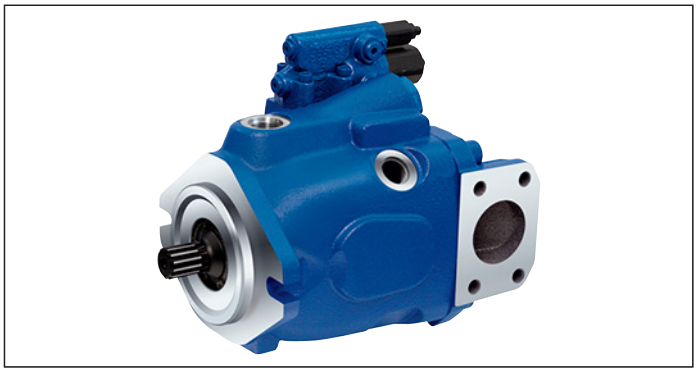
RE 92703/2026-03-09
Replaces: 2025-10-07

rexroth
A Bosch Company

Axial piston variable pump A10VO Series 52 and 53



- For machines with medium pressure requirements
- Sizes 10 to 100
- Nominal pressure 250 bar (3600 psi)
- Maximum pressure 315 bar (4550 psi)
- Open circuit

Features

- Variable pump with axial piston rotary group in swashplate design for hydrostatic drives in open circuit.
- Flow is proportional to drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- Stable bearing for long service life
- High permissible drive speed
- Favorable power-to-weight ratio – compact dimensions
- Low noise
- With pre compression volume PCV
- Excellent suction characteristics
- Electrohydraulic pressure control
- Power control
- Electro proportional swivel angle control
- Short control times

Contents

Type code series 52

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**52**		**–**	**V**					

Axial piston unit

		10	28	45	60	85	
01	Swashplate design, variable, nominal pressure 250 bar (3600 psi), maximum pressure 315 bar (4550 psi)	●	●	●	●	●	**A10V**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

		10	28	45	60	85
03	Geometric displacement, see table of values on page 11	**10**	**28**	**45**	**60**	**85**

Control device

					10	28	45	60	85	
04	Pressure controller	hydraulic			●	●	▲[3]	●	●	**DR**
	with flow controller	hydraulic	X-T open		●	●	▲[3]	●	●	**DFR**
			X-T plugged	with flushing function	●	●	▲[3]	●	●	**DFR1**
				without flushing function	–	●	▲[3]	●	●	**DRSC**
	with pressure cut-off	hydraulic	remote controlled		●	●	●	●	●	**DRG**
		electric	negative control	*U* = 12 V	–	●	●	●	●	**ED71**
				U = 24 V	–	●	●	●	●	**ED72**
		electric	positive control	*U* = 12 V	–	●	●	●	●	**ER71**
				U = 24 V	–	●	●	●	●	**ER72**
	Electrohydraulic control valve		positive control	*U* = 12 V to 24 V	–	●	–	–	–	**EC4**
			negative control		–	o	–	–	–	**EB4**

Series

		10	28	45	60	85	
05	Series 5, index 2	●	●	●	●	●	**52**

Direction of rotation

			10	28	45	60	85	
06	Viewed on drive shaft	clockwise	●	●	●	●	●	**R**
		counter-clockwise	●	●	●	●	●	**L**

Sealing material

		10	28	45	60	85	
07	FKM (fluorocarbon rubber)	●	●	●	●	●	**V**

Drive shaft

			10	28	45	60	85	
08	Splined shaft ISO 3019-1 View in data sheet streamlined. See installation drawing for detailed view.	standard shaft	●	●	●	●	●	**S**
		similar to shaft "S" however for higher torque	–	●	●	●	●	**R**
		reduced diameter, limited suitability for through drive	●	●	●	●	●	**U**
		similar to shaft "U", however for higher torque only conditionally suitable for mounting with through drive. For mounting options, see page 80	–	●	●	●	●	**W**
	Parallel keyed shaft DIN 6885 not for through drive		●[1]	–	–	–	–	**P**
	Parallel keyed shaft ISO 3019-1 not for through drive		●[2]	●	●	●	●	**K**
	Tapered keyed shaft and UNF threaded bolt not for through-drive		–	●	●	●	–	**C**

Mounting flange

			10	28	45	60	85	
09	Based on ISO 3019-2 (ISO)	2-hole	●	–	–	–	–	**A**
	Based on ISO 3019-1 (SAE)	2-hole	●	●	●	●	●	**C**
		4-hole	–	–	–	●	–	**D**

● = Available o = On request – = Not available ▲ = Not for new projects

1) With mounting flange A and C; order item 09 and port plate 14
2) Only with mounting flange C; order item 09 and port plate 64
3) Use data sheet 92706 for pressure flow controller DR, DFR, DFR1, DRSC A10VO 45 series 60.

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**52**		**–**	**V**					

Working port				**10**	**28**	**45**	**60**	**85**	
10	SAE flange ports according to ISO 6162 **metric**	fastening thread **metric** rear	not for through drive	–	●	●	●	●	**11**
		fastening thread **metric** laterally opposite	for through drive	–	●	●	●	●	**12**
		fastening thread **metric** laterally offset 90°	not for through drive; available for counter-clockwise rotation only	–	–	●	–	–	**13**
		fastening thread **metric** laterally and with pre compression volume (PCV)	not for through drive NG 28 with through drive at NG 60	–	○	–	●	–	**32**
	Threaded port, **metric**	rear	not for through drive	●[2]	–	–	–	–	**14**
	SAE flange ports according to ISO 6162 **UNC**	fastening thread **UNC** rear	not for through drive	–	●	●	●	●	**61**
		fastening thread **UNC** laterally opposite	for through drive	–	●	●	●	●	**62**
		fastening thread **UNC** laterally and with pre compression volume (PCV)	not for through drive NG 28 with through drive at NG 60	–	○	–	●	–	**82**
	Threaded port, **UNC**	rear	not for through drive	●[3]	●	●	–	–	**64**

Through drive (for mounting options, see page 80)

11	Flange ISO 3019-1	Hub for splined shaft[1]		**10**	**28**	**45**	**60**	**85**	
	Diameter	Diameter							
	Without through drive			●	●	●	●	●	**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**
	127-4 (C)	1 1/4 in	14T 12/24DP	–	–	–	●	●	**K15**
		1 1/2 in	17T 12/24DP	–	–	–	–	●	**K16**
	127-2 (C)	1 1/4 in	14T12/24DP	–	–	–	–	●	**K07**
		1 1/2 in	17T 12/24DP	–	–	–	–	●	**K24**

Connector for solenoids		**10**	**28**	**45**	**60**	**85**	
12	Without connector (without solenoid, only for hydraulic controls, without code)	●	●	●	●	●	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	–	●	●	●	●	**P**

Swivel angle sensor				**10**	**28**	**45**	**60**	**85**	
13	Without swivel angle sensor (without code)			●	●	●	●	●	
	With electric swivel angle sensor PAL (as per data sheet 95161)[4]	ratiometric	Power supply U = 5V DC	–	○	○	–	–	**H**
		SENT/SENT		–	○	○	–	–	**P**

● = Available ○ = On request – = Not available

Notice

- Observe the general project planning notes on page 88 and the project planning notes regarding each control device.
- In addition to the type code, please specify the relevant technical data.

