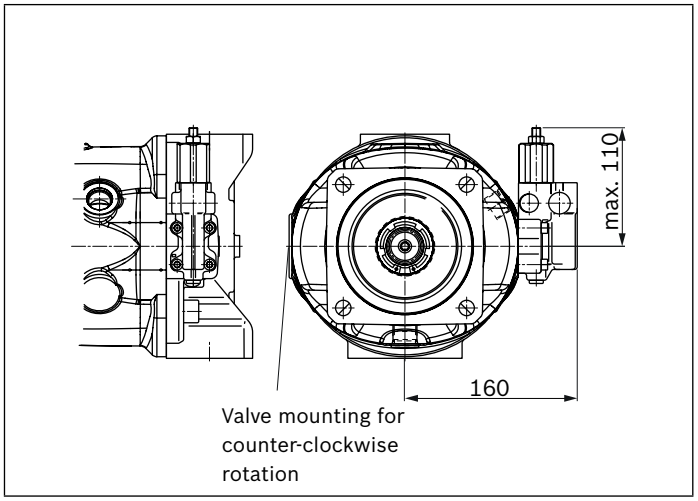
▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



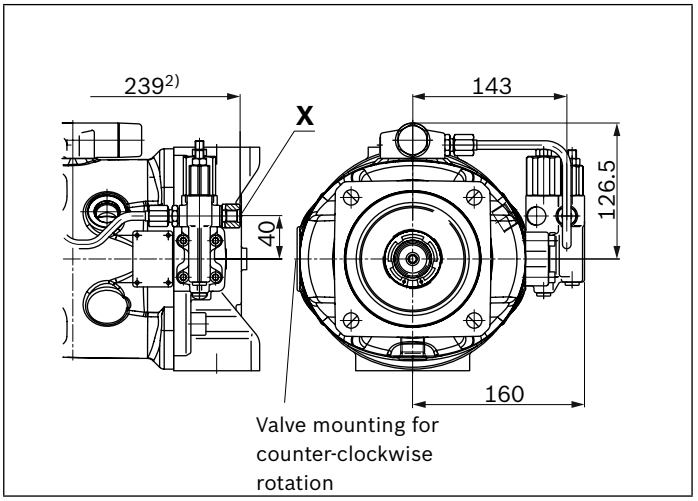
1) ER7. 314 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 12

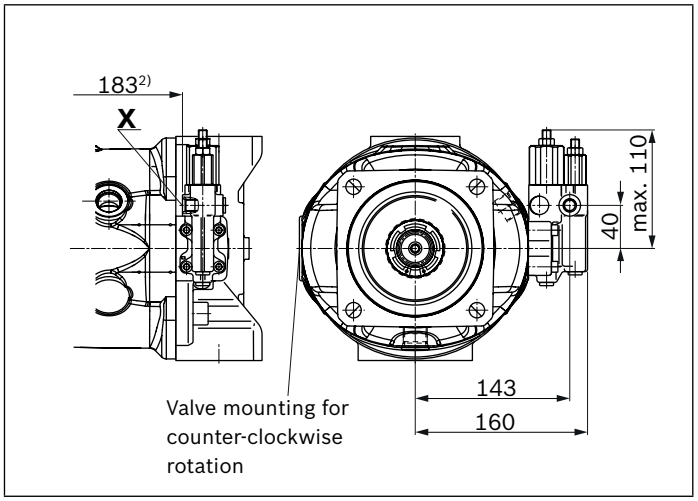
▼ **DR – Pressure controller; mounting flange D**



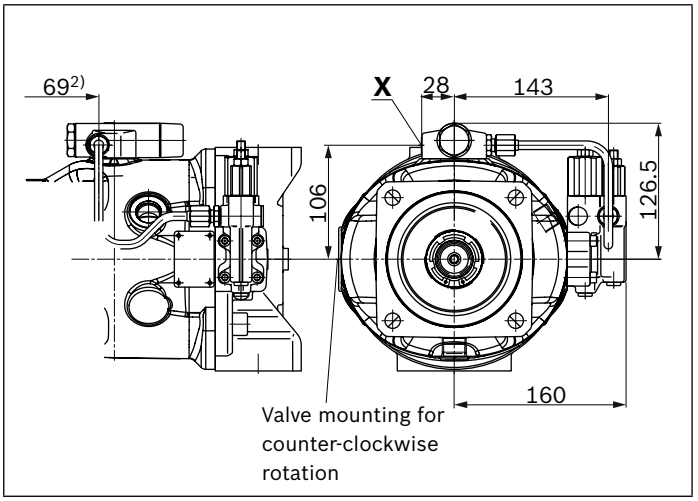
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



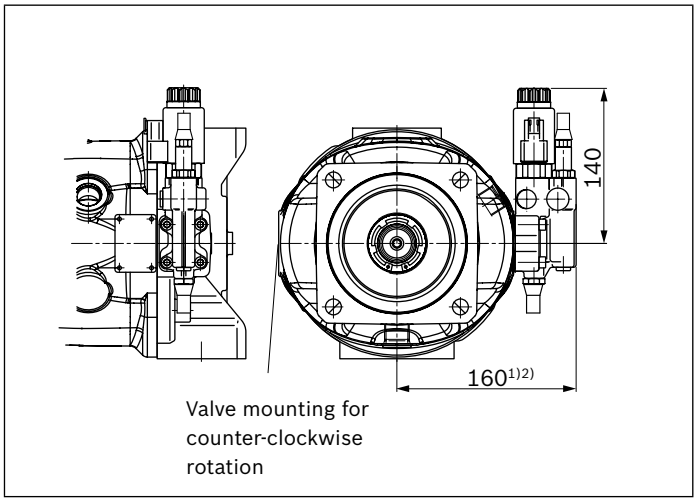
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



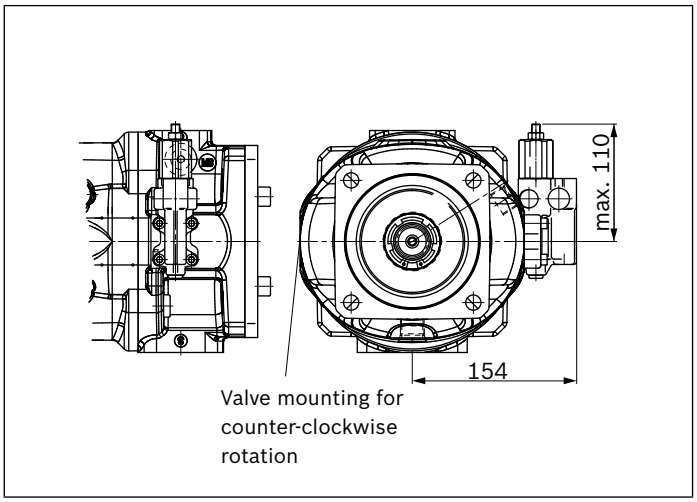
▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



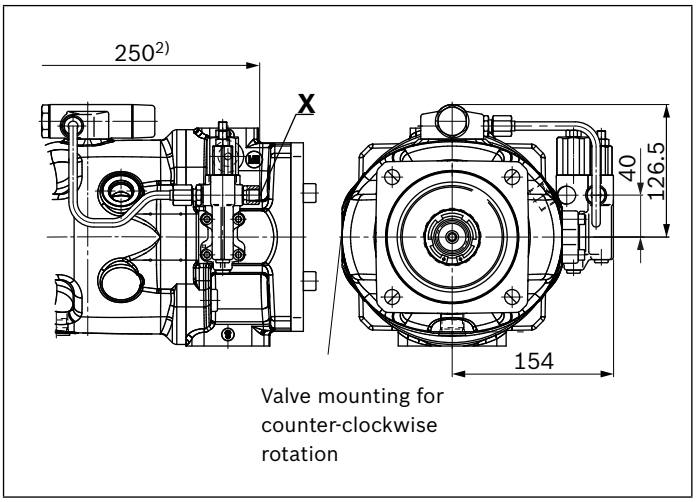
1) ER7. 195 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 22 and 32

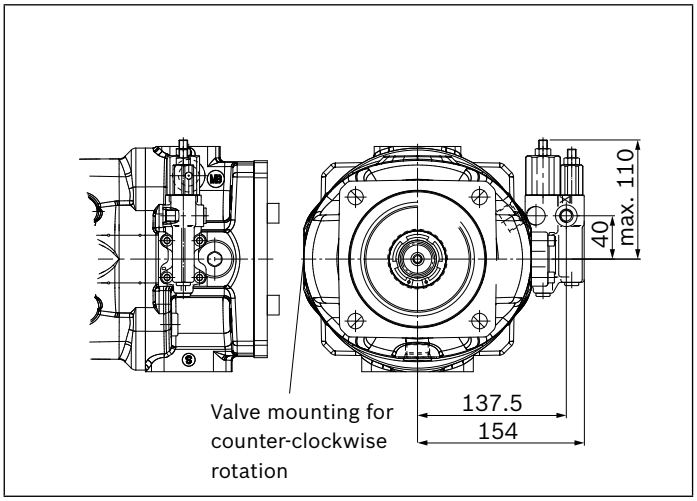
▼ **DR – Pressure controller; mounting flange D**



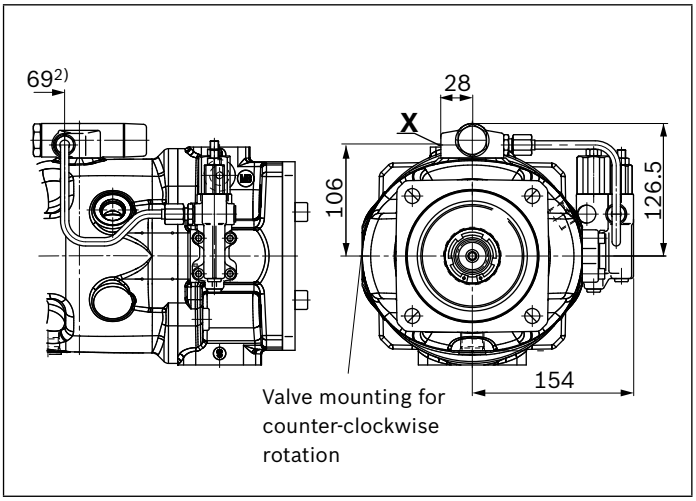
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



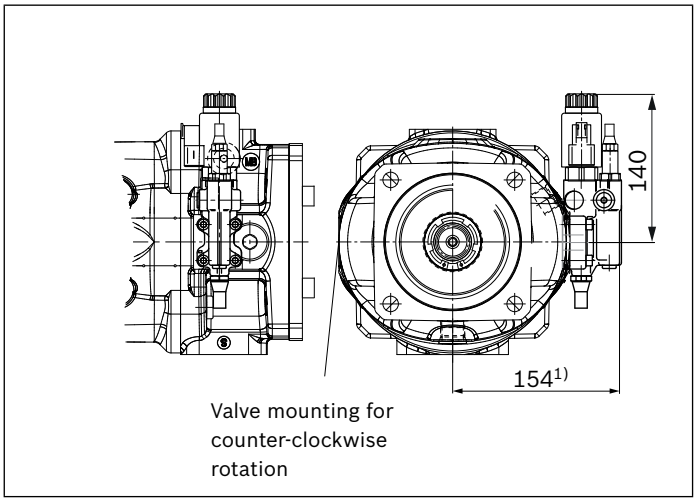
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



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

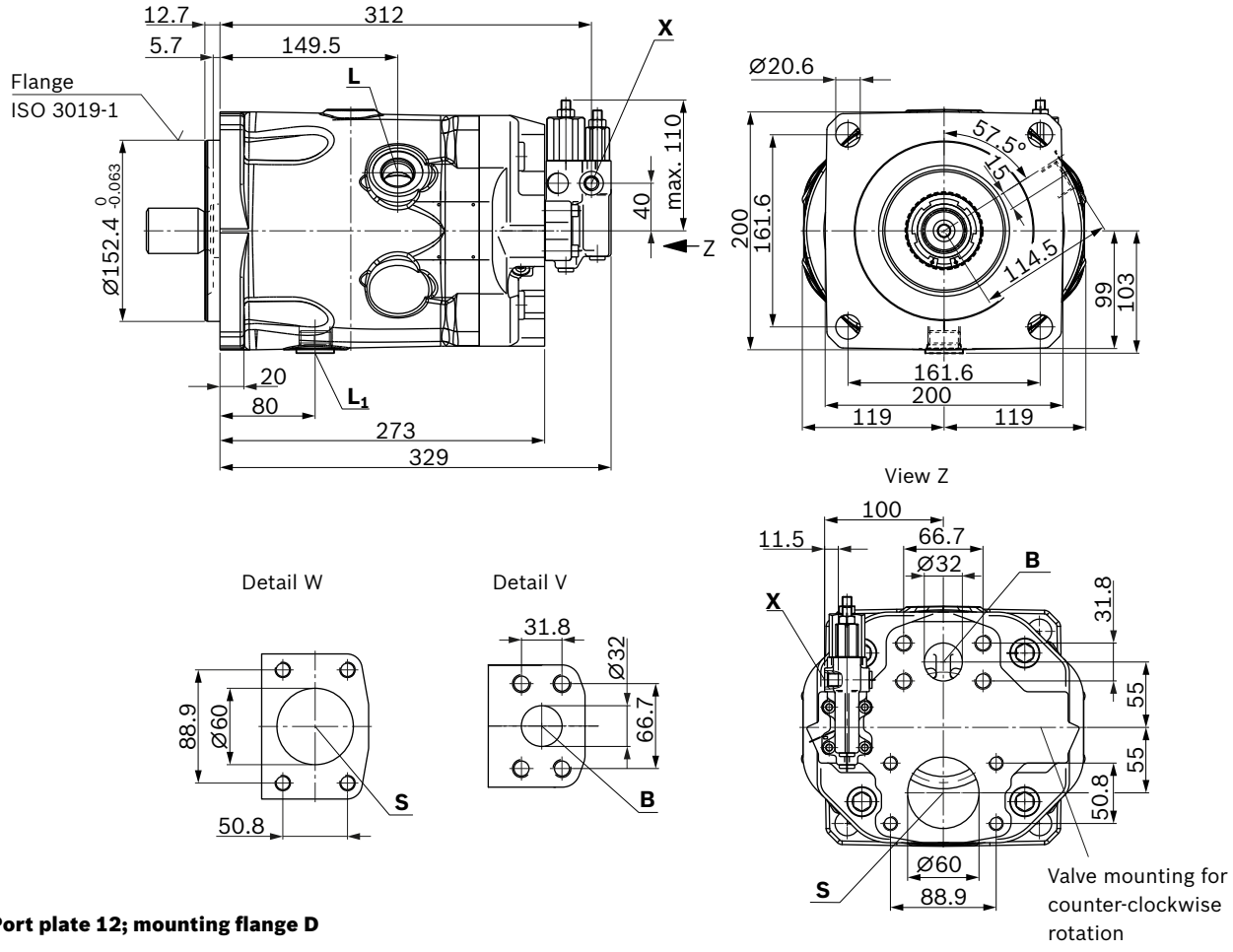


1) ER7. 189 mm if using an intermediate plate pressure controller
2) To mounting flange