1) In accordance with ANSI B92.1a
2) Only with mounting flange A; order item 09
3) Only with mounting flange C; order item 09
4) Also see page 83 for further details

Type code series 53

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**53**		**–**	**V**					

Axial piston unit

		18	28	45	63	72	85	100	
01	Swashplate design, variable, nominal pressure 250 bar (3600 psi), maximum pressure 315 bar (4550 psi)	●	●	●	●	●	●	●	**A10V**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

		18	28	45	63	72	85	100
03	Geometric displacement, see table of values on page 11	**18**	**28**	**45**	**63**	**72**	**85**	**100**

Control device –

04	Pressure controller	hydraulic				●	●	▲[2]	●	●	●	●	**DR**
	with flow controller	hydraulic	X-T open			●	●	▲[2]	●	●	●	●	**DRF**
			X-T plugged	with flushing function		●	●	▲[2]	●	●	●	●	**DRS**
				without flushing function		●	●	▲[2]	●	●	●	●	**DRSC**
	with pressure cut-off	hydraulic	remote controlled			●	●	●	●	●	●	●	**DRG**
		electric	negative control		*U* = 12 V	●	●	●	●	●	●	●	**ED71**
					U = 24 V	●	●	●	●	●	●	●	**ED72**
		electric	positive control		*U* = 12 V	●	●	●	●	●	●	●	**ER71**
					U = 24 V	●	●	●	●	●	●	●	**ER72**
	Electrohydraulic control valve		positive control		*U* = 12 V to 24 V	–	–	–	●[1]	–	–	–	**EC4**
			negative control			–	–	–	○[1]	–	–	–	**EB4**
	Power controller with pressure cut-off	hydraulic	beginning of control	from	10 to 35 bar (145 to 510 psi)	●	●	○	●	●	●	●	**LA5D**
					36 to 70 bar (520 to 1015 psi)	●	●	○	●	●	●	●	**LA6D**
					71 to 105 bar (1030 to 1520 psi)	●	●	○	●	●	●	●	**LA7D**
					106 to 140 bar (1535 to 2030 psi)	●	●	○	●	●	●	●	**LA8D**
					141 to 230 bar (2045 to 3335 psi)	●	●	○	●	●	●	●	**LA9D**
	remote controlled	hydraulic	beginning of control		see LA.D	●	●	○	●	●	●	●	**LA.DG**
	flow control X-T plugged,	hydraulic with flushing function	beginning of control		see LA.D	●	●	○	●	●	●	●	**LA.DS**
		hydraulic without flushing function	beginning of control		see LA.D	●	●	○	●	●	●	●	**LA.DC**

Notice

▶ Note the project planning notes regarding each control device

● = Available ○ = On request – = Not available ▲ = Not for new projects

1) Only available with mounting flange C (order item 09)
2) Use data sheet 92706 for pressure flow controller DR, DRF, DRS, DRSC A10VO 45 series 60.

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**53**		**–**	**V**					

04				18	28	45	63	72	85	100	
	Electro proportional control	positive control									
	with pressure control		*U* = 12 V	●	●	●	●	●	●	●	**EP1D**
			U = 24 V	●	●	●	●	●	●	●	**EP2D**
	with pressure and flow control (load-sensing)	X-T open	*U* = 12 V	●	●	●	●	●	●	●	**EP1DF**
			U = 24 V	●	●	●	●	●	●	●	**EP2DF**
	with pressure and flow control (load-sensing)	X-T plugged	*U* = 12 V	●	●	●	●	●	●	●	**EP1DS**
			U = 24 V	●	●	●	●	●	●	●	**EP2DS**
	with electrohydraulic pressure control		*U* = 12 V	●	●	●	●	●	●	●	**EP1ED**
			U = 24 V	●	●	●	●	●	●	●	**EP2ED**
	Electro proportional control	positive control									
	with pressure control		*U* = 12 V	●	●	○	●	●	●	●	**EK1D**
			U = 24 V	●	●	○	●	●	●	●	**EK2D**
	pressure and flow control with controller cut-off (load sensing)	X-T open	*U* = 12 V	●	●	○	●	●	●	●	**EK1DF**
			U = 24 V	●	●	○	●	●	●	●	**EK2DF**
	pressure and flow control with controller cut-off (load sensing)	X-T plugged	*U* = 12 V	●	●	○	●	●	●	●	**EK1DS**
			U = 24 V	●	●	○	●	●	●	●	**EK2DS**
	electrohydraulic pressure control with controller cut-off		*U* = 12 V	●	●	○	●	●	●	●	**EK1ED**
			U = 24 V	●	●	○	●	●	●	●	**EK2ED**

Series			18	28	45	63	72	85	100	
05	Series 5, index 3		●	●	●	●	●	●	●	**53**

Direction of rotation			18	28	45	63	72	85	100	
06	Viewed on drive shaft	clockwise	●	●	●	●	●	●	●	**R**
		counter-clockwise	●	●	●	●	●	●	●	**L**

Sealing material		18	28	45	63	72	85	100	
07	FKM (fluorocarbon rubber)	●	●	●	●	●	●	●	**V**

Drive shaft			18	28	45	63	72	85	100	
08	Splined shaft ISO3019-1 View in data sheet streamlined. See installation drawing for detailed view.	standard shaft	●	●	●	●	●	●	●	**S**
		similar to shaft "S" however for higher torque	●	●	●	●	●	●	●	**R**
		reduced diameter, limited suitability for through drive	●	●	●	●	●	●	●	**U**
		like shaft "U" but for higher torque, only conditionally suitable for mounting with through drive. For mounting options, see page 80	–	●	●	●	●	●	●	**W**
	Parallel keyed shaft ISO 3019-1 not for through-drive		●	●	●	●	●	●	●	**K**

Mounting flange			18	28	45	63	72	85	100	
09	Based on ISO 3019-1 (SAE)	2-hole	●	●	●	●	●	●	●	**C**
		4-hole	–	–	–	●	●	●	●	**D**

● = Available ○ = On request – = Not available

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**53**		**–**	**V**					

Working port

				18	28	45	63	72	85	100	
10	SAE flange ports according to ISO 6162 **metric**	fastening thread **metric** rear	not for through drive	●	●	●	●	●	●	●	**11**
		fastening thread **metric** laterally opposite	for through drive	●	●	●	●	●	●	●	**12**
		fastening thread **metric** laterally offset 90°	not for through drive; available for counter-clockwise rotation only	–	–	●	–	–	–	–	**13**
		fastening thread **Metric** Lateral and with pre compression volume (PCV)	not for through drive NG 18, 28 with through drive for NG 63, 72	○[1]	○[1]	–	●[1]	●[1]	–	–	**32**
	SAE flange ports according to ISO 6162 **UNC**	fastening thread **UNC** rear	not for through drive	●	●	●	●	●	●	●	**61**
		fastening thread **UNC** laterally opposite	for through drive	●	●	●	●	●	●	●	**62**
		fastening thread **UNC** laterally and with pre compression volume (PCV)	not for through drive NG 18, 28 with through drive for NG 63, 72	○[1]	○[1]	–	●[1]	●[1]	–	–	**82**

Through drive (for mounting options, see page 80)

				18	28	45	63	72	85	100	
11	Flange ISO 3019-1	Hub for splined shaft[2]									
	Diameter	Diameter									
	Without through drive			●	●	●	●	●	●	●	**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**
	127-4 (C)	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	●	**K15**
		1 1/2 in	17T 12/24DP	–	–	–	–	–	●	●	**K16**
	127-2 (C)	1 1/4 in	14T12/24DP	–	–	–	–	–	●	●	**K07**
		1 1/2 in	17T 12/24DP	–	–	–	–	–	●	●	**K24**

Connector for solenoids

		18	28	45	63	72	85	100	
12	Without connector (without solenoid, only for hydraulic controls, without code)	●	●	●	●	●	●	●	
	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	●	●	●	●	●	●	●	**P**

Swivel angle sensor

				18	28	45	63	72	85	100	
13	Without swivel angle sensor (without code)			●	●	●	●	●	●	●	
	With electric swivel angle sensor PAL (as per data sheet 95161)[4]	ratiometric	Power supply U = 5V DC	–	–	–	●[3]	●[3]	–	–	**H**
		SENT/SENT		–	–	–	○[3]	○[3]	–	–	**P**

● = Available ○ = On request – = Not available

Notice

- ▶ Note the project planning notes on page 88.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.

1) Not possible when ordering port plate 32 (82) in combination with the LAxx, EPxx and EKxx controls.
2) In accordance with ANSI B92.1a
3) Only available with mounting flange C (order position 09)
4) Also see page 83 for further details

Hydraulic fluids

The A10VO variable pump is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids

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:

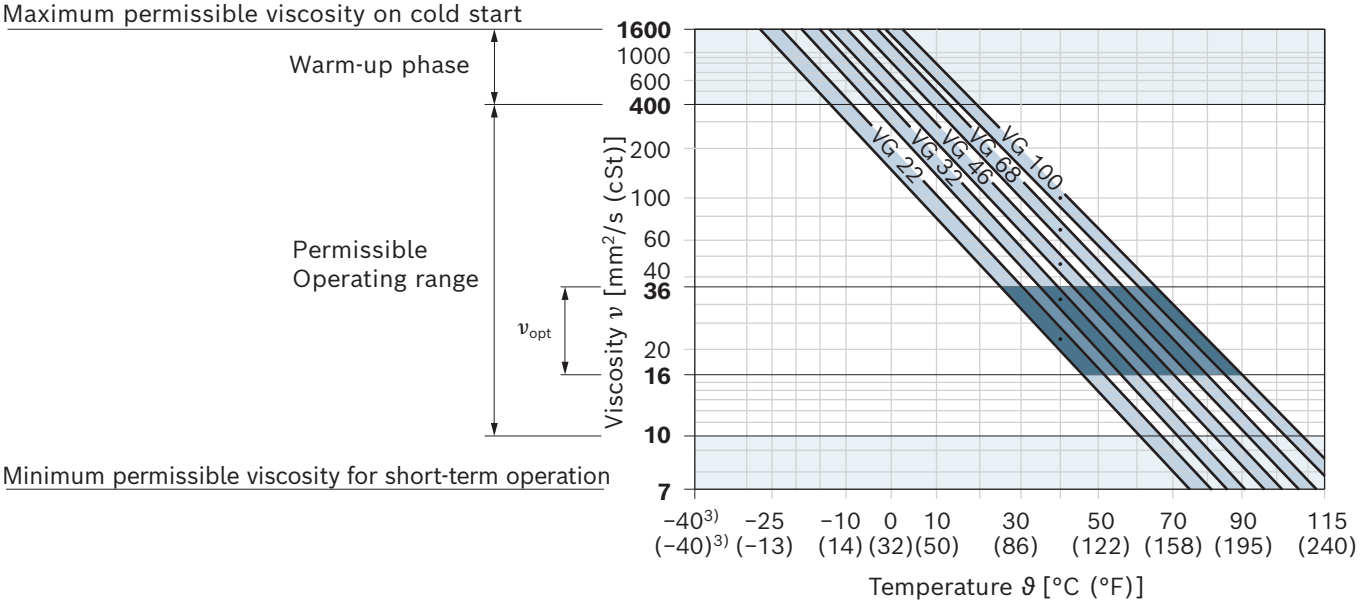
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

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

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[2]	Comment
Cold start	v_{max} ≤ 1600 mm²/s (cSt)	FKM	ϑ_{St} ≥ −25 °C (−13 °F)	t ≤ 3 min, without load (p ≤ 50 bar (725 psi)), n ≤ 1000 rpm Permissible temperature difference between the axial piston unit and hydraulic fluid in the system max. 25 K (45 °F)
Warm-up phase	v = 1600 ... 400 mm²/s (cSt)			t ≤ 15 min, p ≤ 0.7 × p_{nom} und n ≤ 0.5 × n_{nom}
Permissible operating range	v = 400 ... 10 mm²/s (cSt)[1]	FKM	ϑ ≤ +110 °C (+230 °F)	Measured at port **L_x**
	v_{opt} = 36 ... 16 mm²/s (cSt)			Optimal operating viscosity and efficiency range
Short-term operation	v_{min} = 10 ... 7 mm²/s (cSt)	FKM		t ≤ 3 min, p ≤ 0.3 × p_{nom}, measured at port **L_x**

▼ **Selection diagram**



1) This corresponds, e.g. with the VG 46, to a temperature range of +4 °C to +85 °C (+39 °F to +113 °F) (see selection diagram)

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

3) For applications in the low-temperature range, please contact us.

Filtration of the hydraulic fluid

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

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406

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

Examples of hydraulic fluid temperatures at a viscosity of 10 mm^2/s (cSt):

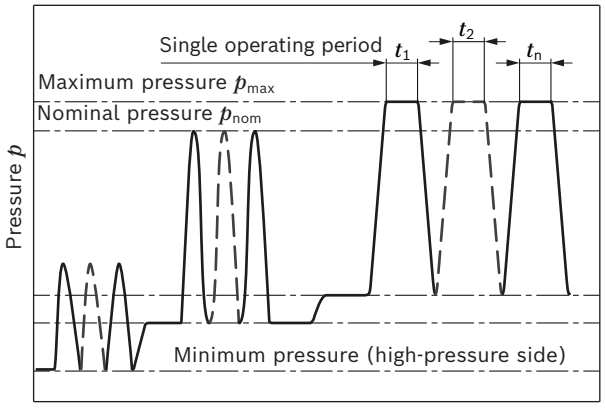
- 73 °C (163 °F) at HLP 32
- 85 °C (185 °F) at HLP 46

Working pressure range

Pressure at working port B		**Definition**
Nominal pressure p_{nom}	250 bar (3600 psi)	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	315 bar (4550 psi)	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
Single operating period	2.5 ms	
Total operating period	300 h	
Minimum pressure $p_{B\ absolute}$ (high-pressure side)	10 bar (145 psi)	Minimum pressure on the high-pressure side (**B**) required to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	16000 bar/s (232000psi/s)	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure $p_{S\ min}$ Standard	0.8 bar (12 psi) absolute	Minimum pressure at suction port **S** (inlet) which is required to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{S\ max}$	5 bar (75 psi) absolute	
Case pressure at port L, L_1, L_2		
Maximum pressure $p_{L\ max}$	2 bar (30 psi) absolute	Maximum 0.5 bar (7.5 psi) higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. The case pressure must always exceed the ambient pressure. A drain line to the reservoir is required.
Pilot pressure port X with external high pressure		
Maximum pressure p_{max}	315 bar (4550 psi)	When designing all control lines with external high pressure, the values for the rate of pressure change, maximum single operating period and total operating period applicable to port **B** must not be exceeded.

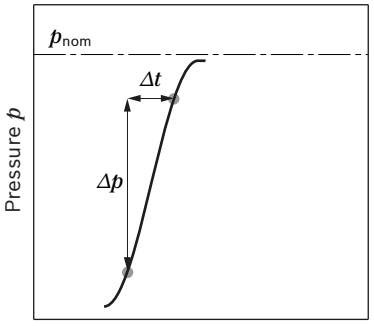
Notice
Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

▼ **Pressure definition**



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

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



Pre compression volume for pulsation reduction (PCV)
The PCV reduces the pressure pulsation applied to the system by the pump. Reducing the flow pulsation can lead to a reduction of pressure pulsation of up to 50% at the operating point and on the system side.
Depending on the mechanical design of the working machine, in our experience machine noise is reduced quite significantly.
With port plate 32 (82), the pre compression volume is included in the scope of delivery.

Notice

If an axial piston pump is operated with operating data of <5 % swivel angle and <10 bar working pressure, there is a risk of damage. These states can be caused, for example, when using the electrohydraulic control valve EC4 or electro-proportional control EP in de-energized operation – but in principle also in connection with other control concepts.