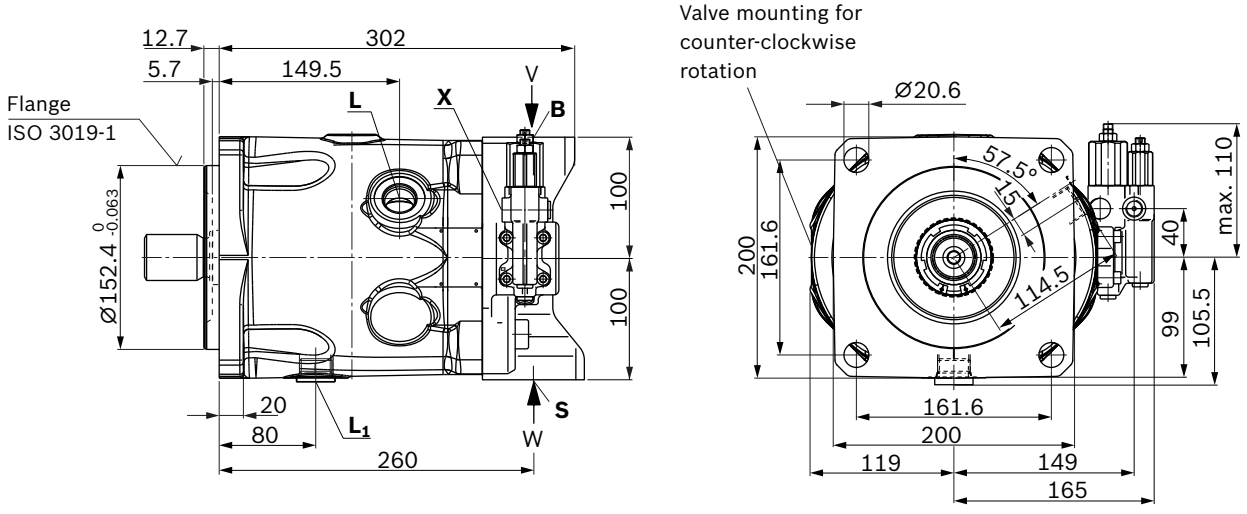
Dimensions, size 100

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

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



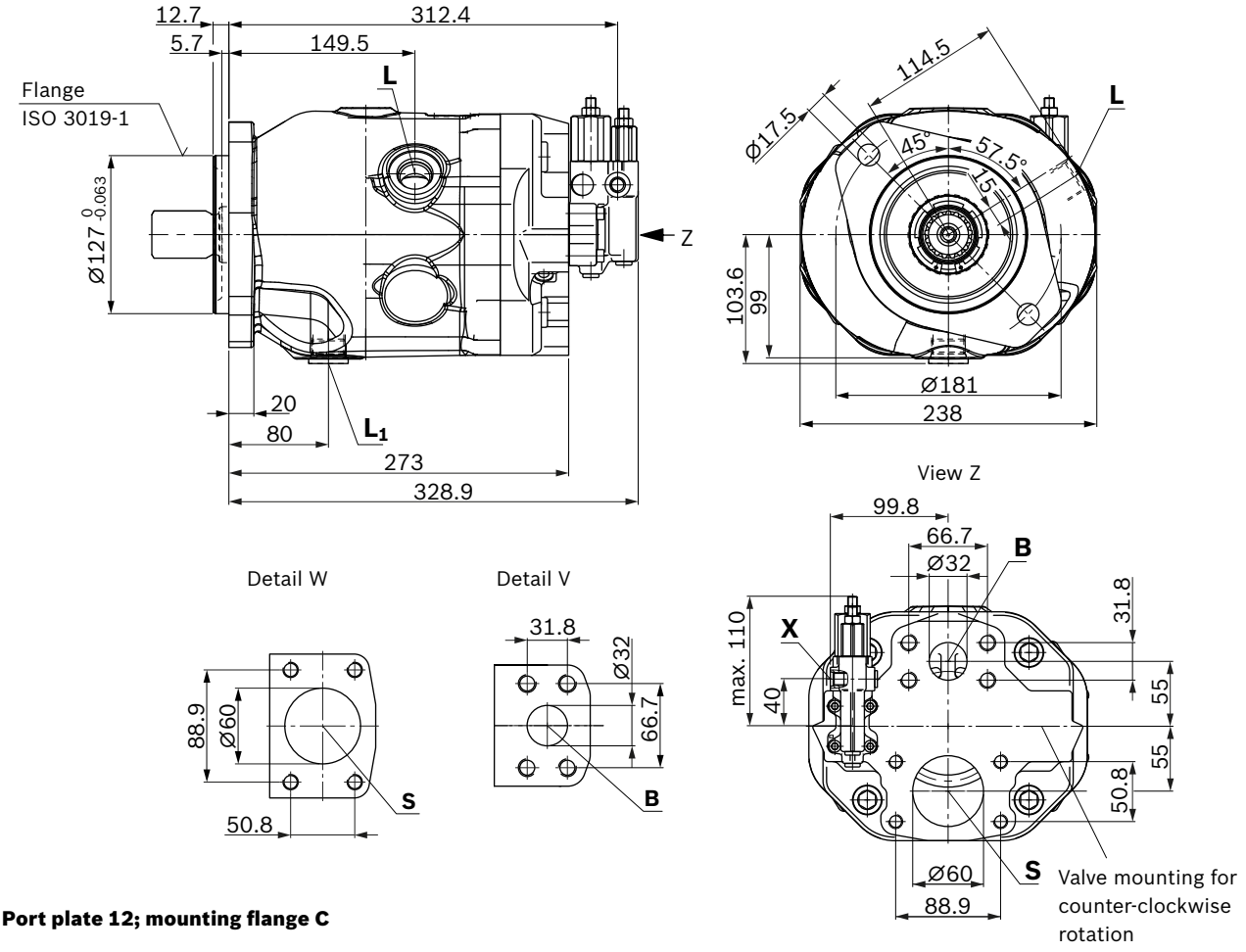
▼ **Port plate 12; mounting flange D**



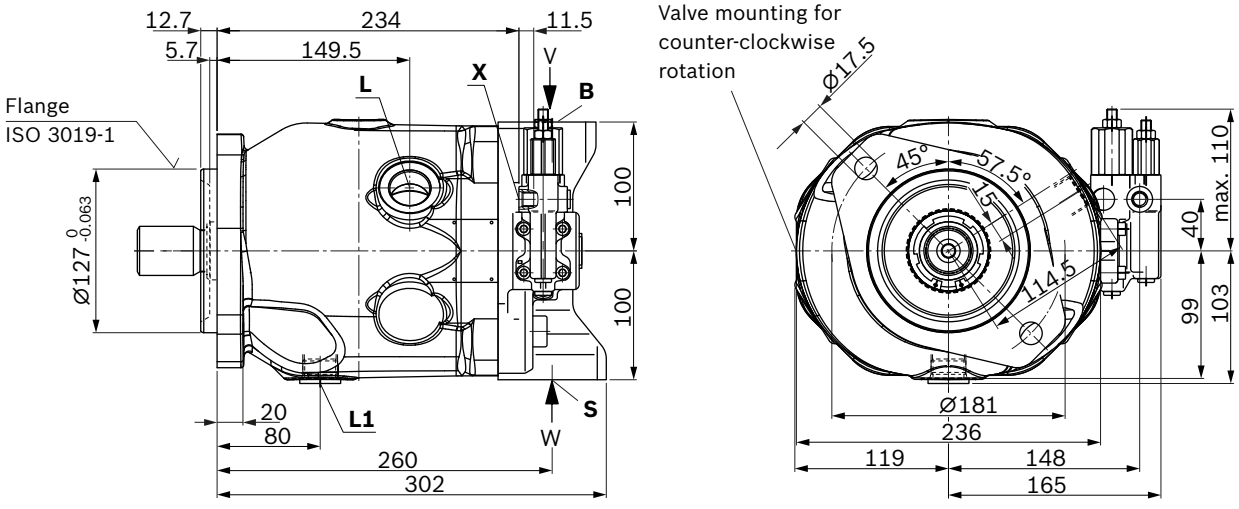
Dimensions, size 100

DRF, DRS, DRSC – Pressure flow controller, port plate 11, 12; mounting flange C (SAE-C; 127-2)

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

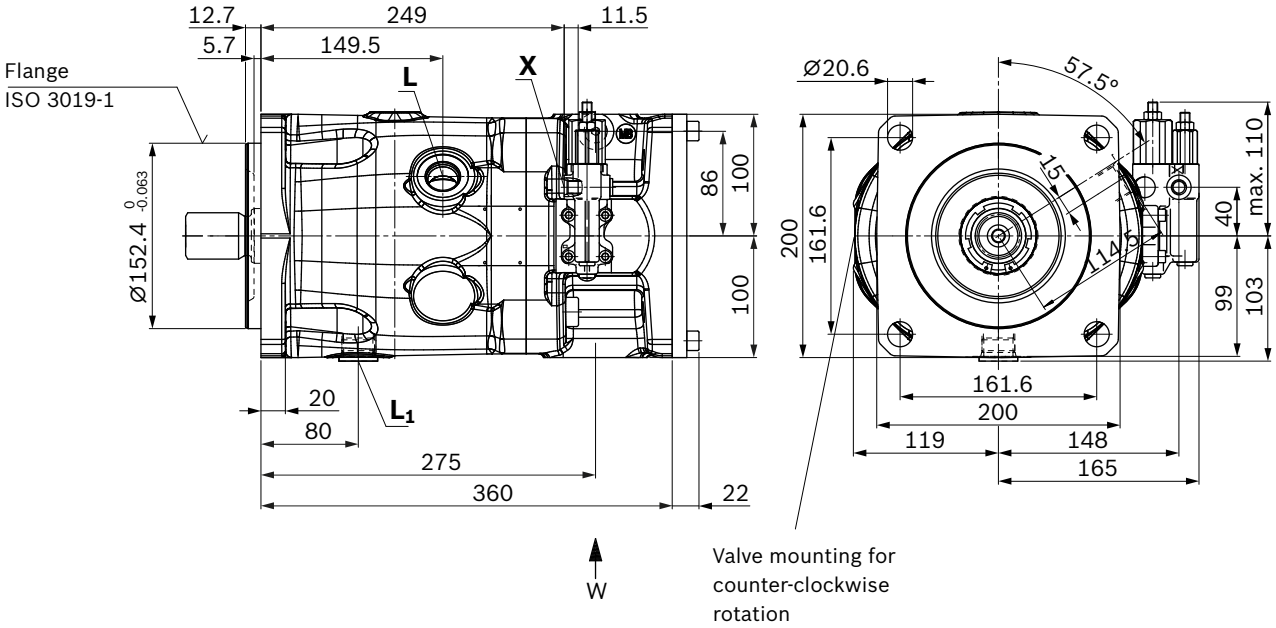


▼ **Port plate 12; mounting flange C**

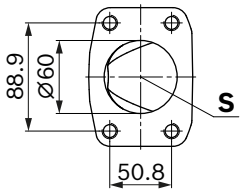


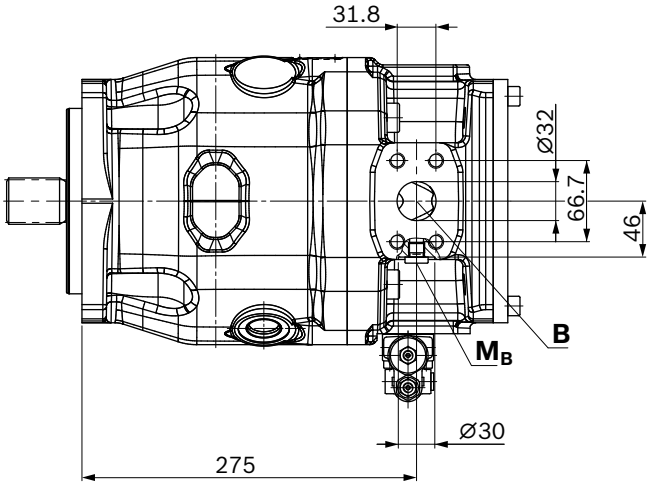
DRF, DRS, DRSC – Pressure flow controller, port plate 22; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22**



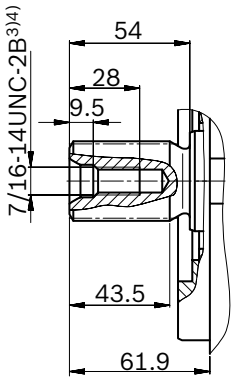
Detail W





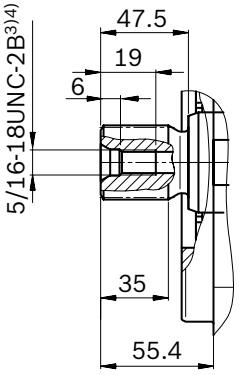
▼ **Splined shaft 1 1/2 in (SAE J744)**

S – 17T 12/24DP[1)]



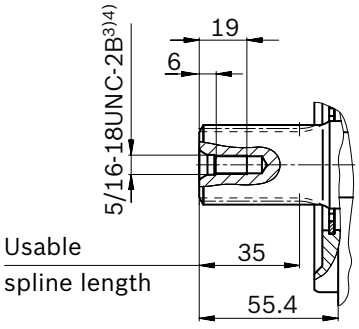
▼ **Splined shaft 1 1/4 in (SAE J744)**

U – 14T 12/24DP[1)]



▼ **Splined shaft 1 1/4 in (SAE J744)**

W – 14T 12/24DP[1)2)]

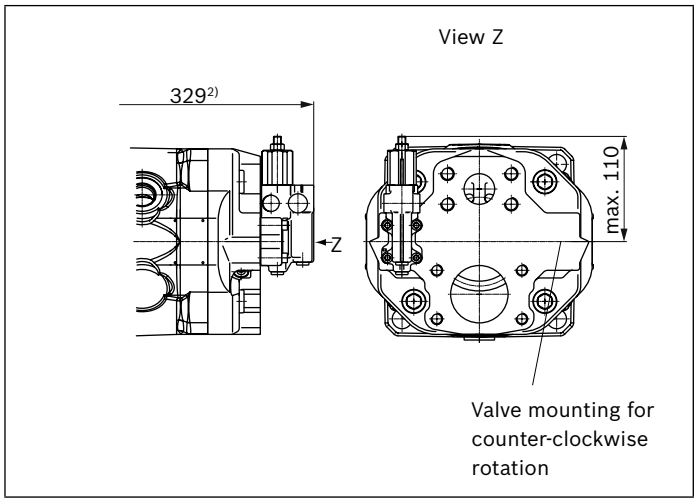


Ports		Standard	Size	$p_{max\ abs}$ [bar][4)]	State[8)]
B	Working port (high-pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	ISO 11926[6)]	1 1/16-12 UNF-2B; 20 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	1 1/16-12 UNF-2B; 20 deep	2	X[7)]
X	Pilot pressure	ISO 11926	7/16-20 UNF; 12 deep	350	O
M_B	Measuring pressure **B** (only with port plates 22 and 32)	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

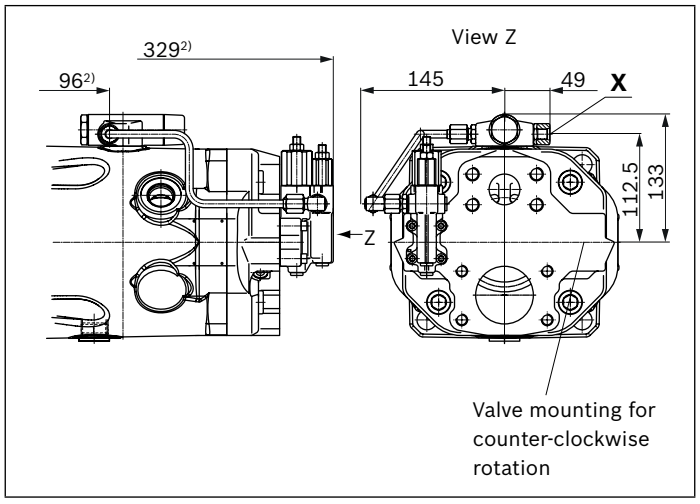
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 64).
8) O = Must be connected (comes plugged)
X = Plugged (in normal operation)

Port plate 11

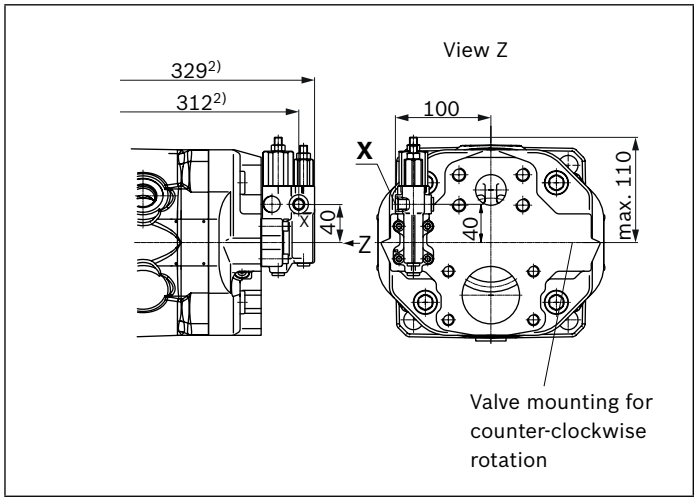
▼ **DR – Pressure controller; mounting flange D**



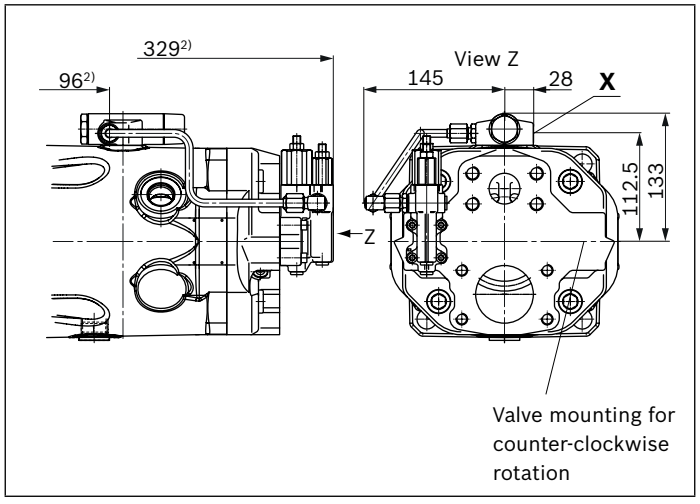
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



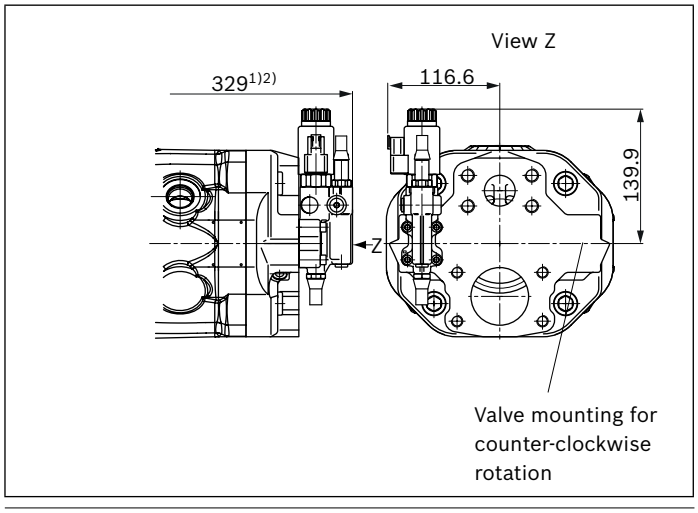
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



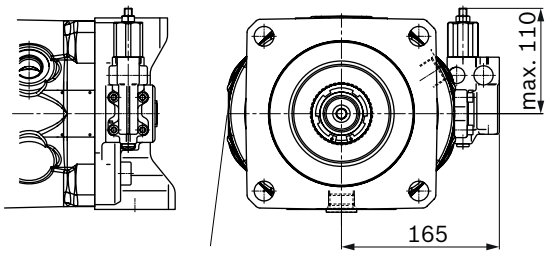
▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



1) ER7. 364 mm if using an intermediate plate pressure controller
2) To mounting flange

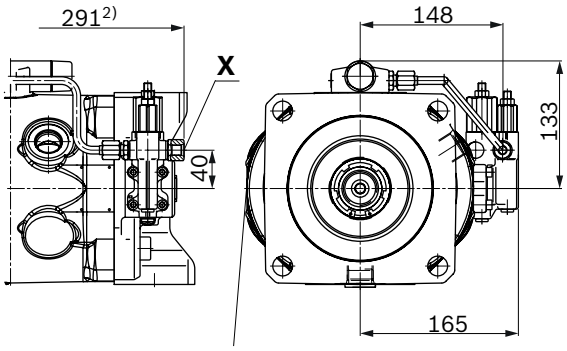
Port plate 12

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



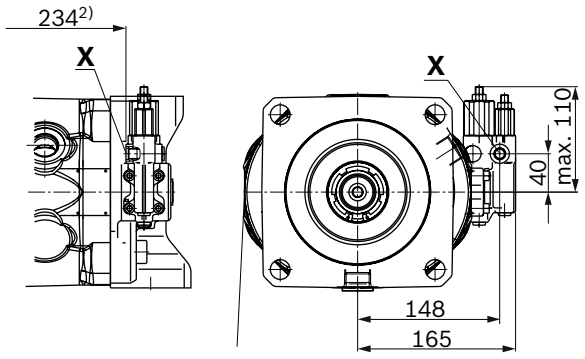
Valve mounting for counter-clockwise rotation

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



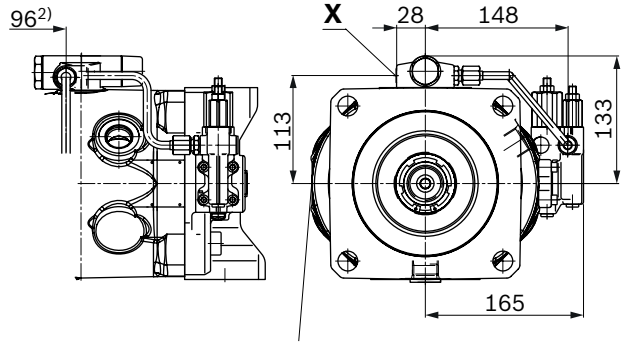
Valve mounting for counter-clockwise rotation

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



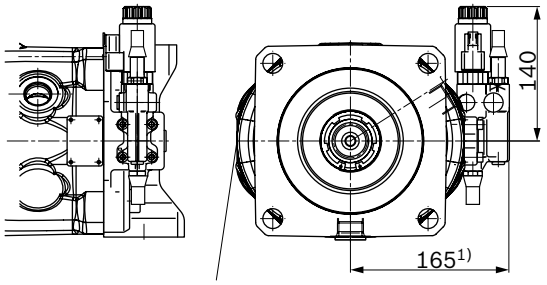
Valve mounting for counter-clockwise rotation

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



Valve mounting for counter-clockwise rotation

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

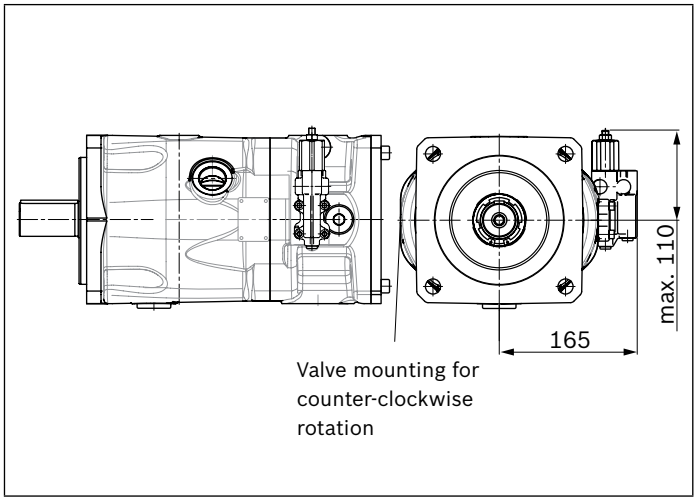


Valve mounting for counter-clockwise rotation

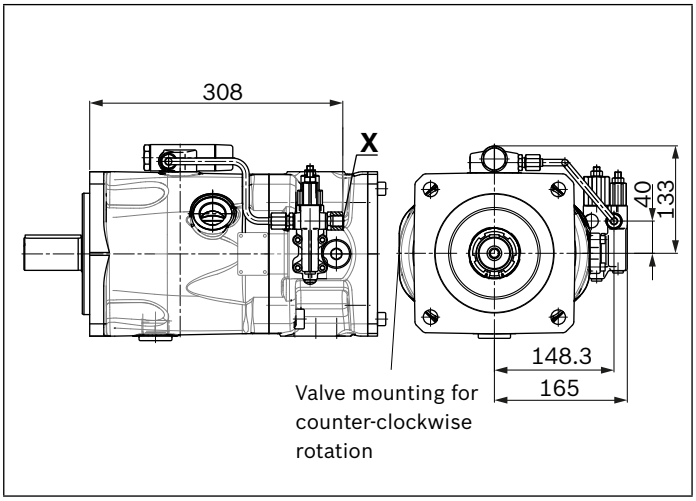
1) ER7. 200 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 22

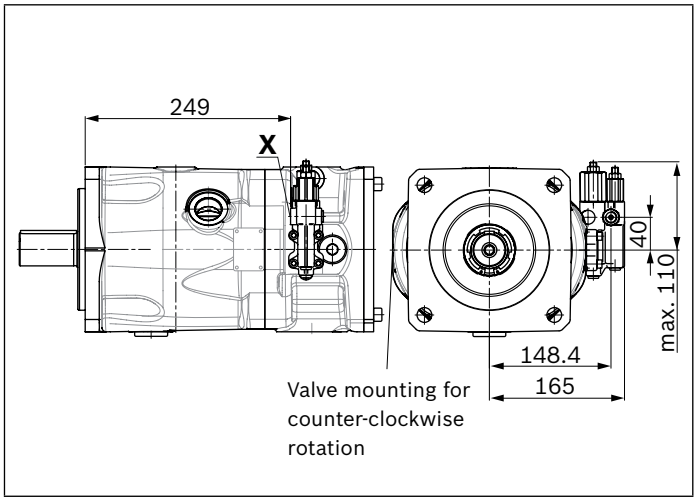
▼ **DR – Pressure controller; mounting flange D**



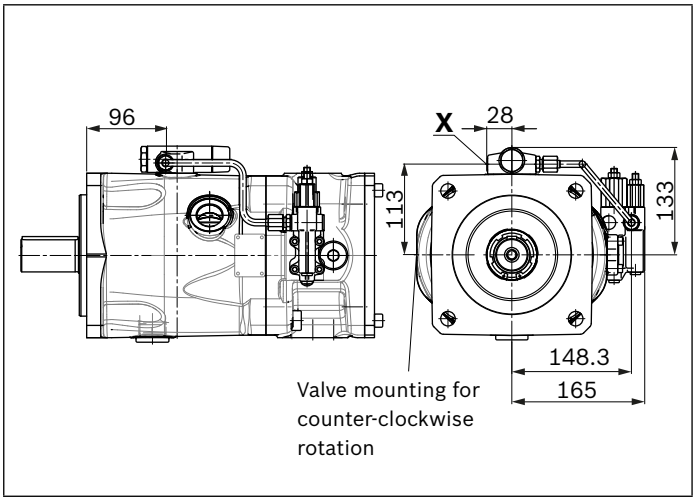
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



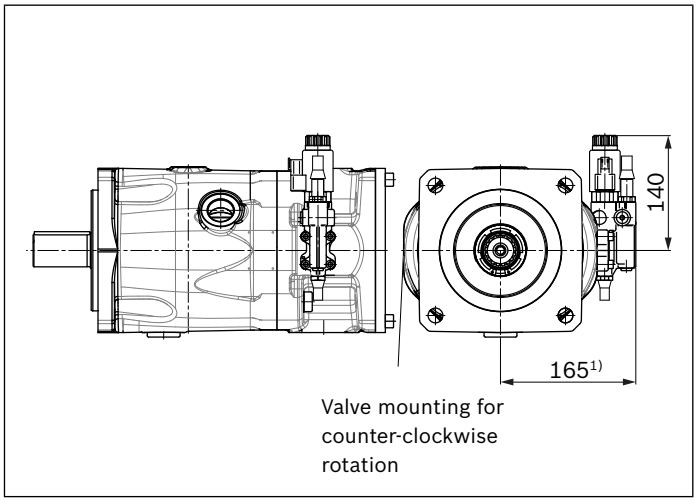
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



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

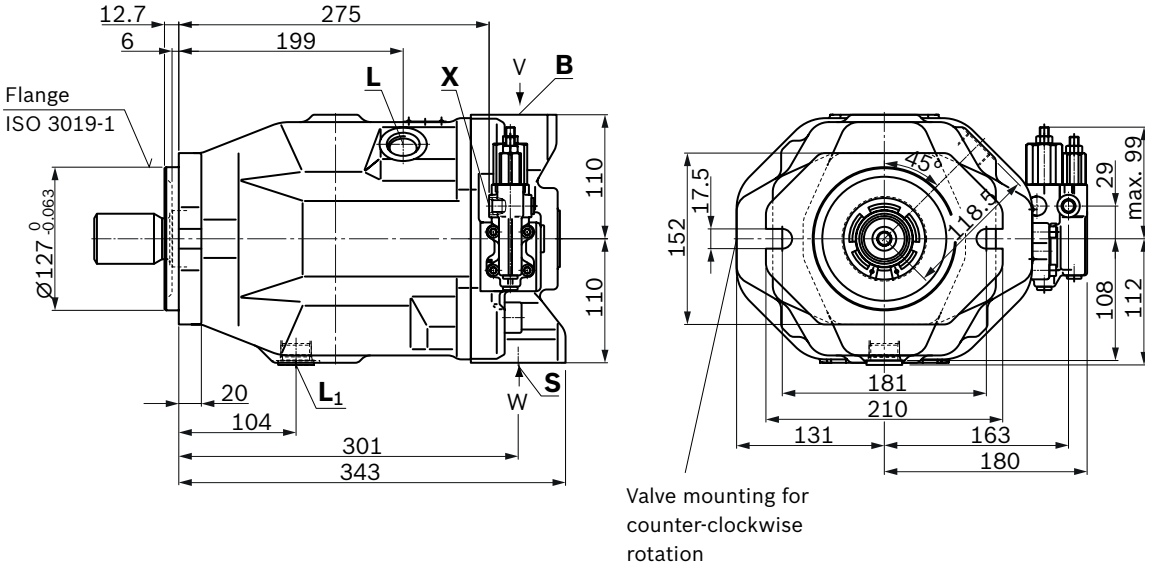


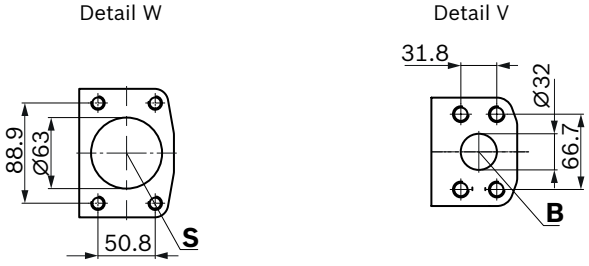
1) ER7. 200 mm if using an intermediate plate pressure controller
2) To mounting flange

Dimensions, size 140

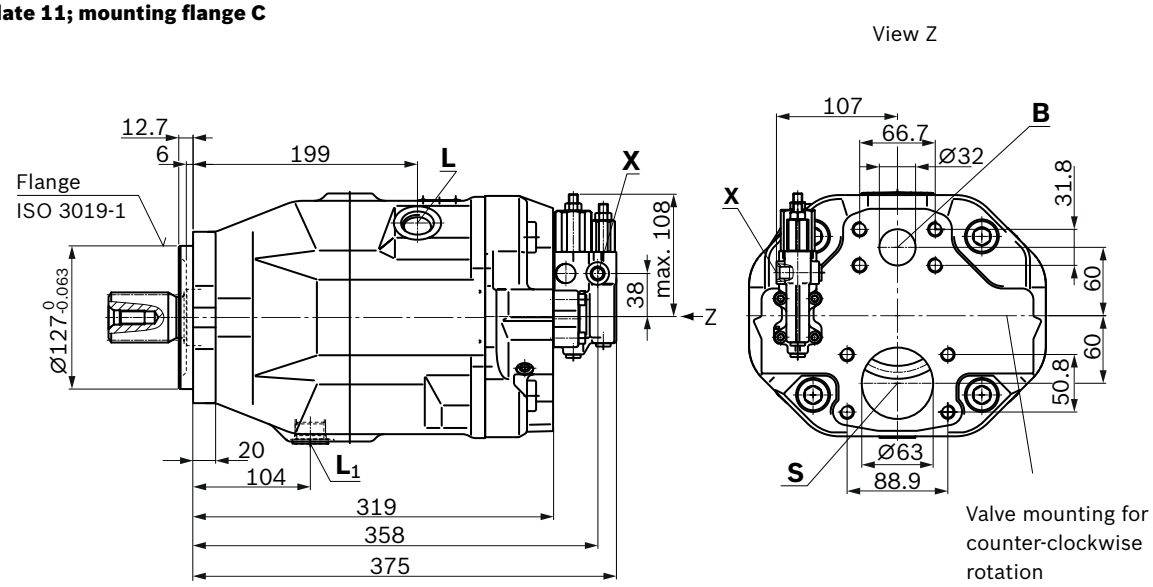
DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-C; 127-2)

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



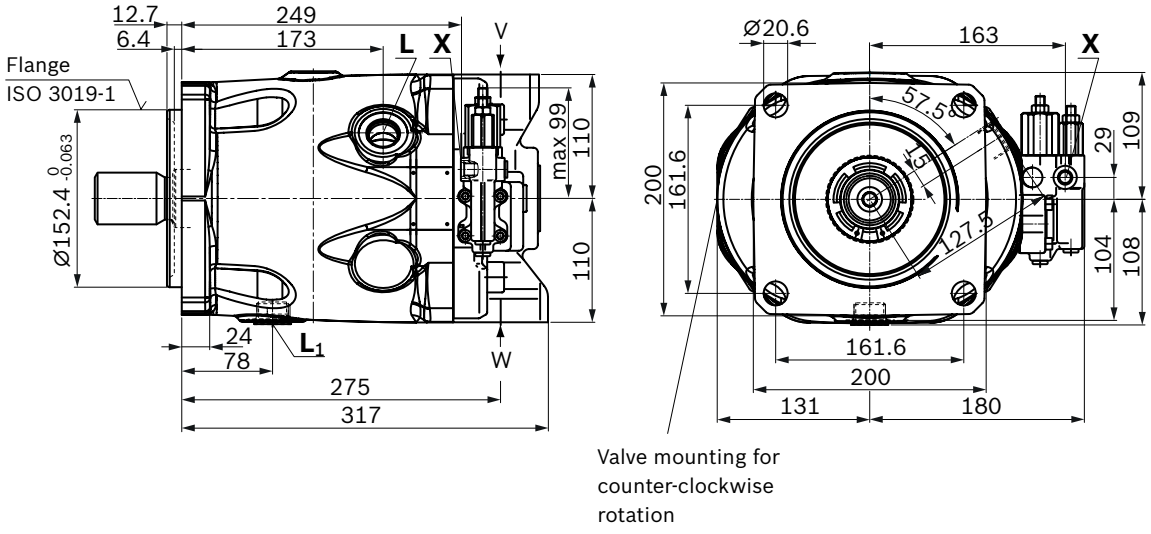


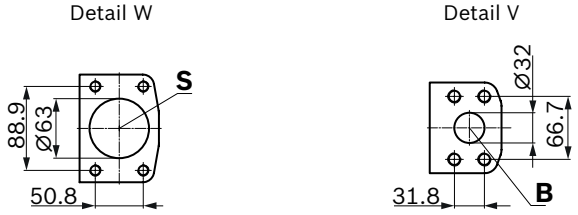
▼ **Port plate 11; mounting flange C**



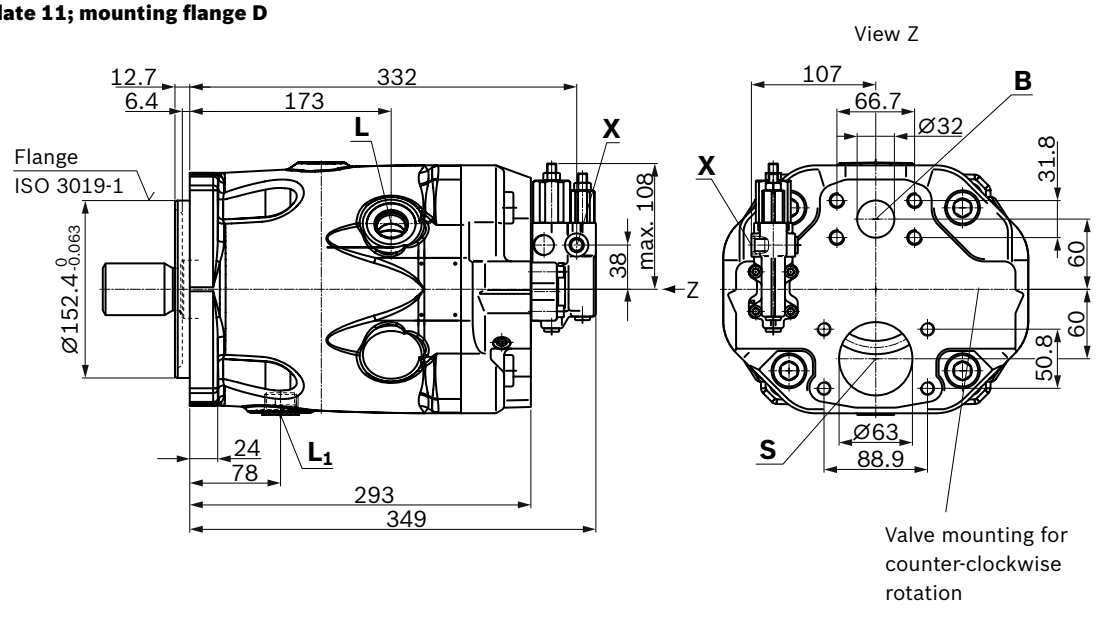
DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange D (SAE-D; 152-4)