Therefore, the following restricted operating conditions apply for operation with <5 % swivel angle and <10 bar

- Viscosity-dependent rotational speed limits must be observed:
  - Viscosity range >16 mm²/s and ≤200 mm²/s: Maximum 70% of the nominal maximum rotational speed (n_{nom})
  - Viscosity range >200 mm²/s: Rotational speed ≤800 rpm
- Dynamic swivel-out operations from <5% swivel angle and <10 bar working pressure are not permitted.
- A swivel-out dynamic in ms corresponding to three times the nominal pump size is permissible.
  Example for A10VO45: 3 × 45= 135 ms.

Technical data

Size		NG		10	18	28	45	60	63	72	85	100
Geometric displacement, per revolution		$V_{g\,max}$	cm^3	10.5	18	28	45	60	63	72	85	100
			$inch^3$	0.64	1.10	1.75	2.75	3.66	3.84	4.39	5.18	6.10
Maximum rotational speed[1]	at $V_{g\,max}$	n_{nom}	rpm	3600	3300	3000	2600[5]	2700	2600	2600	2500	2300
	at $V_g < V_{g\,max}$[2]	$n_{max\ perm.}$	rpm	4320	3960	3600	3120	3140	3140	3140	3000	2500
Minimum rotational speed	at $V_{g\,max}$	n_{min}	rpm	500	500	500	500	500	500	500	500	500
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	37	59	84	117	162	163	187	212	230
			gpm	9.7	15.6	22	31	42	43	49.4	55	60
	at n_E = 1500 rpm	q_{vE}	l/min	15	27	42	68	90	95	108	128	150
			gpm	4	7.1	11.1	18	24	25.1	28.5	34	39
Power	at n_{nom}, $V_{g\,max}$ and Δp = 250 bar (3600 psi)	P	kW	16	25	35	49	65	68	77	89	96
			HP	22	34	47	65	88	90	103	119	130
	at n_E = 1500 rpm	P_E	kW (HP)	7 (9.4)	11 (15)	18 (24)	28 (38)	37 (50)	39 (52)	45 (60)	53 (71)	62 (84)
Torque	at $V_{g\,max}$ and Δp = 250 bar (3600 psi)	M	Nm	42	71	111	179	238	250	286	338	398
			lb-ft	31	52	82	132	175	184	211	247	293
	at $V_{g\,max}$ and Δp = 100 bar (1450 psi)	M	Nm	17	29	45	72	95	100	114	135	159
			lb-ft	13	21	33	53	70	74	84	102	117
Rotary stiffness of drive shaft	S	c	kNm/rad	9.2	11.0	22.3	37.5	65.5	65.5	65.5	143.0	143.0
			lb-ft/rad	6760	8082	16400	27560	48100	48100	48100	105100	105100
	R	c	kNm/rad	–	14800	26300	41000	69400	69400	69400	152900	152900
			lb-ft/rad	–	10870	19400	30240	51200	51200	51200	112773	112773
	U	c	kNm/rad	6.8	8.0	16.7	30.0	49.2	49.2	49.2	102.9	102.9
			lb-ft/rad	5020	5870	12317	22130	36290	36290	36290	75900	75900
	W	c	kNm/rad	–	–	19.9	34.4	54.0	54.0	54.0	117.9	117.9
			lb-ft/rad	–	–	14678	25270	39830	39830	39830	86960	86960
	P	c	kNm/rad	10.7	–	–	–	–	–	–	–	–
			lb-ft/rad	7892	–	–	–	–	–	–	–	–
	K	c	kNm/rad	10.8	13.3	26.8	43.9	73.9	73.9	73.9	163.4	163.4
			lb-ft/rad	7965	9810	19770	32380	54506	54506	54506	120518	120518
	C	c	kNm/rad	–	–	4)	4)	4)	–	–	–	–
			lb-ft/rad	–	–	4)	4)	4)	–	–	–	–
Moment of inertia of the rotary group		J_{TW}	kgm^2	0.0006	0.0009	0.0017	0.003	0.0056	0.0056	0.0056	0,012	0,012
			$lb\text{-}ft^2$	0.0142	0.2207	0.0403	0.0783	0.1329	0.1329	0.1329	0.2848	0.2848
Maximum angular acceleration[3]		α	rad/s^2	8000	6800	5500	4000	3300	3300	3300	2700	2700
Case volume		V	l	0.2	0.25	0.3	0.5	0.8	0.8	0.8	1	1
			gal	0.05	0.06	0.08	0.13	0.21	0.21	0.21	0.26	0.26
Weight **without** through drive (approx.)		m	kg	8	11.5	15	18	22	22	22	36	36
			lbs	17	25	33	40	48.5	48.5	48.5	79	79
Weight **with** through drive (approx.)			kg	–	13	18	24	28	28	28	45	45
			lbs	–	28.6	40	53	62	62	62	99	99

1) The values are applicable:
   – at absolute pressure p_{abs} = 1 bar (15 psi) at suction port **S**
   – for the optimum viscosity range from v_{opt} = 36 to 16 mm^2/s (cSt)
   – with hydraulic fluid based on mineral oils

2) See diagram on page 12 at speed increase up to $n_{max\ perm.}$

3) The data are valid for values between the minimum required and maximum permissible rotational speed. Valid for external excitation (e.g. diesel engine 2 to 8 times the rotary frequency; cardan shaft 2 times the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

4) On request

5) Higher rotational speeds on request.

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

Determination of the characteristics						
Flow	q_v	=	$\frac{V_g \times n \times \eta_v}{231}$			[gpm]
Torque	M	=	$\frac{V_g \times \Delta p}{24 \times \pi \times \eta_{hm}}$			[lb-ft]
Power	P	=	$\frac{2 \pi \times M \times n}{33000}$	=	$\frac{q_v \times \Delta p}{1714 \times \eta_t}$	[HP]

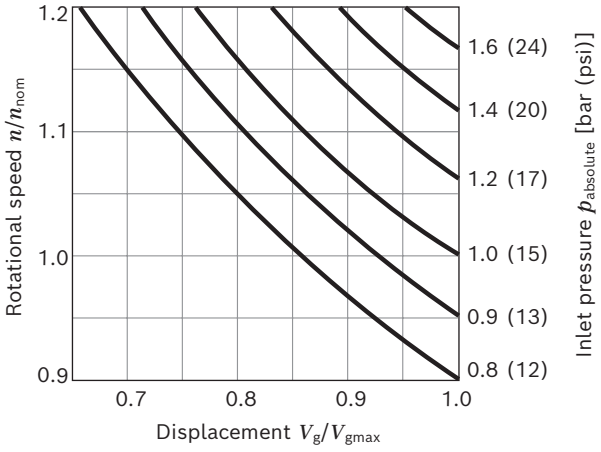
Key

V_g Displacement per revolution [cm³ (inch³)]
Δp Differential pressure [bar (psi)]
n Rotational speed [rpm]
η_v Volumetric efficiency
η_{hm} Hydraulic-mechanical efficiency
η_t Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

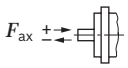
Notice

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

▼ **Maximum permissible rotational speed (speed limit)**
Permissible rotational speed by increasing inlet pressure $p_{absolute}$ at suction opening S or at $V_g < V_{gmax}$



Permissible radial and axial loading of the drive shaft

Size		NG		10	18	28	45	60/63	72	85	100
Maximum radial force at a/2		$F_{q\ max}$	N	250	350	1200	1500	1700	1500	2000	2000
			lbf	56	78	270	337	382	337	450	450
Maximum axial force		$\pm F_{ax\ max}$	N	400	700	1000	1500	2000	1500	3000	3000
			lbf	90	157	225	337	450	337	675	675

Notice

- The values given are maximum values and do not apply to continuous operation. All loads of the drive shaft reduce the bearing service life.

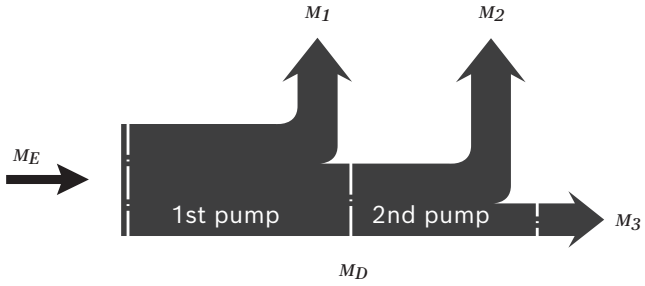
Permissible input and through-drive torques

Size				10	18	28	45	60	63	72	85	100
Torque at $V_{g\,max}$ and Δp = 250 bar (3600 psi)[1]		M_{max}	Nm	42	71	111	179	238	250	286	338	398
			lb-ft	31	52	82	132	176	184	211	247	293
Max. input torque on drive shaft[2]												
	S	$M_{E\,max}$	Nm	126	124	198	319	630	630	630	1157	1157
			lb-ft	93	91	146	235	464	464	464	853	853
		Ø	in	3/4	3/4	7/8	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2
	R	$M_{E\,max}$	Nm	–	160	250	400	650	650	650	1215	1215
			lb-ft	–	118	184	295	479	479	479	895	895
		Ø	in	–	3/4	7/8	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2
	U	$M_{E\,max}$	Nm	60	59	105	188	306	306	306	628	628
			lb-ft	44	43	77	139	226	226	226	463	463
		Ø	in	5/8	5/8	3/4	7/8	1	1	1	1 1/4	1 1/4
	W	$M_{E\,max}$	Nm	–	–	140	220	396	396	383	650	650
			lb-ft	–	–	103	162	292	292	282	479	479
		Ø	in	–	–	3/4	7/8	1	1	1	1 1/4	1 1/4
	P	$M_{E\,max}$	Nm	90	–	–	–	–	–	–	–	–
			lb-ft	66	–	–	–	–	–	–	–	–
		Ø	mm	18	–	–	–	–	–	–	–	–
			in	0.71	–	–	–	–	–	–	–	–
	K	$M_{E\,max}$	Nm	106	104	145	212	441	441	441	750	750
			lb-ft	78	76	107	156	325	325	325	553	553
		Ø	in	3/4	3/4	7/8	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2
	C	$M_{E\,max}$	Nm	–	–	145	212	441	441	–	–	–
			lb-ft	–	–	107	156	325	325	–	–	–
Maximum through-drive torque												
	S	$M_{D\,max}$	Nm	–	108	160	319	484	484	484	698	698
			lb-ft	–	80	118	235	357	357	357	515	515
	R	$M_{D\,max}$	Nm	–	120	176	365	484	484	484	698	–
			lb-ft	–	89	130	270	357	357	357	515	–
	U	$M_{D\,max}$	Nm	–	59	105	188	306	306	306	628	628
			lb-ft	–	43	77	139	226	226	226	463	463
	W	$M_{D\,max}$	Nm	–	–	140	220	396	396	383	650	650
			lb-ft	–	–	103	162	292	292	282	479	479
	K	$M_{D\,max}$	Nm	–	104	145	212	441	441	441	–	750
			lb-ft	–	76	107	156	325	325	325	–	553

1) Efficiency not considered

2) For drive shafts with no radial force

▼ **Distribution of torques**



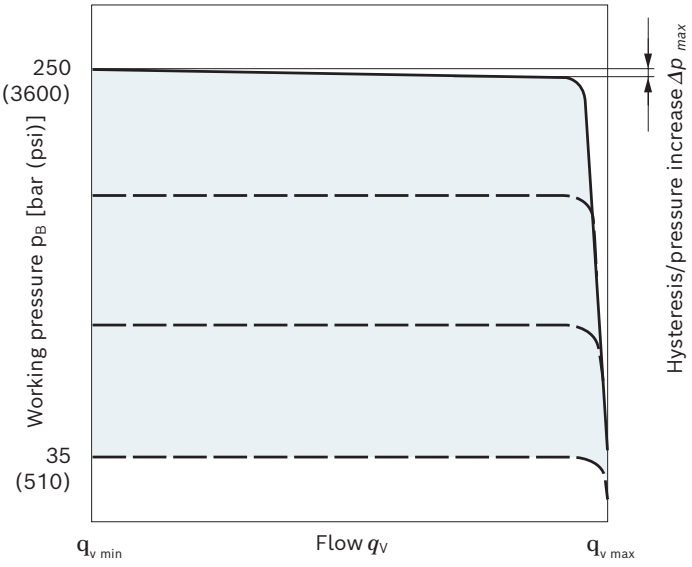
Torque at 1st pump	M_1		
Torque at 2nd pump	M_2		
Torque at 3rd pump	M_3		
Input torque	M_E	=	$M_1 + M_2 + M_3$
	M_E	<	$M_{E\,max}$
Through-drive torque	M_D	=	$M_2 + M_3$
	M_D	<	$M_{D\,max}$

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.

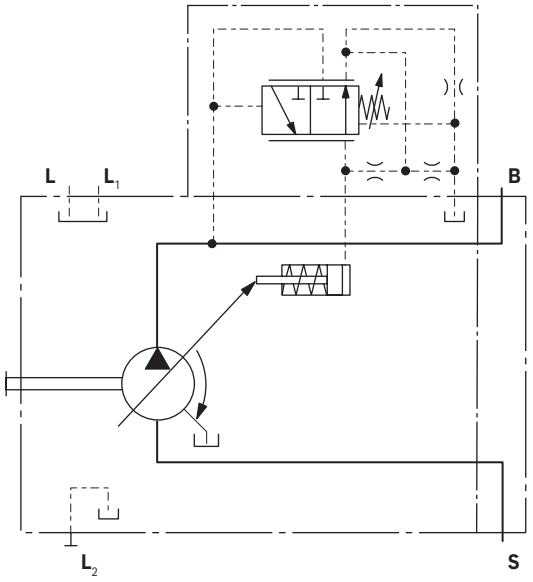
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 35 to 250 bar (510 to 3600 psi).
  Standard is 250 bar (3600 psi).

▼ **Characteristic curve DR**



Characteristic curve valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120° F).

▼ **Circuit diagram DR**



Controller data

Size		10	18	28	60 63	72	85	100
Pressure increase	Δp [bar]	6	6	6	8	8	12	14
	Δp [psi]	90	90	90	115	115	175	200
Hysteresis	Δp [bar]	Maximum 4						
	Δp [psi]	Maximum 60						
Pilot fluid consumption	[l/min]	Maximum approx. 3						
	[gpm]	Maximum approx. 0.8						

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.

DRG – Pressure controller, remotely controlled

For the remote controlled pressure controller, the LS pressure relief 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 15.
A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control. When there is differential pressure of 20 bar (290 psi) Δp, the pilot fluid quantity at the port is **X** approx. 1.5 l/min (0.4 gpm).
If another setting is required (range from 14 to 22 bar (200 to 320 psi)) please state in plain text. As a separate pressure relief valve (**1**) we recommend:

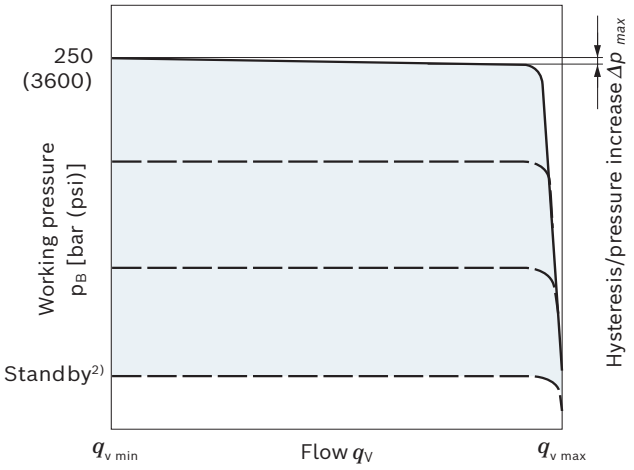
- A direct operated, hydraulic or electric proportional one, suitable for the pilot fluid quantity mentioned above.