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



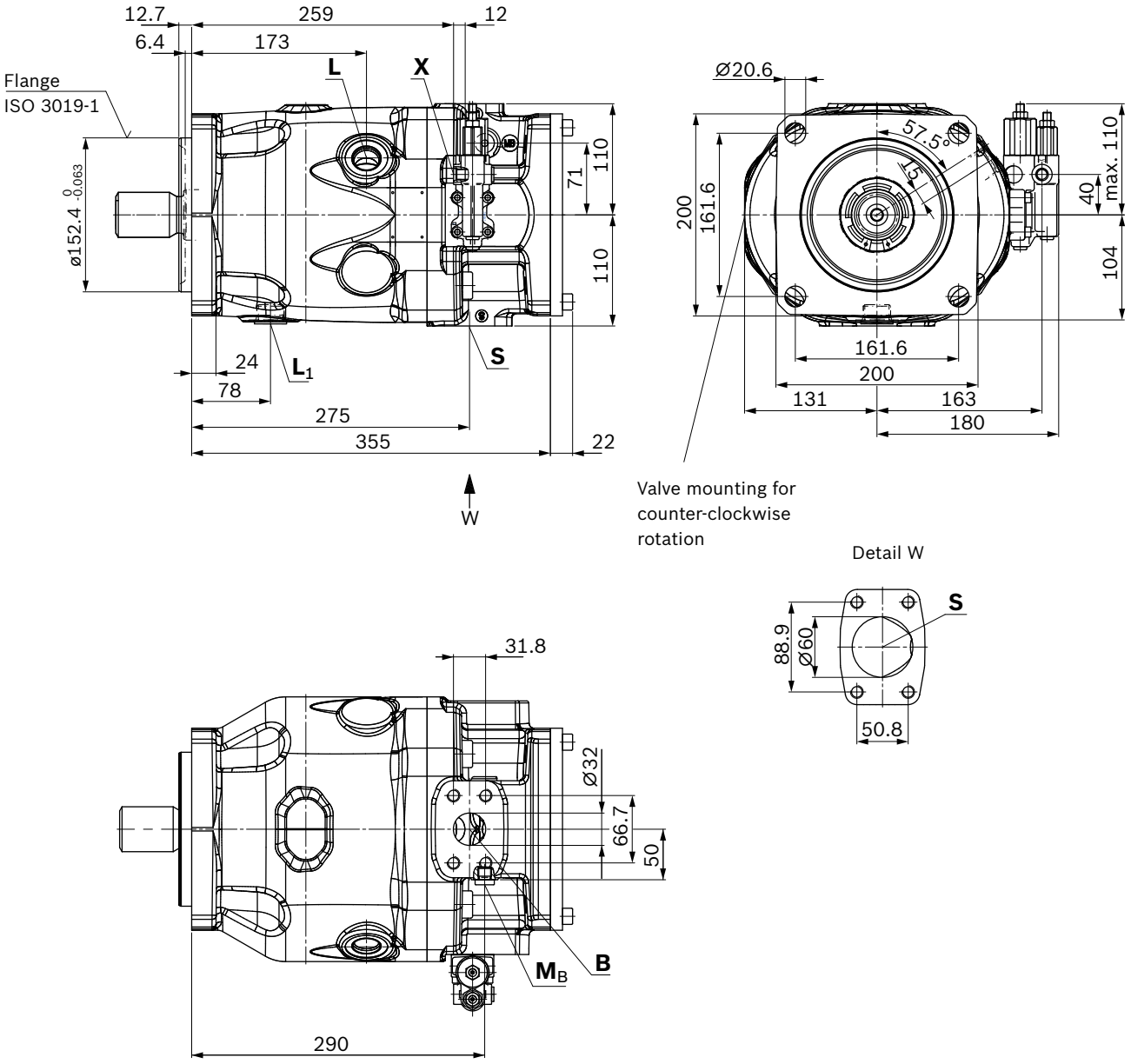


▼ **Port plate 11; mounting flange D**



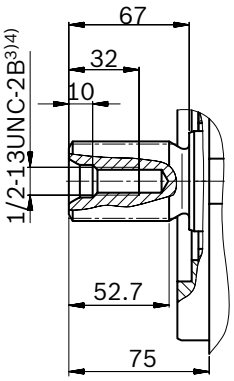
DRF, DRS, DRSC – Pressure flow controller, port plate 22; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22; mounting flange D**



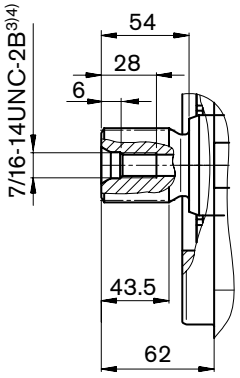
▼ **Splined shaft 1 3/4 in SAE J744**

S – 13T 8/16DP[1)]



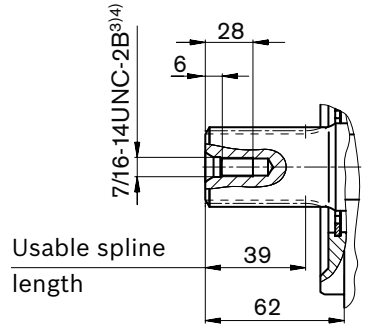
▼ **Splined shaft 1 1/2 in SAE J744**

U – 17T 12/24DP[1)]



▼ **Splined shaft 1 1/2 in SAE J744**

W – 17T 12/24DP[1)2)]

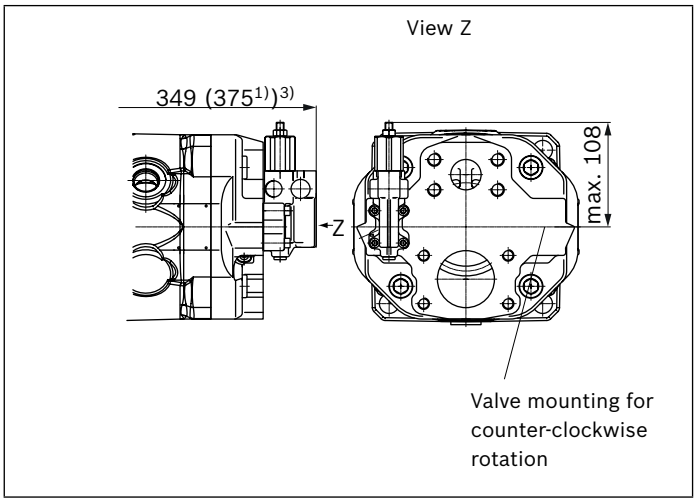


Ports		Standard	Size	$p_{max\ abs}$ [bar][4)]	State[8)]
B	Working port (high-pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	ISO 11926[6)]	1 1/16-12 UNF-2B; 20 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	1 1/16-12 UNF-2B; 20 deep	2	X[7)]
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 12 deep	350	O
M_B	Measuring pressure **B** (only with port plates 22 and 32)	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

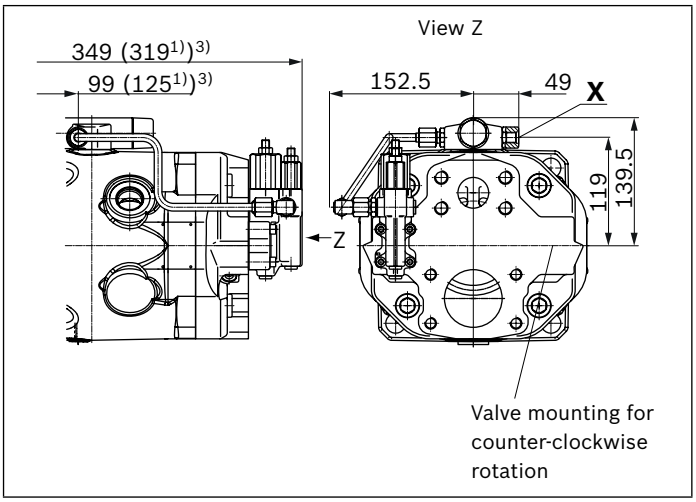
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur.
   Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink may be deeper than specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page64).
8) O = Must be connected (comes plugged)
   X = Plugged (in normal operation)

Port plate 11

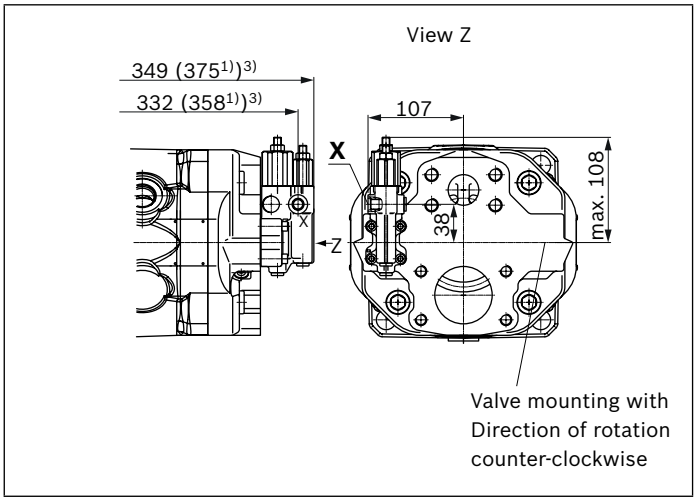
▼ **DR – Pressure controller; mounting flange D**



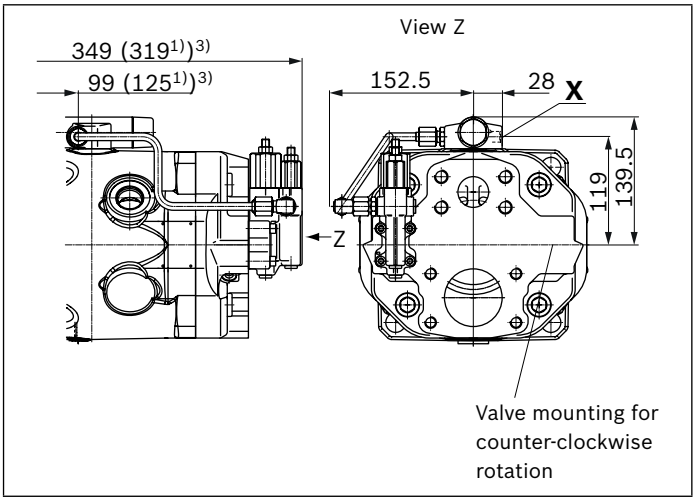
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



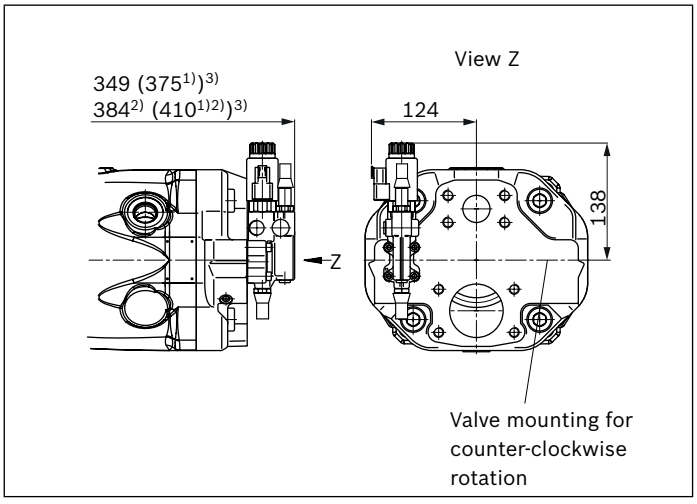
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



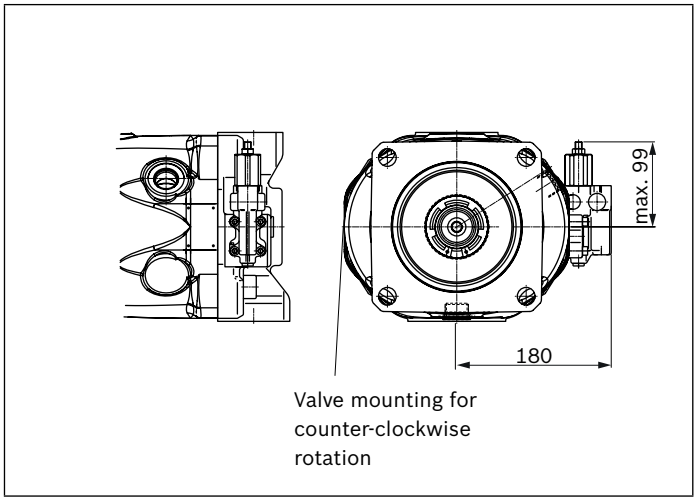
▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



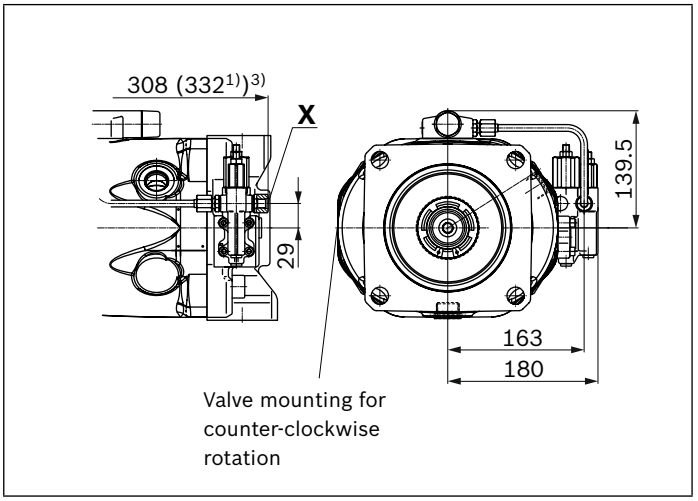
1) Dimension of mounting flange C
2) ER7. If using an intermediate plate pressure controller
3) To mounting flange

Port plate 12

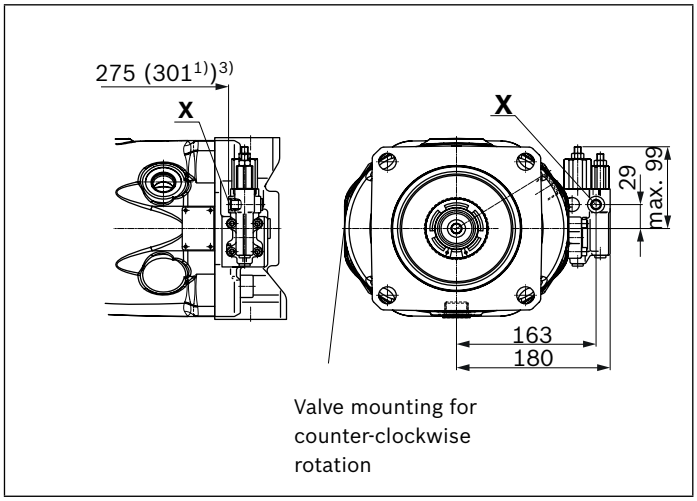
▼ **DR – Pressure controller; mounting flange D**



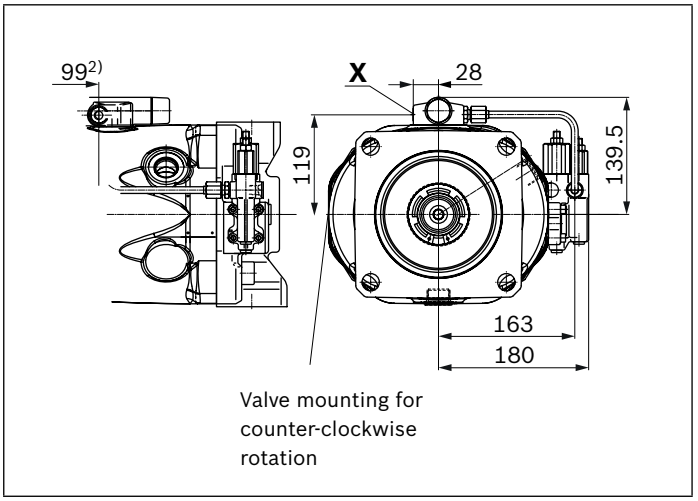
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