The maximum line length should not exceed 2 m (6.6 ft).

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control 35 to 250 bar (510 to 3600 psi) (**3**). Standard is 250 bar (3600 psi).
- Setting range for differential pressure 14 to 22 bar (200 to 320 psi) (**2**), standard is 20 bar (290 psi).

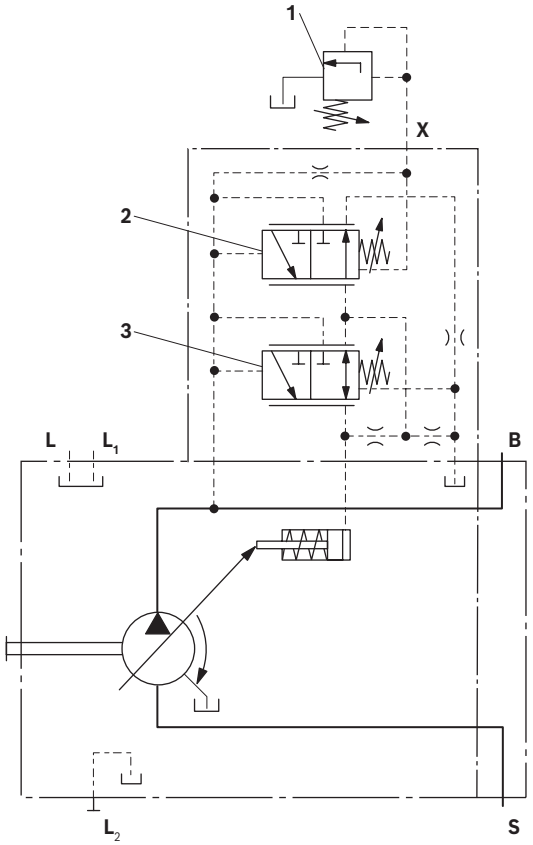
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp, however system influences are not taken into account.

▼ **Characteristic curve DRG**



Characteristic curve valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

▼ **Circuit diagram DRG**



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

Controller data

Size		10	18	28	45	60 63	72	85	100
Pressure increase	Δp [bar]	6	6	6	6	8	8	12	14
	Δp [psi]	87	87	87	87	115	115	175	200
Hysteresis	Δp [bar]	Maximum 4							
	Δp [psi]	Maximum 60							
Pilot fluid consumption	[l/min]	Maximum approx. 3							
	[gpm]	Maximum approx. 0.8							

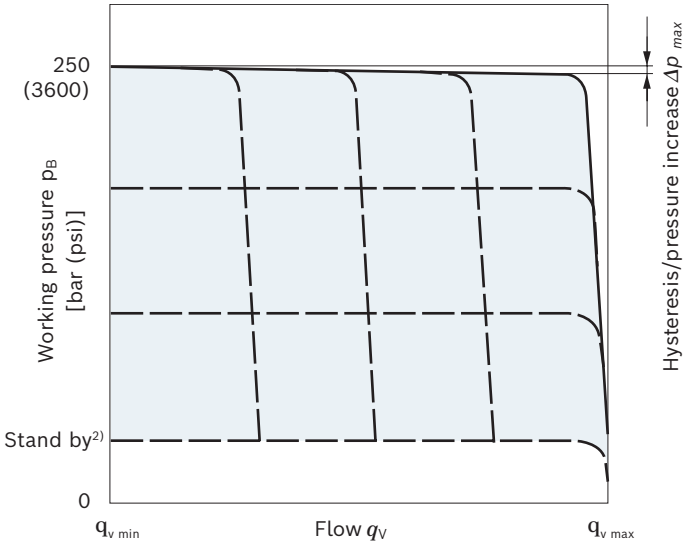
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting Δp on controller (**2**)

DRF (DFR) / DRS (DFR1) / DRSC – pressure flow controller

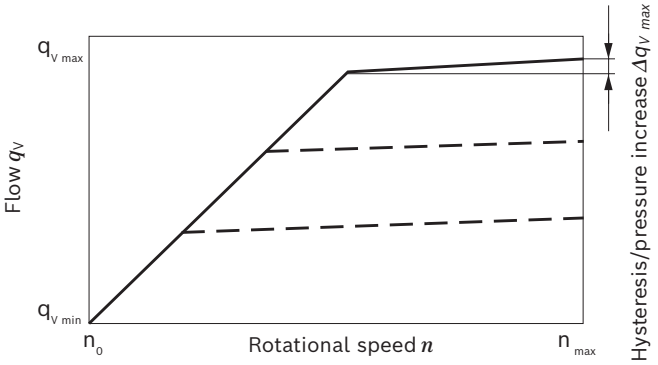
In addition to the pressure controller function (see page 15), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required 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 250 bar (3600 psi).
- DR pressure controller data see page 15

▼ **Characteristic curve DRF (DFR) / DRS (DFR1) / DRSC**



▼ **Characteristic curve at variable rotational speed**



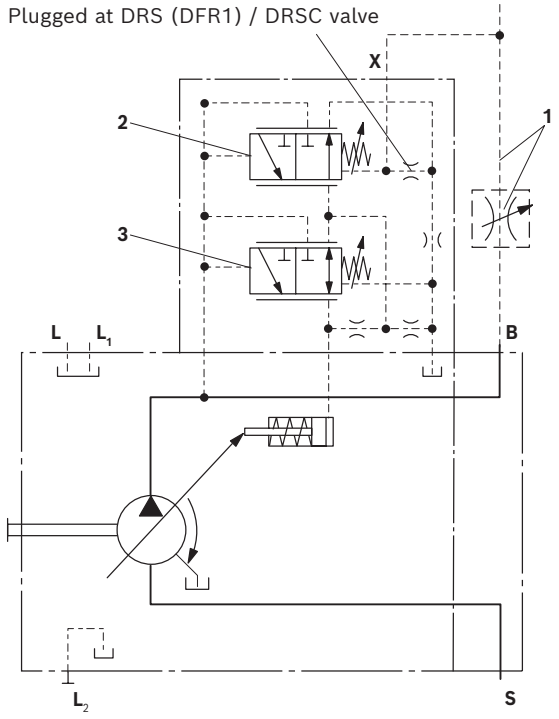
Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

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 differential pressure setting Δp on controller (**2**)

Possible connections at port **B** (not included in the scope of delivery)

LS mobile control blocks	Data sheets
M4-12	64276
M4-15	64283
LUDV mobile control blocks	
M7-22	64295

▼ **Circuit diagram DRF (DFR)**



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

Notice
The DRS (DFR1) 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 sufficient unloading of the flow controller in DRS (DFR1) control valve **X**-line must also be provided.
If this unloading of the **X** line cannot be ensured, the DRF control valve must be used.

For further information see page 18

Differential pressure Δp:

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

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

Controller data

- DR pressure controller data, see page 15.
- Maximum flow deviation measured at drive speed n = 1500 rpm.

Size		10	18	28	60 63	72	85	100
Flow deviation	Δq_{vmax} [l/min]	0.5	0.9	1.0	2.5	2.5	3.1	3.1
	Δq_{vmax} [gpm]	0.13	0.24	0.26	0.66	0.66	0.83	0.83
Hysteresis	Δp [bar]	Maximum 4						
	Δp [psi]	Maximum 60						
Pilot fluid consumption	[l/min]	maximum approx. 3 to 4.5 (DRF (DFR)) maximum approx. 3 ((DFR1) / DRSC)						
	[gpm]	maximum approx. 0.8 to 1.2 (DRF (DFR)) maximum approx. 0.8 (DRSC)						

LA... – Pressure, flow and power controller

Pressure controller equipped as DR(G),
see page 15 (16). Equipment of the flow controller like DRS (DFR1), see page 17.
In order to achieve a constant drive torque with varying working pressures, the swivel angle and with it the volume flow from the axial piston pump is varied so that the product of flow and pressure remains constant.
Flow control is possible below the power control curve.

When ordering please state the power characteristics to be set at the factory in plain text, e.g. 20 kW (27 HP) at 1500 rpm.

Controller data

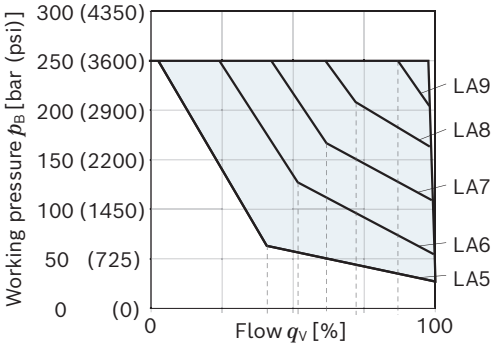
- Pressure controller DR see page 15.
- Pressure and flow controller DR see page 17.
- Pilot fluid consumption max. approx. 5.5 l/min (1.45 gpm).

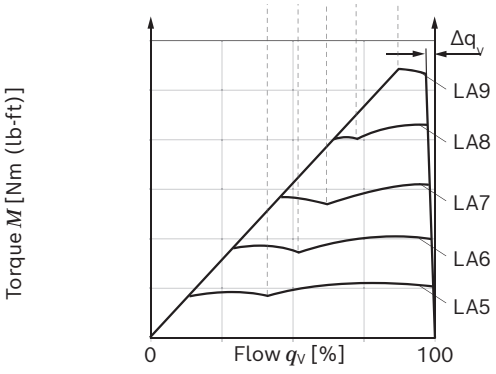
Beginning of control	**Torque M** [Nm (lb-ft)] **for size**							**Code**
[bar (psi)]	**18**	**28**	**45**	**63**	**72**	**85**	**100**	
10 to 35	3.8 – 12.1	6 – 19	10 – 30	15 – 43	17 – 49.2	20 – 57	24 – 68	**LA5**
(145 to 510)	(2.80 – 8.92)	(4.4 – 14)	(7.4 – 22.1)	(11 – 32)	(12.5 – 36.3)	(15 – 42)	(18 – 49.5)	
36 to 70	12.2 – 23.3	19.1 – 36	30.1 – 59	43.1 – 83	49.3 – 94.9	57.1 – 112	68.1 – 132	**LA6**
(520 to 1015)	8.92 / 17.2	(14 – 26.5)	(22.2 – 43.5)	(32 – 61)	(36.4 – 69.9)	(42 – 83)	(49.5 – 97.1)	
71 to 105	23.4 – 33.7	36.1 – 52	59.1 – 84	83.1 – 119	95.0 – 136.0	112.1 – 160	132.1 – 189	**LA7**
(1030 to 1520)	(17.2 –24.9)	(26.6 – 38.4)	(43.6 – 62)	(61 – 88)	(70 – 100.3)	(83 – 118)	(97.1 – 139.4)	
106 to 140	33.8 – 45	52.1 – 70	84.1 – 112	119.1 – 157	136.1 – 179.4	160.1 – 212	189.1 – 249	**LA8**
(1535 to 2030)	(24.9 –33.2)	(38.4 – 51.6)	(62 – 83)	(88 – 116)	(100.4 – 132.3)	(118 – 156)	(139.4 – 183.6)	
141 – 230	45.1 – 74.8	70.1 – 111	112.1 – 174	157.1 – 240	179.5 – 274	212.1 – 255	249.1 – 263	**LA9**
(2045 to 3335)	(33.2 – 55.2)	(51.7 – 82.4)	(83 – 128)	(116 – 178)	(132.4 – 203)	(156 – 189)	(183.3 – 195)	

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

$P = \frac{M}{6.4\ (3.5)}$ [kW (HP)] (At 1500 rpm) or $P = \frac{2\pi \times M \times n}{60000\ (33000)}$ [kW (HP)] (For rotational speeds see table on page 11)

▼ **Characteristic curve LA.DS**

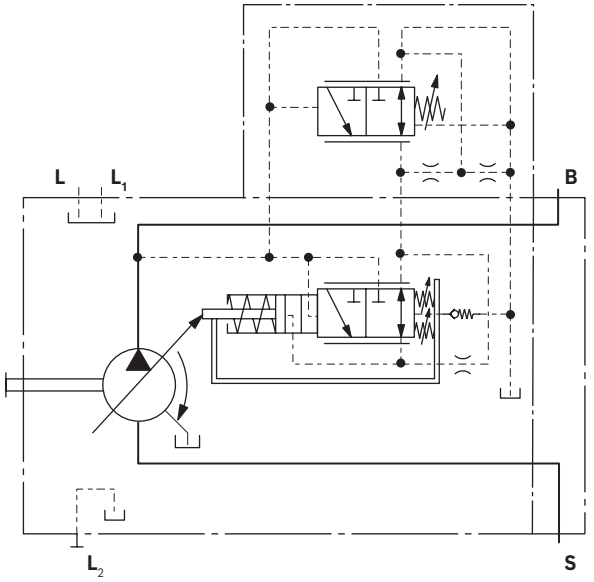




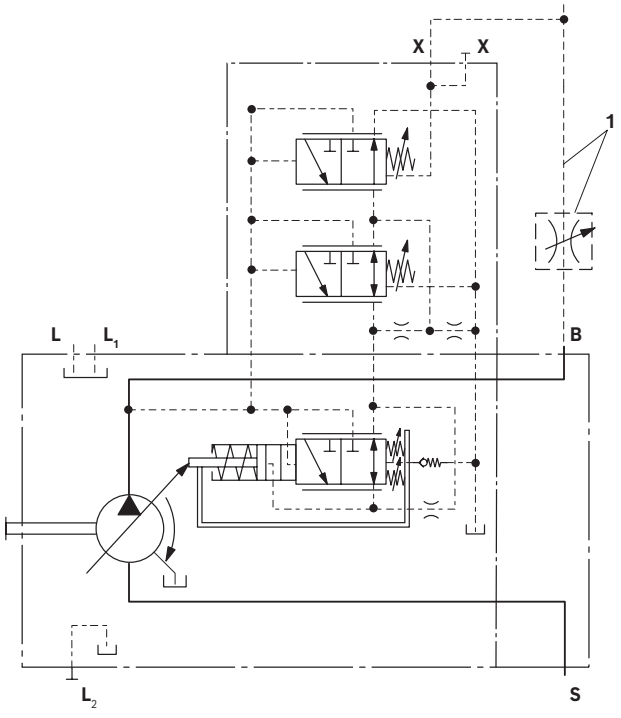
▶ **Combination options with LA.. see page 20**