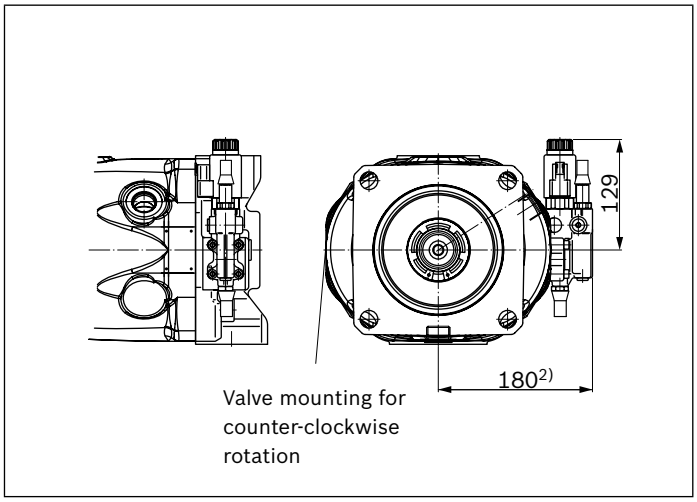
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



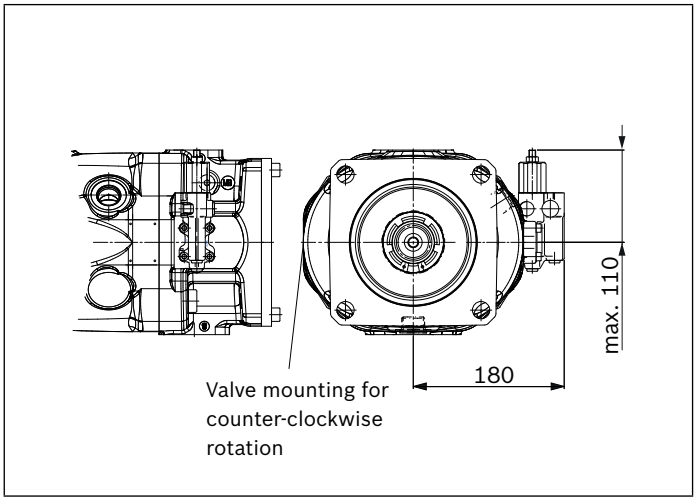
▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



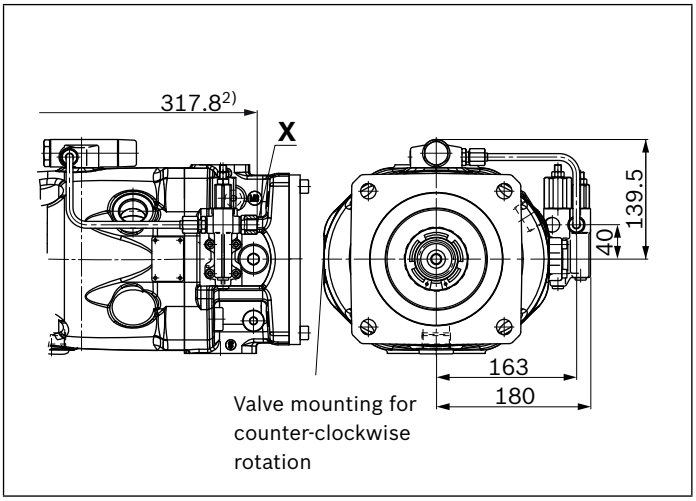
1) Dimension of mounting flange C
2) ER7. 215 mm if using an intermediate plate pressure controller
3) To mounting flange

Port plate 22

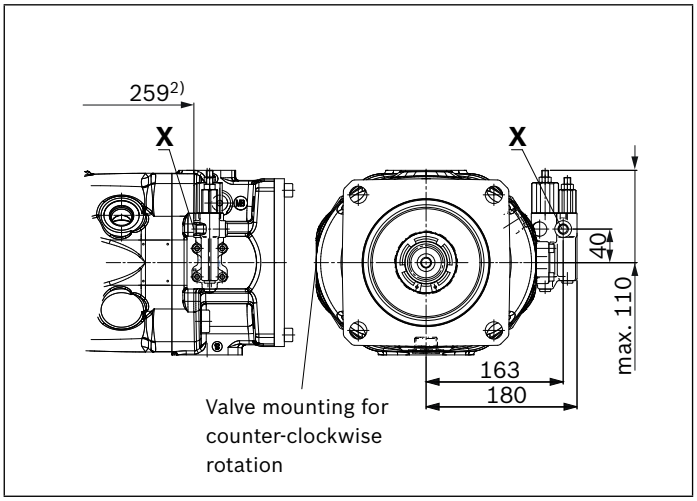
▼ **DR – Pressure controller; mounting flange D**



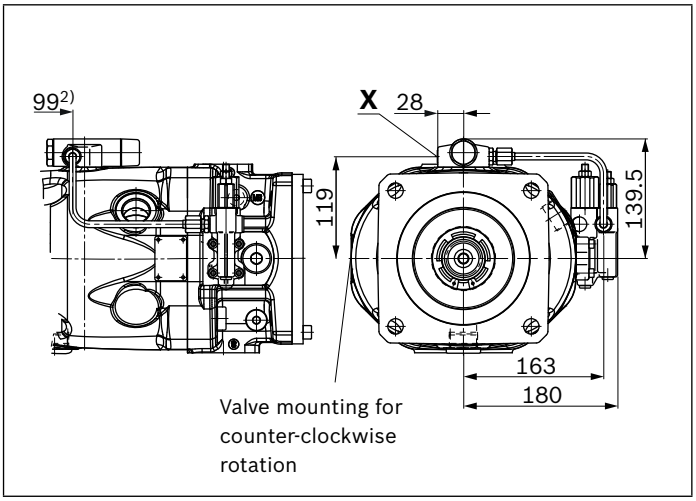
▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



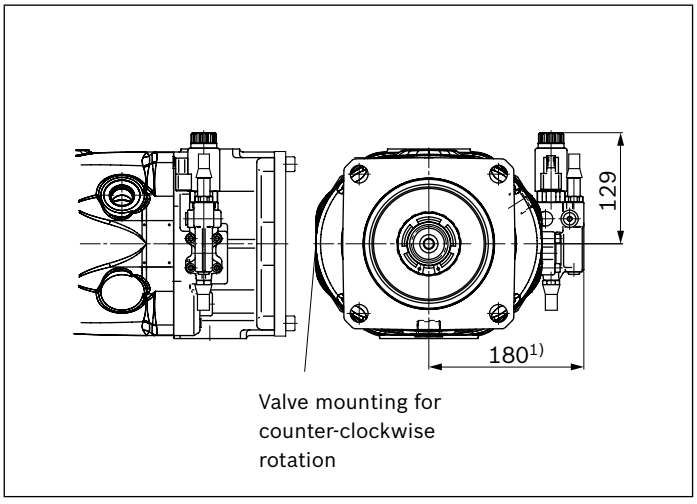
▼ **DRG – Pressure controller, remotely controlled; mounting flange D**



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



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

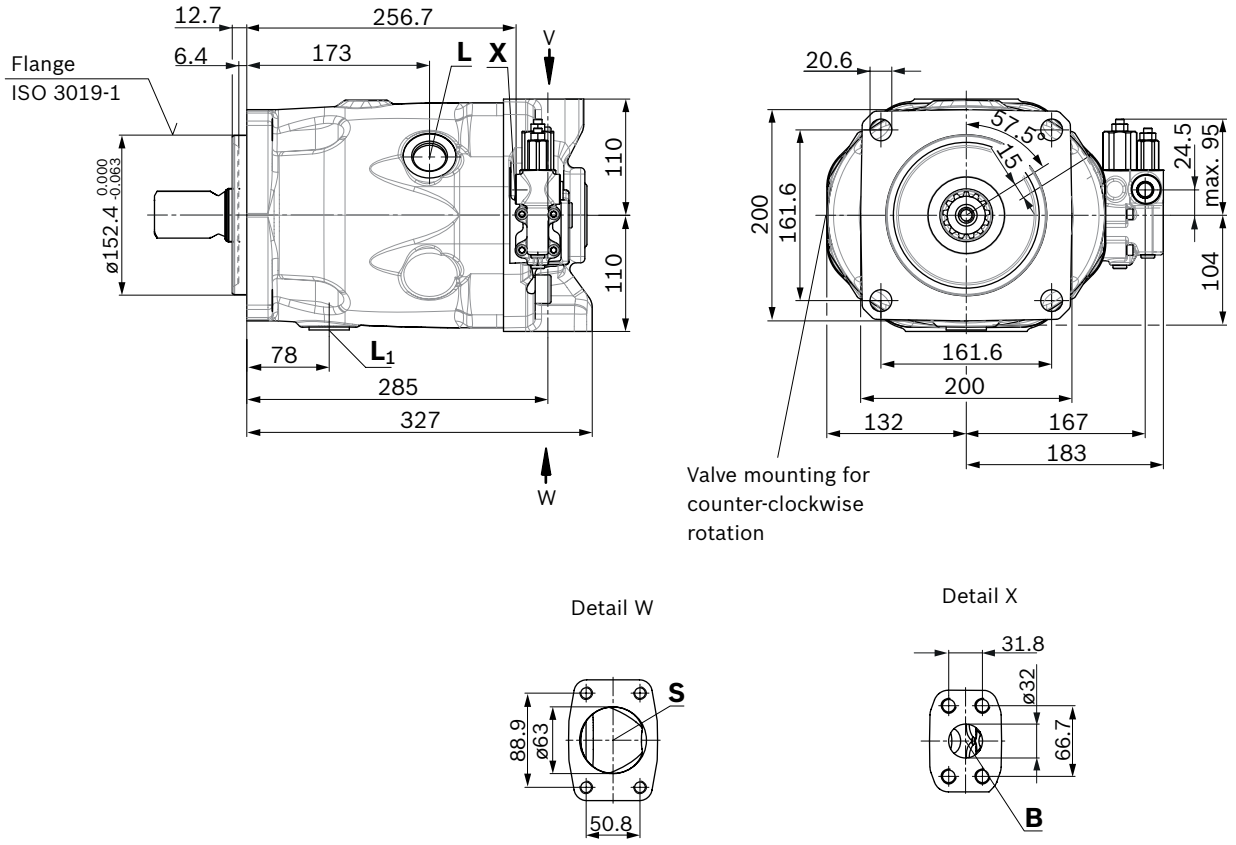


1) ER7. 215 mm if using an intermediate plate pressure controller
2) To mounting flange

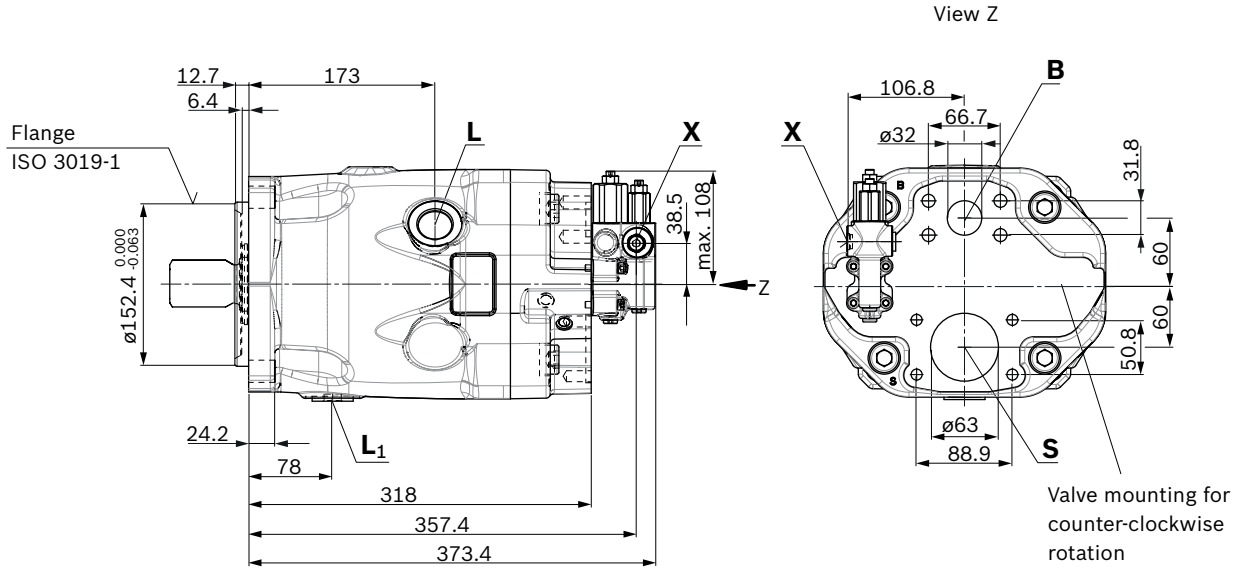
Dimensions, size 180

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

▼ **Port plate 12**



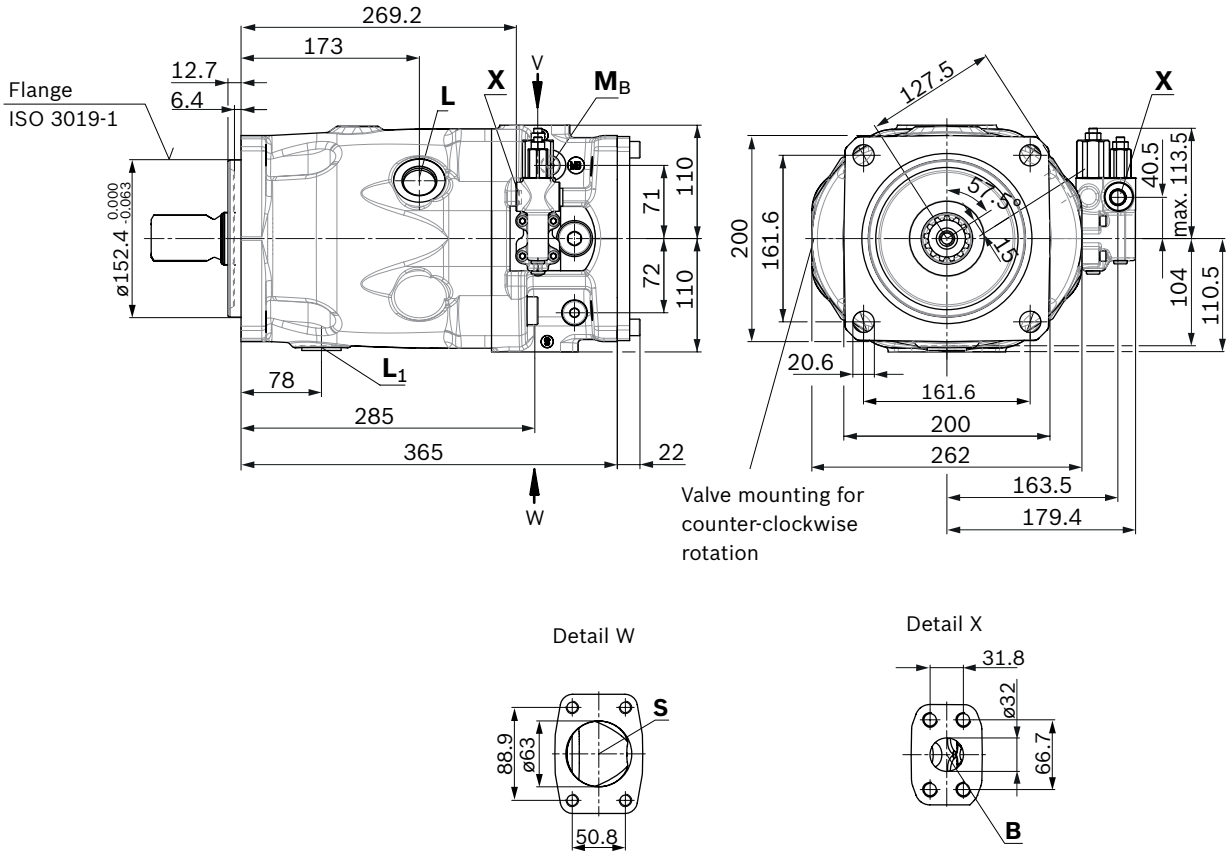
▼ **Port plate 11**



Dimensions, size 180

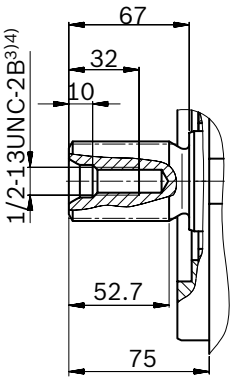
DRF, DRS, DRSC – Pressure flow controller, port plate 22 and 32; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22 and 32**



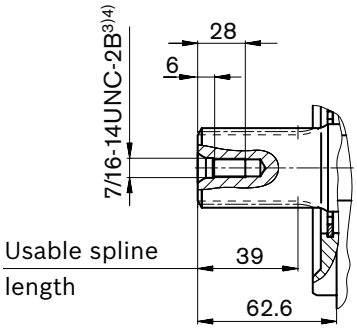
▼ **Splined shaft 1 3/4 in SAE J744**

S – 13T 8/16DP[1)]



▼ **Splined shaft 1 1/2 in SAE J744**

W – 17T 12/24DP[1)2)]

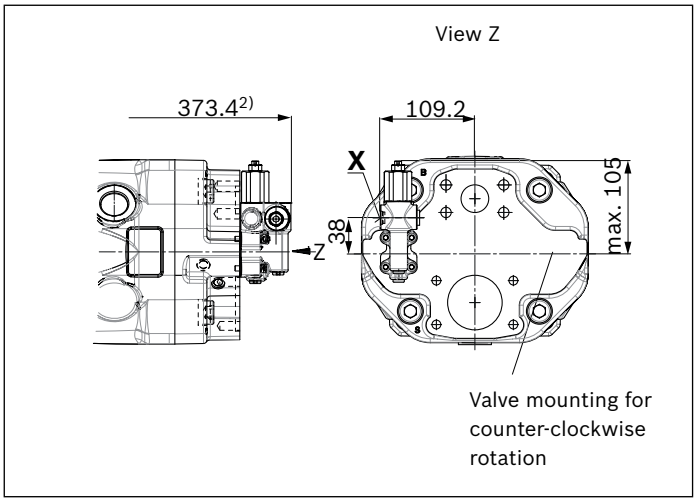


Ports		Standard	Size[4)]	$p_{max\ abs}$ [bar][5)]	State[9)]
B	Working port (high-pressure series) Fastening thread	SAE J518[6)] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction port (standard pressure series) Fastening thread	SAE J518[6)] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Drain port	ISO 11926[7)]	1 5/16-12 UN-2B; 20 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	1 5/16-12 UN-2B; 20 deep	2	X[8)]
X	Pilot pressure	ISO 11926	7/16-20 UNF-2B; 12 deep	350	O
M_B	Measuring pressure **B** (only with port plates 22 and 32)	DIN 3852-2[7)]	G 1/4 in; 12 deep	350	X

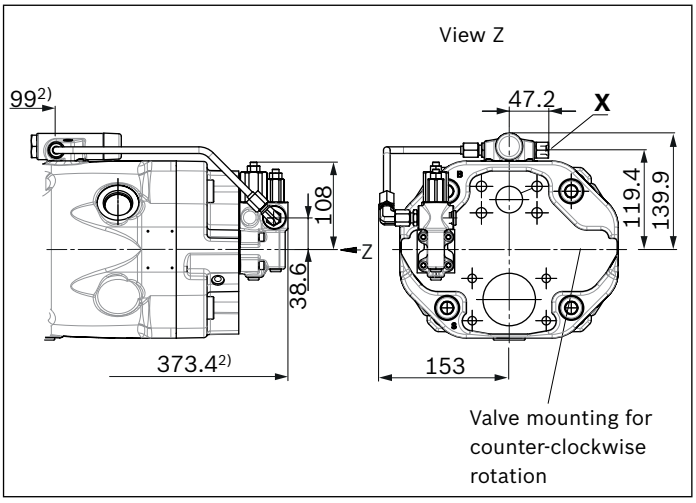
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur.
   Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink may be deeper than specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 64).
9) O = Must be connected (comes plugged)
   X = Plugged (in normal operation)

Port plate 11

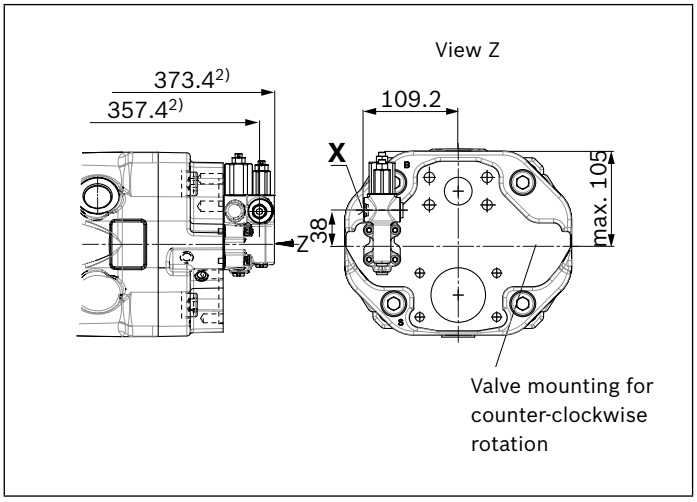
▼ **DR – Pressure controller**



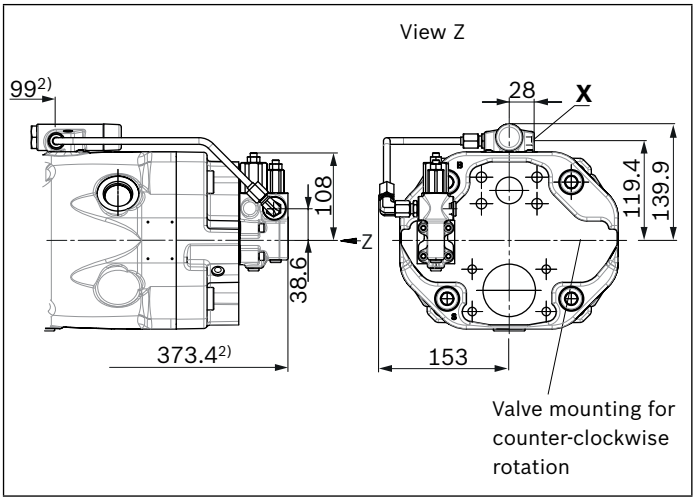
▼ **LA.DS – Pressure, flow and power controller**



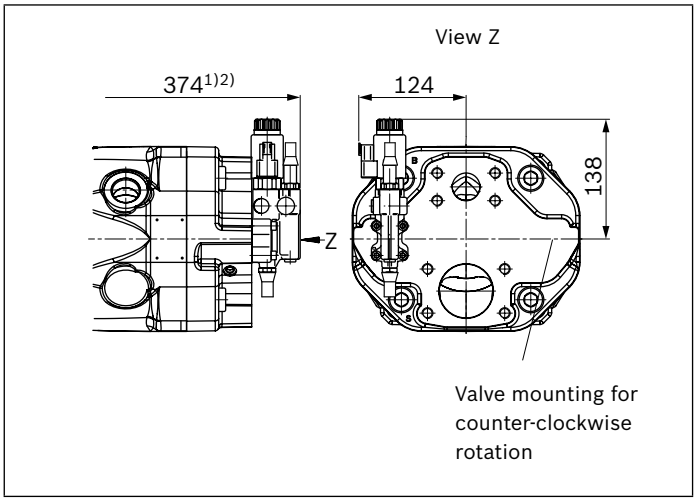
▼ **DRG – Pressure controller, remotely controlled**



▼ **LA.DG – Power controller; with pressure cut-off remotely controlled**



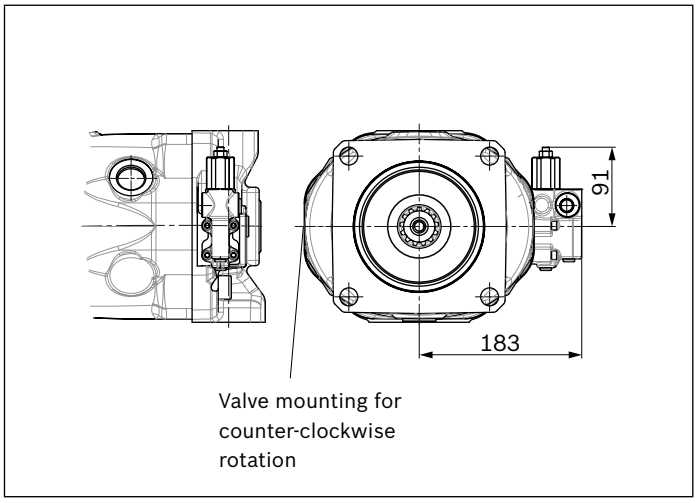
▼ **ED7./ER7. – Pressure controller, electric**



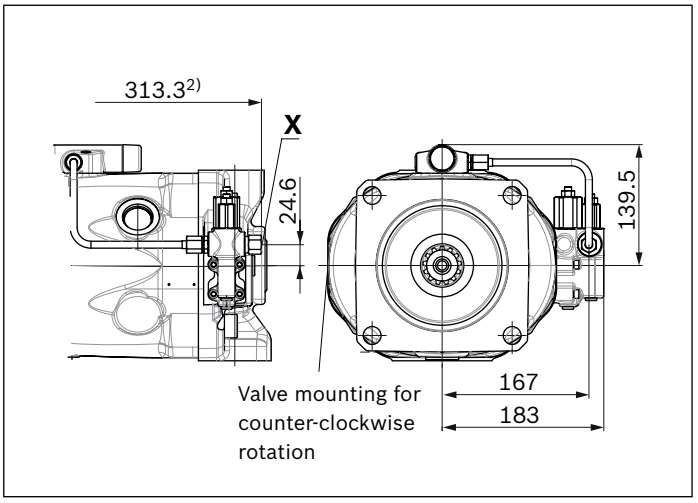
1) ER7. 409 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 12

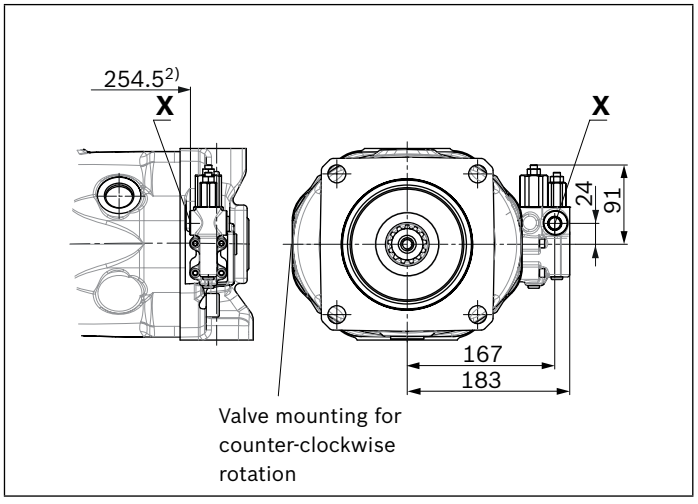
▼ **DR – Pressure controller**



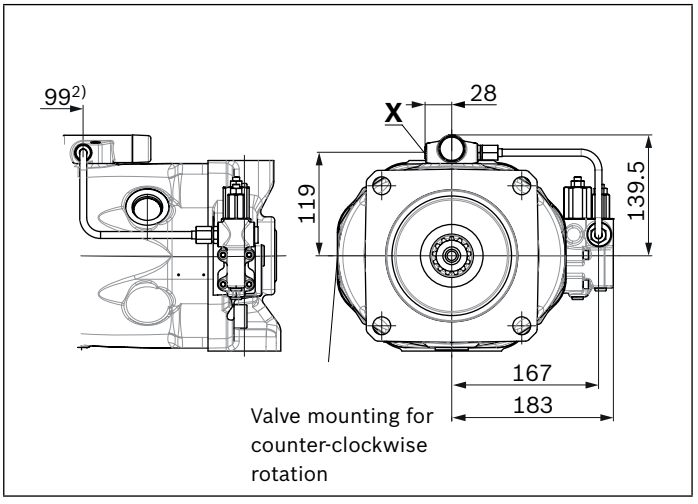
▼ **LA.DS – Pressure, flow and power controller**



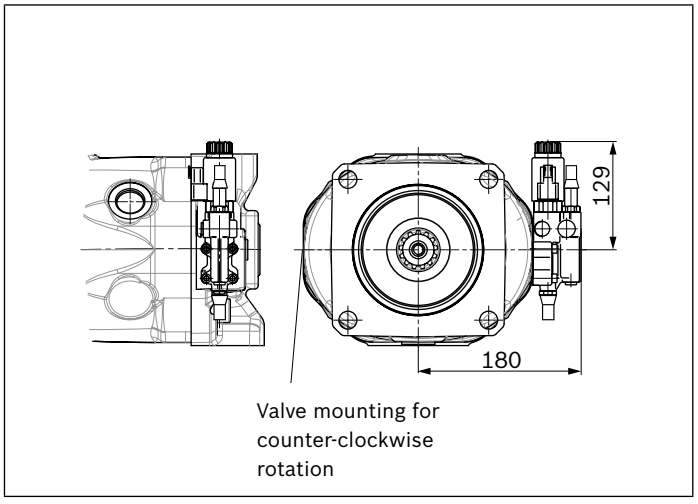
▼ **DRG – Pressure controller, remotely controlled**



▼ **LA.DG – Power controller; with pressure cut-off remotely controlled**



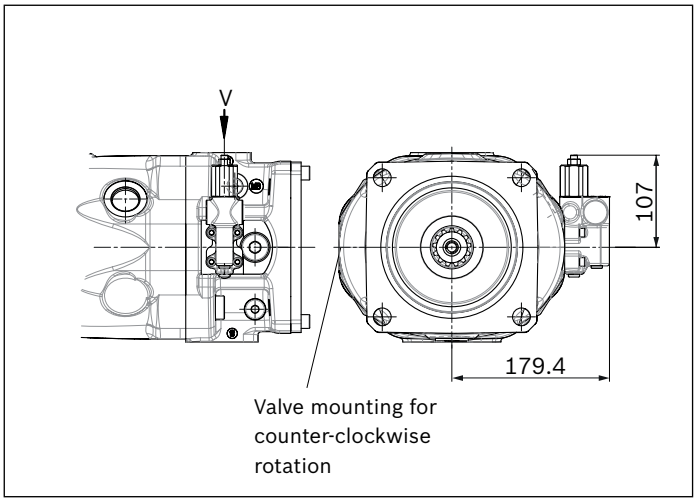
▼ **ED7./ER7. – Pressure controller, electric**



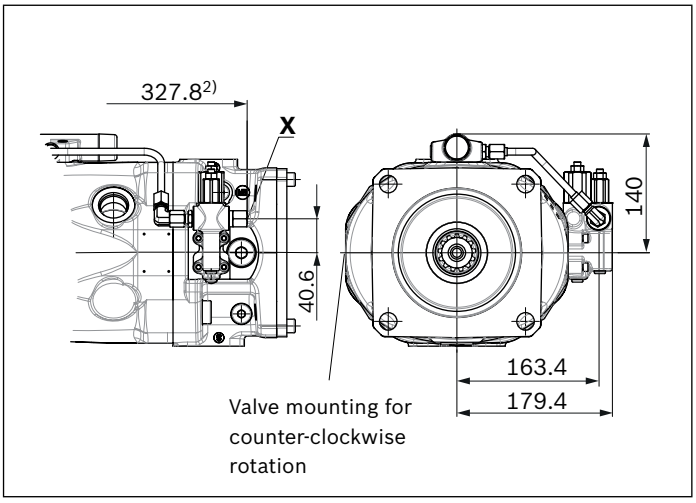
1) ER7. 215 mm if using an intermediate plate pressure controller
2) To mounting flange

Port plate 22 and 32

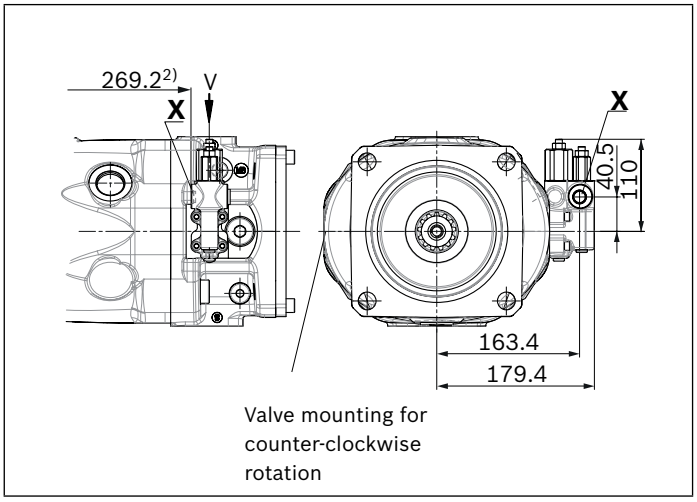
▼ **DR – Pressure controller**



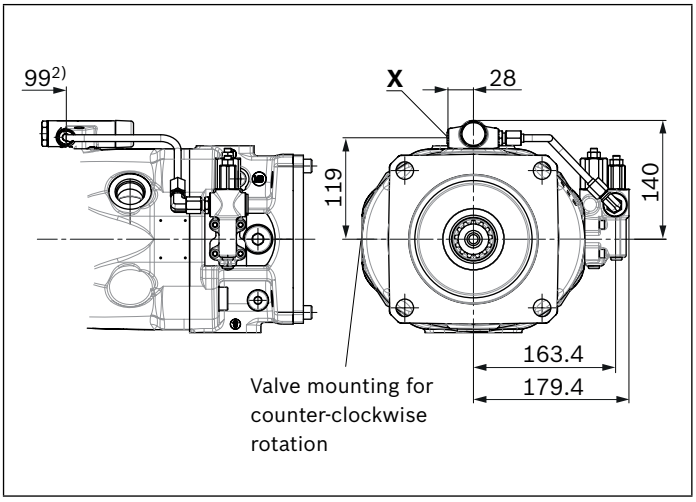
▼ **LA.DS – Pressure, flow and power controller**



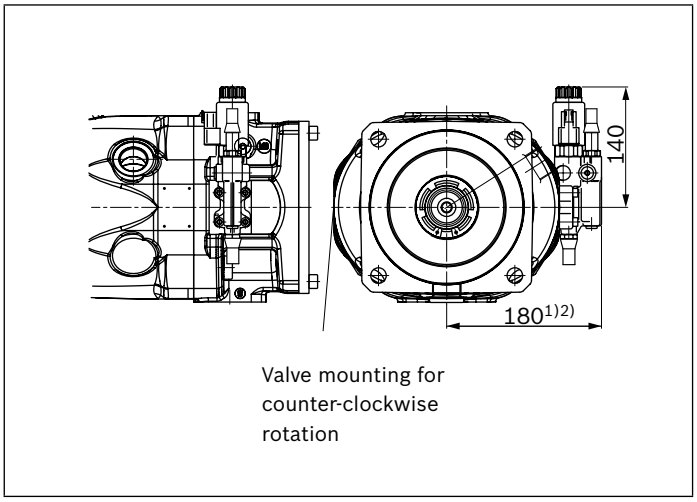
▼ **DRG – Pressure controller, remotely controlled**



▼ **LA.DG – Power controller; with pressure cut-off remotely controlled**



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



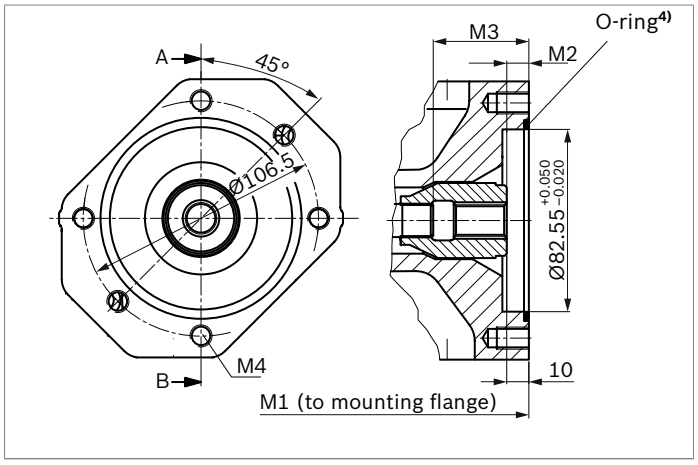
1) ER7. 215 mm if using an intermediate plate pressure controller
2) To mounting flange

Dimensions for through drives

Flange ISO 3019-1 (SAE J744)		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	**Attachment[2]**	**Diameter**		**45**	**71**	**100**	**140**	**180**	
82-2 (A)	⚷, ☍, ⚯	5/8 in	9T 16/32DP	●	●	●	●	–	K01
	⚷, ☍, ⚯	5/8 in	9T 16/32DP	○	●	●	●	●	U01

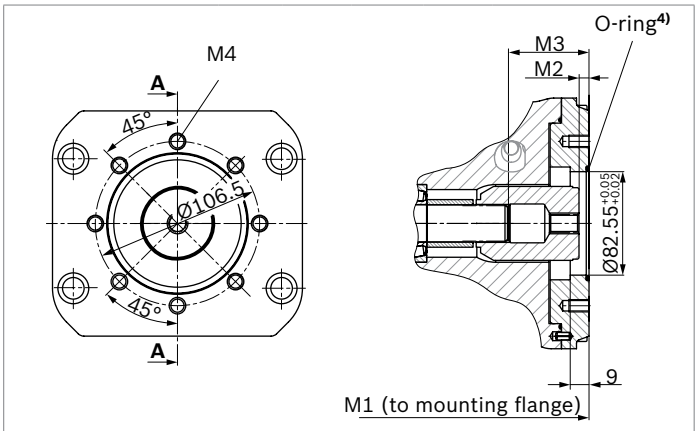
● = Available ○ = On request – = Not available

▼ **82-2 (A)**



K01 (SAE J744 16-4 (A))	NG	M1	M2	M3	M4[3]
	45	229	10.7	53.4	M10; 16 deep
	71	267	11.2	61.3	M10; 20 deep
	100	338	9.9	65	M10; 16 deep
	140[5]	350	10.8	77.3	M10; 16 deep
	140[6]	376			

▼ **82-2 (A)**



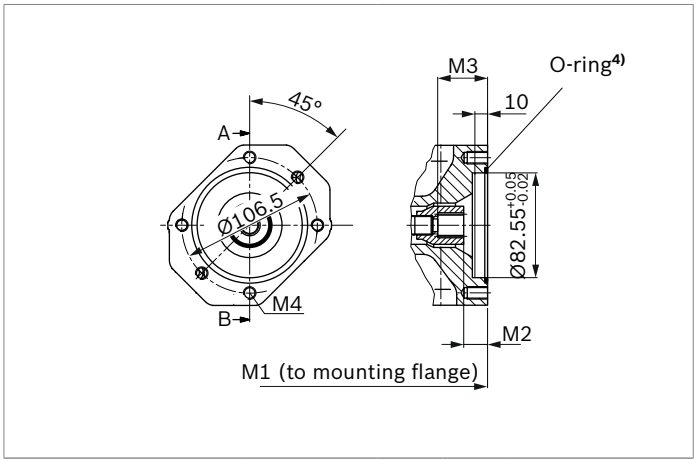
U01 (SAE J744 16-4 (A))	NG	M1	M2	M3	M4[3]
	71	299	9.3	61.3	M10; 16 deep
	100	360	9.9	65	M10; 16 deep
	140	377	On request		
	180	387	11.2	78.1	M10; 16 deep

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

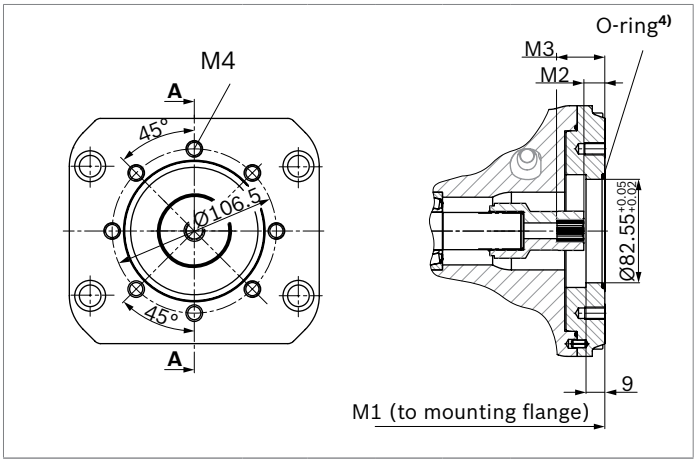
Flange ISO 3019-1 (SAE J744)		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	Attachment[2]	Diameter		45	71	100	140	180	
82-2 (A)	⚷, ☍, ⚯	3/4 in	11T 16/32DP	●	●	●	●	–	K52
	⚷, ☍, ⚯	3/4 in	11T 16/32DP	●	●	●	●	●	U52

● = Available ○ = On request – = Not available

▼ **82-2 (A)**



▼ **82-2 (A)**



K52 (SAE J744 19-4 (A-B))	NG	M1	M2	M3	M4[3]
	45	229	18.9	38.7	M10; 16 deep
	71	267	20.7	41.4	M10; 20 deep
	100	338	19	38.9	M10; 16 deep
	140[5]	350	18.9	38.6	M10; 16 deep
	140[6]	376			

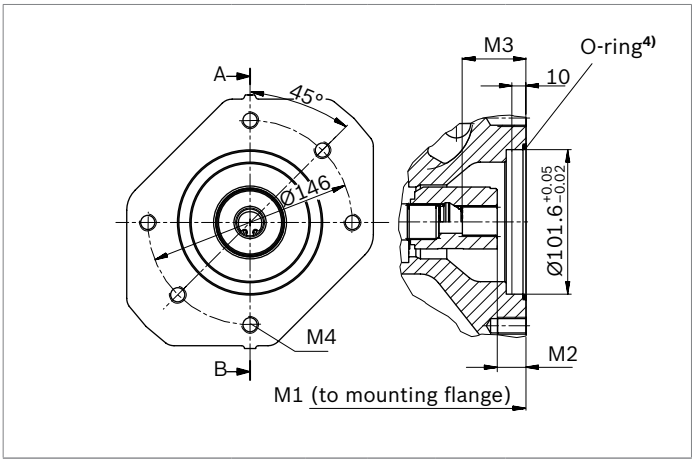
U52 SAE J744 19-4 (A-B))	NG	M1	M2	M3	M4[3]
	45	264	19.6	38.7	M10; 16 deep
	71	299	20.7	41.4	M10; 20 deep
	100	360	17	38	M10; 16 deep
	140	377	19	38.6	M10; 20 deep
	180	387	On request		M10; 16 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange

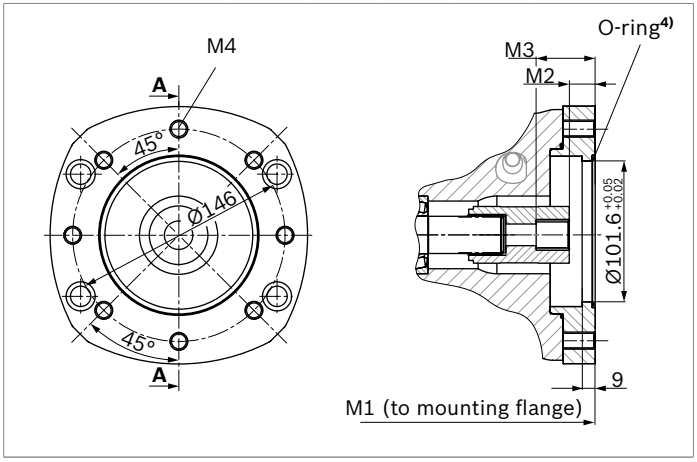
Flange ISO 3019-2 (metric)		Hub for splined shaft[1]		Availability across sizes					Code
Diameter	**Attachment[2]**	**Diameter**		**45**	**71**	**100**	**140**	**180**	
101-2 (B)	⚷, ☍, ⚯	7/8 in	13T 16/32DP	●	●	●	●	–	K68
	⚷, ☍, ⚯	7/8 in	13T 16/32DP	●	●	●	●	●	U68

● = Available ○ = On request – = Not available

▼ **101-2 (B)**



▼ **101-2 (B)**



K68 (SAE J744 22-4) (B))	NG	M1	M2	M3	M4[3]
	45	229	17.9	41.7	M12; 18 deep
	71	267	20.3	44.1	M12; 20 deep
	100	338	18	41.9	M12; 20 deep
	140[5]	350	17.8	41.6	M12; 20 deep
	140[6]	376			

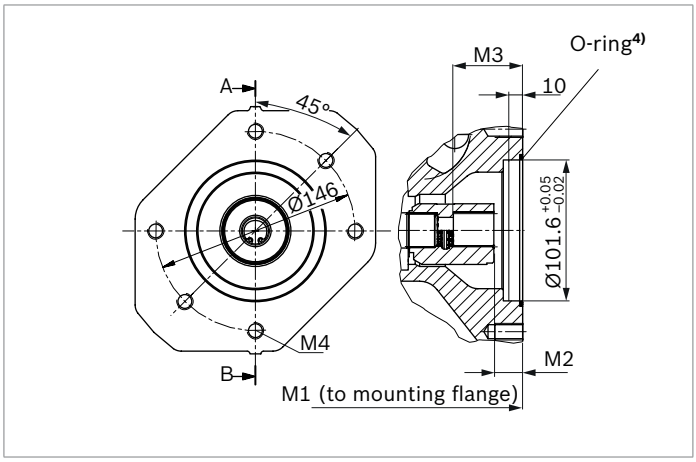
U68 (SAE J744 22-4) (B))	NG	M1	M2	M3	M4[3]
	45	264	17.4	41.6	M12; 22 deep
	71	299	17.4	41.6	M12; 22 deep
	100	360	17.4	41.3	M12; 22 deep
	140	377	17.4	41.6	M12; 22 deep
	180	387	17.4	42.5	M12; 22 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange

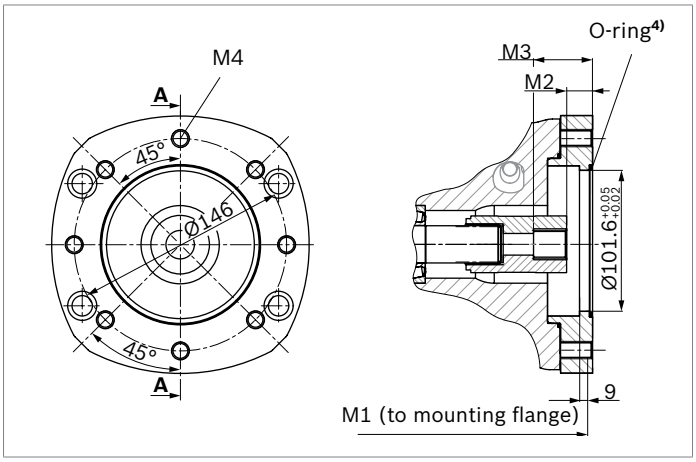
Flange ISO 3019-1 (SAE J744)		Splined shaft[1]		Availability across sizes					Code
Diameter	Attachment[2]	Diameter		45	71	100	140	180	
101-2 (B)	⚷, ☍, ⚯	1 in	15T 16/32DP	●	●	●	●	–	K04
	⚷, ☍, ⚯	1 in	15T 16/32DP	○	●	●	●	●	U04

● = Available ○ = On request – = Not available

▼ **101-2 (B)**



▼ **101-2 (B)**



K04 (SAE J744 25-4 (B-B))	NG	M1	M2	M3	M4[3]
	45	229	18.4	46.7	M12; 18 deep
	71	267	20.8	49.1	M12; 20 deep
	100	338	18.2	46.6	M12; 20 deep
	140[5]	350	18.3	45.9	M12; 20 deep
	140[6]	376			

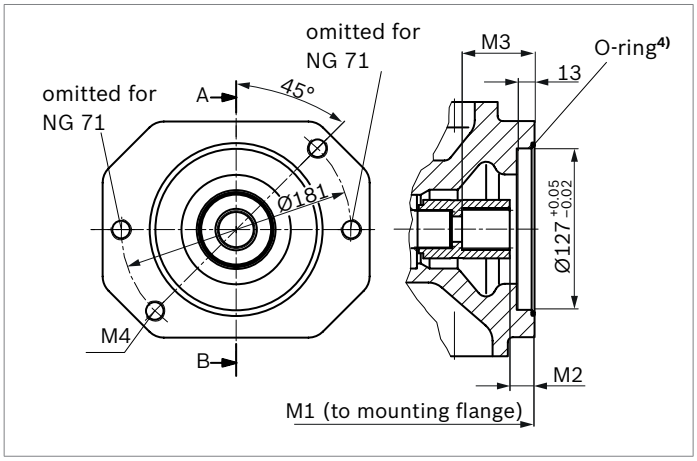
U04 (SAE J744 25-4 (B-B))	NG	M1	M2	M3	M4[3]
	71	299	20.2	49.1	M12; 22 deep
	100	360	17.6	46.6	M12; 22 deep
	140	377	17.9	46.3	M12; 22 deep
	180	387	17.3	46.3	M12; 22 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange

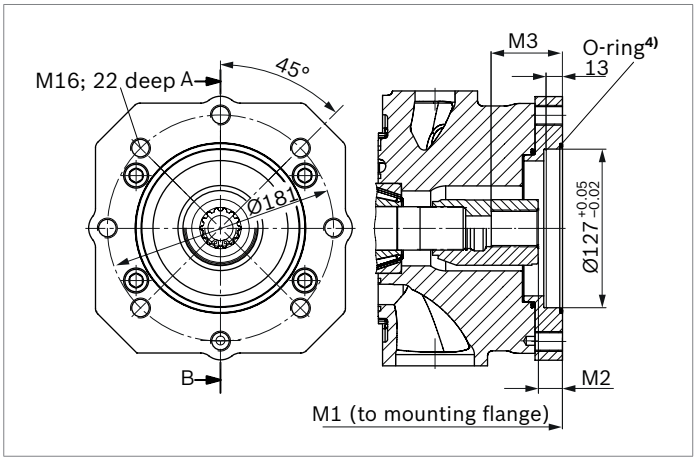
Flange ISO 3019-1 (SAE J744)		Splined shaft[1]		Availability across sizes					Code
Diameter	Attachment[2]	Diameter		45	71	100	140	180	
127-2 (C)	☍, ⊶	1 1/4 in	14T 12/24DP	–	●	●	●	–	K07
	⚷, ☍, ⊶	1 1/4 in	14T 12/24DP	–	●	●	●	●	U07

● = Available ○ = On request – = Not available

▼ **127-2 (C)**



▼ **127-2 (C)**



K07 (SAE J744 32-4 (C))	NG	M1	M2	M3	M4[3]
	71	267	21.8	58.6	M16; continuous
	100	338	19.5	56.4	M16; continuous
	140[5]	350	19.3	56.1	M16; 24 deep
	140[6]	376			

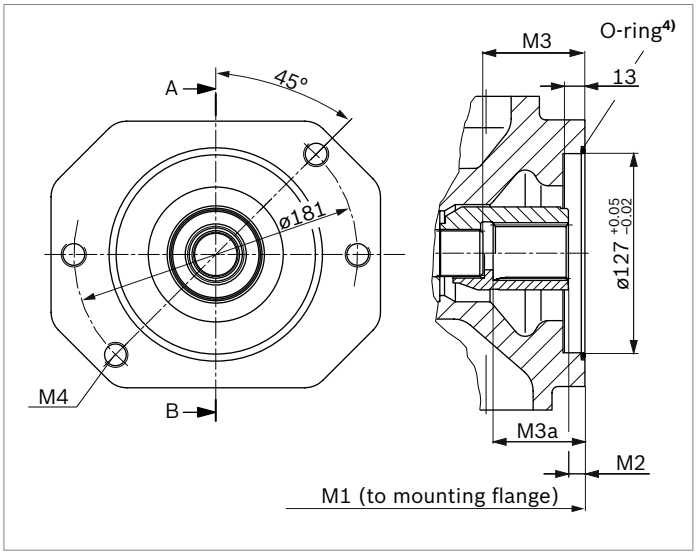
U07 (SAE J744 32-4 (C))	NG	M1	M2	M3	M4[3]
	71	299	21.2	58.1	M16; 22 deep
	100	360	19.5	56.3	M16; 22 deep
	140	377	18.9	56.1	M16; 22 deep
	180	387	18.9	56.1	M16; 22 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange

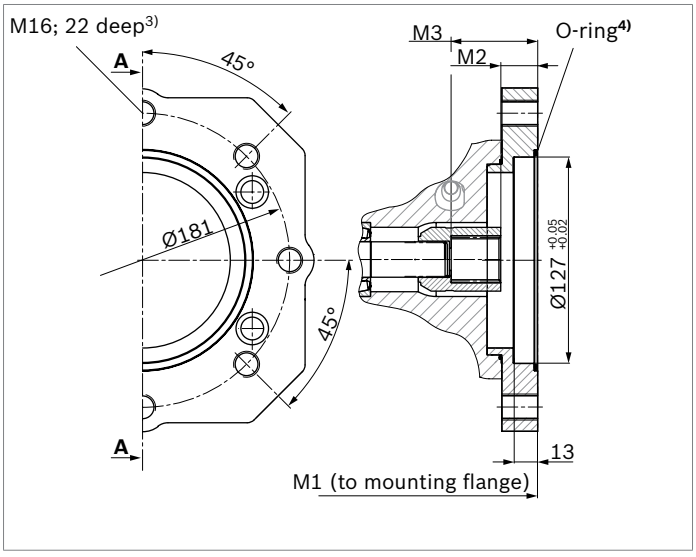
Flange ISO 3019-1 (SAE J744)		Splined shaft[1]		Availability across sizes					Code
Diameter	Attachment[2]	Diameter		45	71	100	140	180	
127-2 (C)	☍, ⚯	1 1/2 in	17T 12/24DP	–	–	●	●	–	K24
	⚷, ☍, ⚯	1 1/2 in	17T 12/24DP	–	–	●	●	●	U24

● = Available ○ = On request – = Not available

▼ **127-2 (C)**



▼ **127-2 (C)**



K24 (SAE J744 38-4 (C-C))	NG	M1	M2	M3	M3a	M4[3]
	100	323	9.9	65	–	M16; continuous
	140[5]	350	9.7	–	69.1	M16; 24 deep
	140[6]	376				

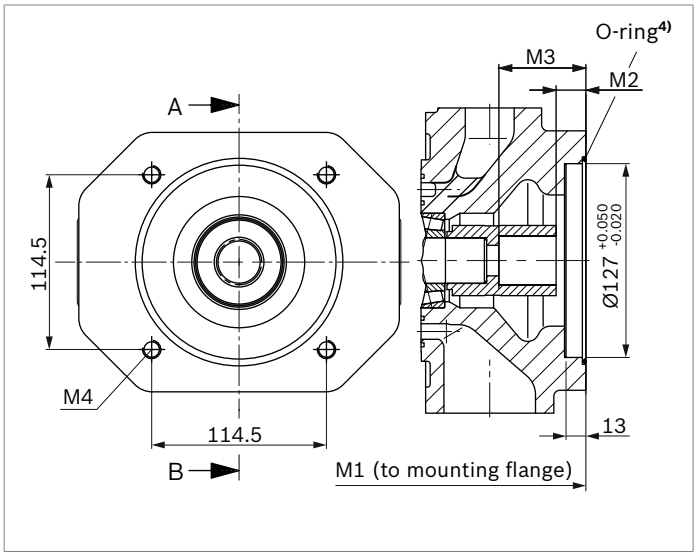
U24 (SAE J744 38-4 (C-C))	NG	M1	M2	M3	M4[3]
	100	360	21.5	62.3	M16; 22 deep
	140	377	21.5	62.3	M16; 22 deep
	180	387	9.9	62.3	M16; 22 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange

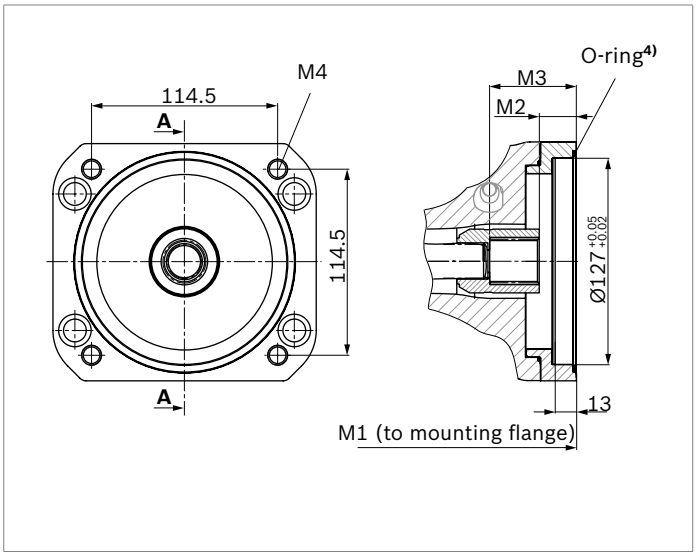
Flange ISO 3019-1 (SAE J744)		Splined shaft[1]	Availability across sizes					Code
Diameter	**Attachment[2]**	**Diameter**	**45**	**71**	**100**	**140**	**180**	
127-4 (C)	⌘	1 1/4 in 14T 12/24DP	–	○	●	●	–	K15
		1 1/4 in 14T 12/24DP	–	–	●	●	●	U15

● = Available ○ = On request – = Not available

▼ **127-4 (C)**



▼ **127-4 (C)**



K15 (SAE J744 32-4 (C))	NG	M1	M2	M3	M4[3]
	100	338	17.9	56.5	M12; 22 deep
	140	350	17.9	56.5	M12; 22 deep

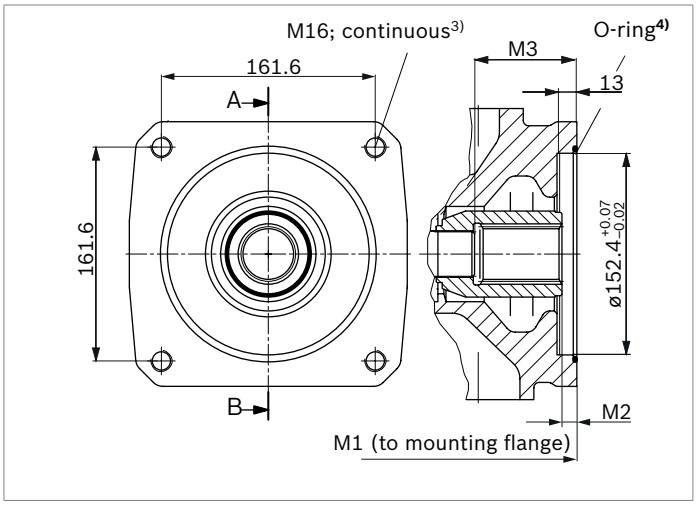
U15 (SAE J744 32-4 (C))	NG	M1	M2	M3	M4[3]
	100	360	20	57	M12; 22 deep
	140	377	20	57	M12; 22 deep
	180	387	20	57	M12; 22 deep

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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery

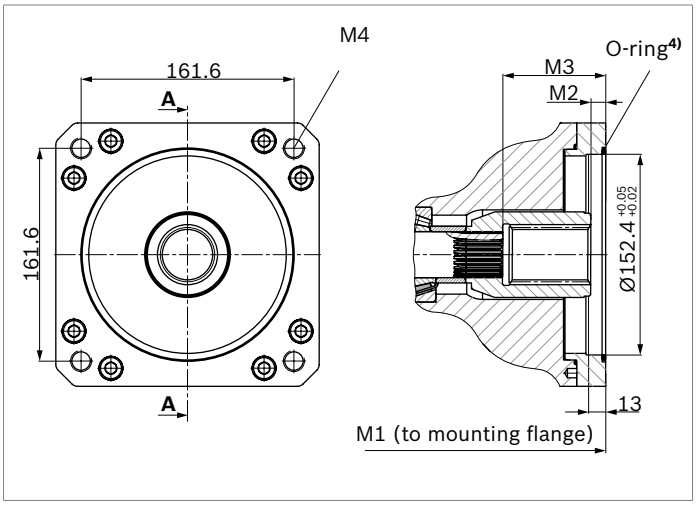
Flange ISO 3019-1 (SAE J744)		Splined shaft[1]		Availability across sizes					Code
Diameter	Attachment[2]	Diameter		45	71	100	140	180	
152-4 (C)	⌘	1 3/4 in	13T 8/16DP	–	–	–	●	–	K17
		1 3/4 in	13T 8/16DP	–	–	–	●	●	U17

● = Available ○ = On request – = Not available

▼ **152-4 (D)**



▼ **152-4 (D)**



K17 152-4 (D)	NG	M1	M2	M3
	140	350	11	77.3

U17 152-4 (D)	NG	M1	M2	M3	M4[3]
	140	377	10.7	77.5	M16; 22 deep
	180	387	10.8	78.1	M16; 22 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; observe the max. tightening torques in the instruction manual.
4) O-ring included in the scope of delivery

Overview of mounting options

Through drive			Mounting options – 2nd pump			
Flange (SAE) ISO 3019-1	**Hub for splined shaft**	**Code[1)]**	**A10VO/31 and 32 NG (shaft)**	**A10VO/52 and 53 NG (shaft)**	**A1VO/10 NG (shaft)**	**External gear pump**
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)	18, 28 (S3)	
101-2 (B)	7/8 in	(K)(U)68	28 (S, R)/31 45 (U, W)	28 (S, R) 45 (U, W)	28 (S4) 35 (S4)	Design N/G
	1 in	(K)(U)04	45 (S, R)	45 (S, R) 60, 63 (U, W) 72 (U, W)	35 (S5)	–
127-2 (C)	1 1/4 in	(K)(U)07	71 (S, R) 88 (S, R)/31 100 (U, W)	85 (U, W) 100 (U, W)		–
	1 1/2 in	(K)(U)24	100 (S) 140 (W)/31	85 (S, R) 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, W) 100 (U, W)		–
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	22/32	22/32
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).

Combination pumps A10VO + A10VO

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

Order example:

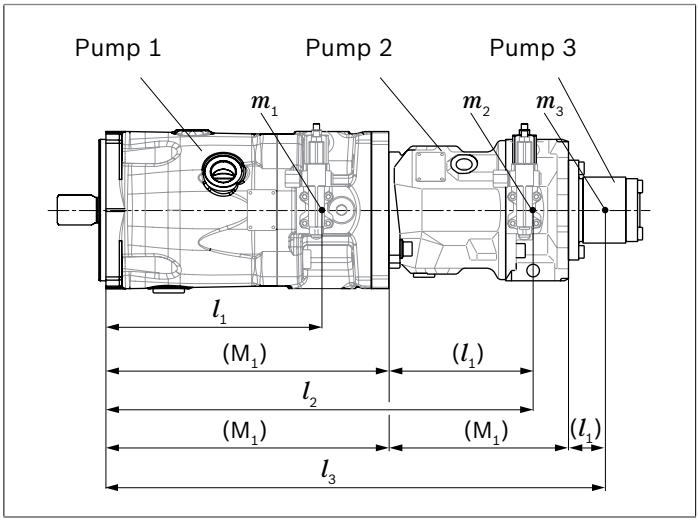
A10VO100DR/32R-VSC12K07+
A10VO71DR/32R-VSC12N00

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s^2).

For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque (please contact us).

The "K.." through drives are plugged with a **non-pressure-resistant** cover. This means the units must be sealed with a pressure-resistant cover before commissioning. Through drives can also be ordered with pressure-resistant covers, please state in plain text.

The "U.." through drives are equipped with a flexible, universal through drive (without hub and intermediate flange) and a pressure-resistant cover. This enables the utilization of various through drive options without mechanical machining of the port plate. Details of the necessary assembled parts can be found in data sheet RE 95581.



m_1, m_2, m_3	Weight of pump	[kg]
l_1, l_2, l_3	Distance from center of gravity	[mm]
$T_m = (m_1 \bullet l_1 + m_2 \bullet l_2 + m_3 \bullet l_3) \bullet \frac{1}{102}$		[Nm]

Calculation for multiple pumps

l_1	=	Front pump distance from center of gravity (values from "Permissible moments of inertia" table)
l_2	=	Dimension "M1" from through drive drawings (from page 53) + l_1 of the 2nd pump
l_3	=	Dimension "M1" from through drive drawings (from page 53) of the 1st pump + "M1" of the 2nd pump + l_1 of the 3rd pump

Permissible moments of inertia

Size			45	71	100	140	180
for 4-hole flange							
static	T_m	Nm	3000	3000	7000	7000	7000
dynamic at 10 g (98.1 m/s^2)	T_m	Nm	300	300	700	700	700
for 2-hole flange							
static	T_m	Nm	1370	2160	3000	On request[1)]	–
dynamic at 10 g (98.1 m/s^2)	T_m	Nm	137	216	300		–
Weight with port plate 11/12N00 and mounting flange C or D	m	kg	25.8	40.4	56.4	70.5	75.2
Weight with port plate 12K.. and mounting flange C	m	kg	27.4	43.3	62.6	79.5	–
Weight with port plate 22(32)Uxx and mounting flange D or U	m	kg	32.6	51.8	76	90.2	89.4
Distance from center of gravity with 11/12N00	l_1	mm	108	120	138	158	159
Distance from center of gravity with 12Kxx	l_1	mm	115	129	153	177	–
Distance from center of gravity with 22/32Uxx	l_1	mm	135	153	184	196	190

Please also pay attention to the installation information on page 66.

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

Connector for solenoids

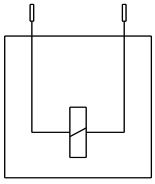
DEUTSCH DT04-2P

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)

Notice
If necessary, you can change the position of the connector by turning the solenoid body.
The procedure is defined in the instruction manual.

▼ **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).

Control electronics

Control	Electronics function	Electronics		Data sheet
Electric pressure control	Controlled power outlet	RA	analog	95230
		RC4-5/30	digital	95205

Installation instructions

General

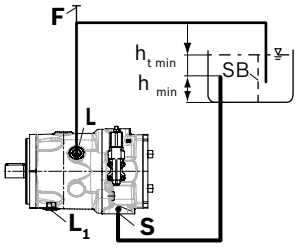
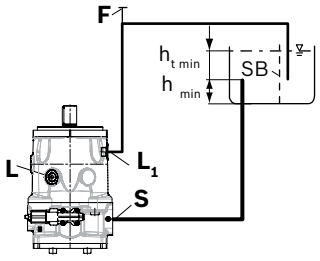
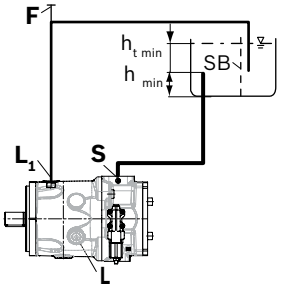
The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be discharged to the reservoir via the highest available tank port (**L**, **L_1**).
For combination pumps, the leakage must be drained off at each single pump.
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating conditions, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the total pressure loss. However, it must not be higher than $h_{S\,max}$ = 800 mm. The minimum suction pressure at port **S** (see the technical data on page 7) must not be fallen short of during operation and at cold starting either.
When designing the reservoir, ensure that there is an 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**

Below-reservoir installation (standard)

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

Installation position	Air bleed	Filling
1 	**F**	**F (L)**
2[1)] 	**F**	**F (L_1)**
3 	**F**	**F (L_1)**

Notice

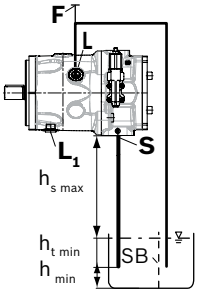
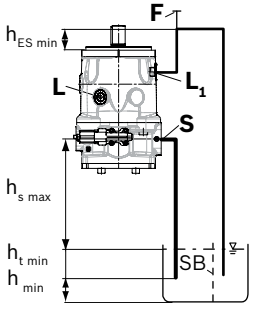
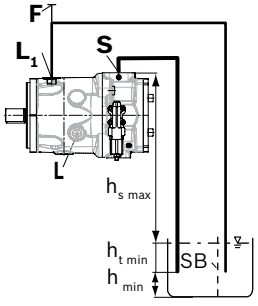
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

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.

Above-reservoir installation

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

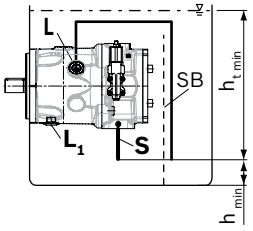
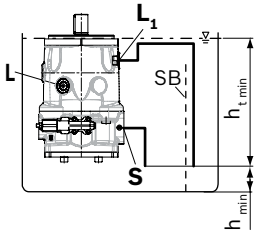
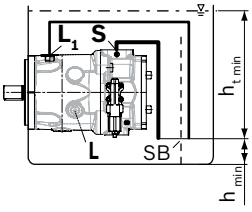
A check valve in the drain line is only permissible in individual cases. Consult us for approval.

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

Inside-reservoir installation

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

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

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

For key, see page 66.

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.

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.

Apart from this, you should take into account the information regarding tightening torques in the instruction manual.

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

Project planning notes

- The A10VO axial piston variable pump is designed to be used in open circuit.
- The project planning, assembly and commissioning of the axial piston unit require the involvement of qualified skilled persons.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- 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 preservative protection for a maximum of 12 months. If longer preservation is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, which can be found in data sheet 90312 or in the instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. The use of the direct current (DC) on the electromagnet does not produce any electromagnetic interference (EMI), nor is the electromagnet influenced by EMI. Potential electromagnetic interference (EMI) exists if the solenoid is energized with a modulated direct current (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.
- Pressure controllers are not safeguards against pressure overload. A pressure relief valve is to be fitted in the hydraulic system.
- For drives that are operated for a long period with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of burning on the axial piston unit, 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 get stuck in an undefined position due to contamination (e.g. impure hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer should test whether additional measures are required on the machine for the relevant application in order to bring the driven consumer into a safe position (e.g. safe stop) and make sure any measures are properly implemented.

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