LA... – Variations

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

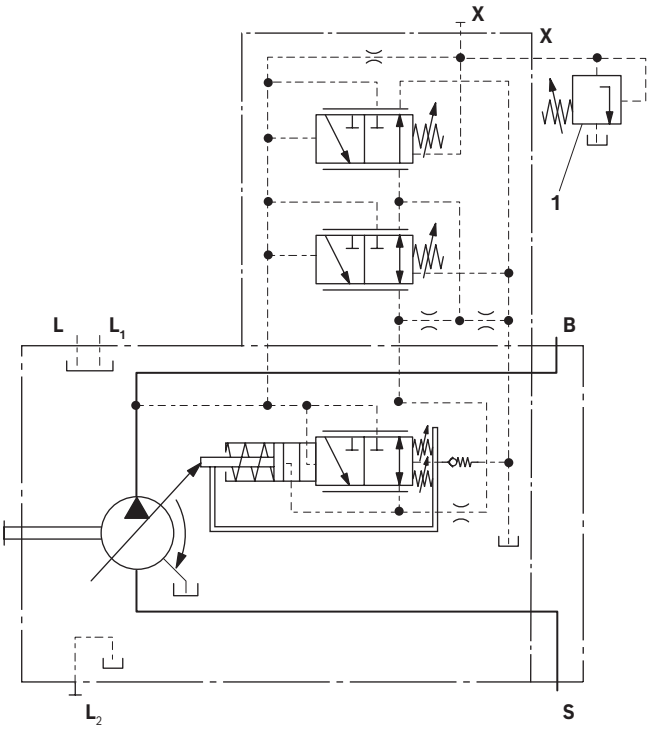


▼ **Circuit diagram LA.DS**



1 The metering orifice (control block) and the line is not included in the scope of delivery.

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

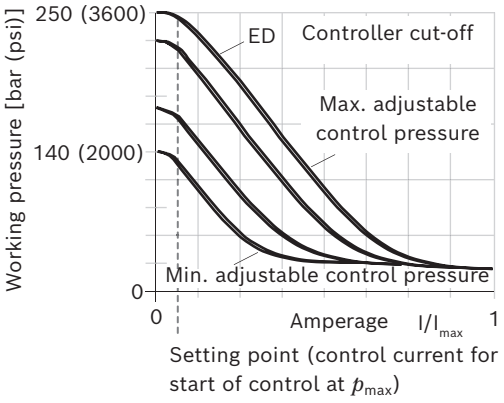


1 The pressure relief valve and the line are not included in the scope of delivery.

ED – Electrohydraulic pressure control

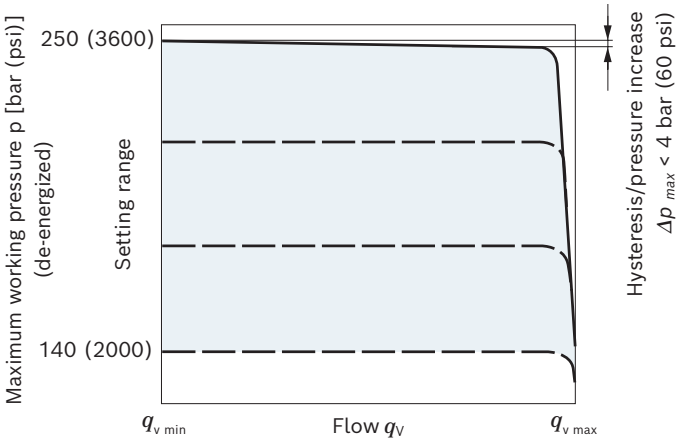
The ED valve is set to a certain pressure by a specified variable solenoid current.
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
The pump thus only delivers as much hydraulic fluid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

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



▶ Hysteresis static < 25 bar (365 psi).

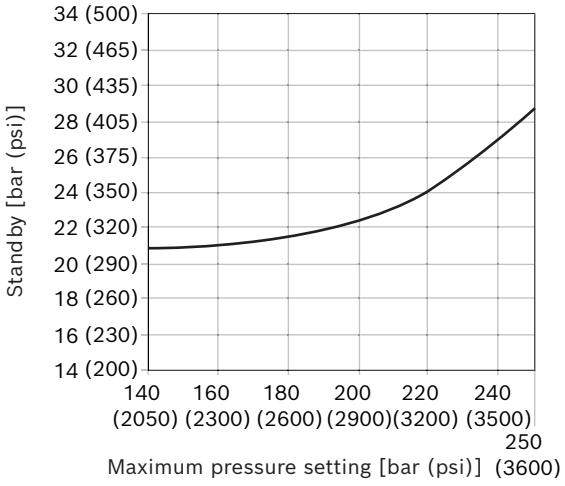
▼ **Flow-pressure characteristic curve**



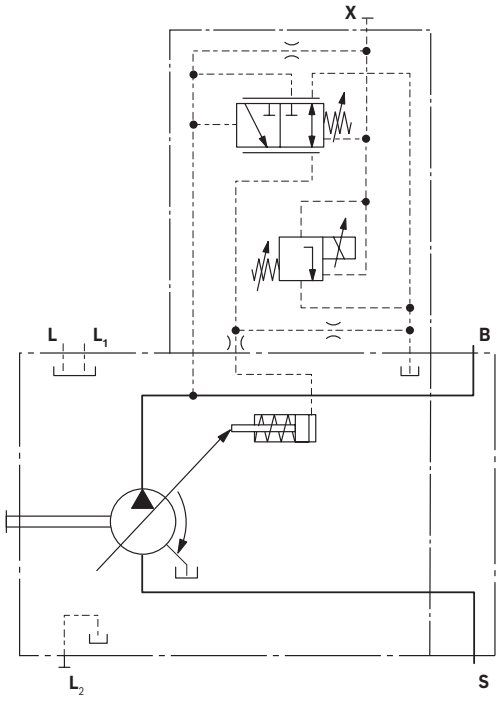
▶ Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).

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

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



▼ **Circuit diagram ED71/ED72**



Technical data, solenoids	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at p_{max}	100 mA	50 mA
End of control at p_{min}	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%
Type of protection: see connector version page 16		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

The following electronic control units are available for control:

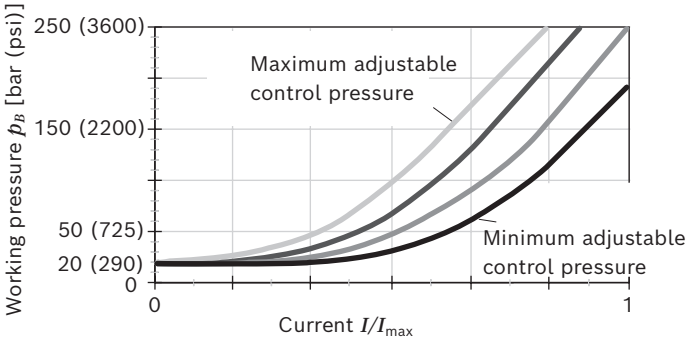
BODAS controllers	Data sheet
RC5-6, series 40	95207
RC18-12, series 40	95208
RC27-18, series 40	95208

Notice!
With **ED71**, de-energized operating condition (jump from 100 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).
With **ED72**, de-energized operating condition (jump from 50 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).

ER – Electrohydraulic pressure control

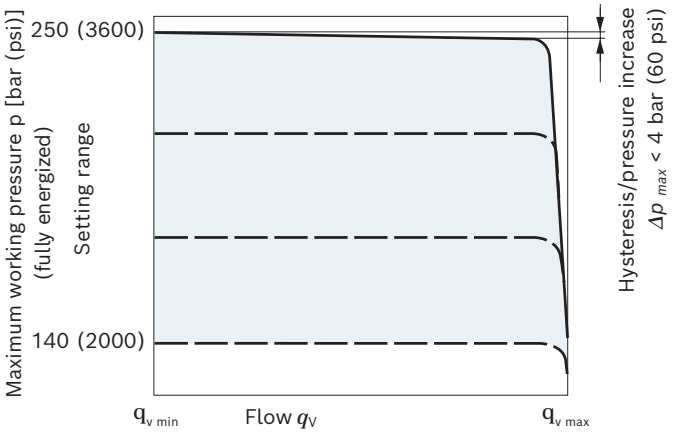
The ER valve is set to a certain pressure by a specified variable solenoid current.
When a change is made at the consumer (load pressure), the position of the control piston will shift.
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure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

▼ **Current-pressure characteristic curve ER (positive characteristic curve)**



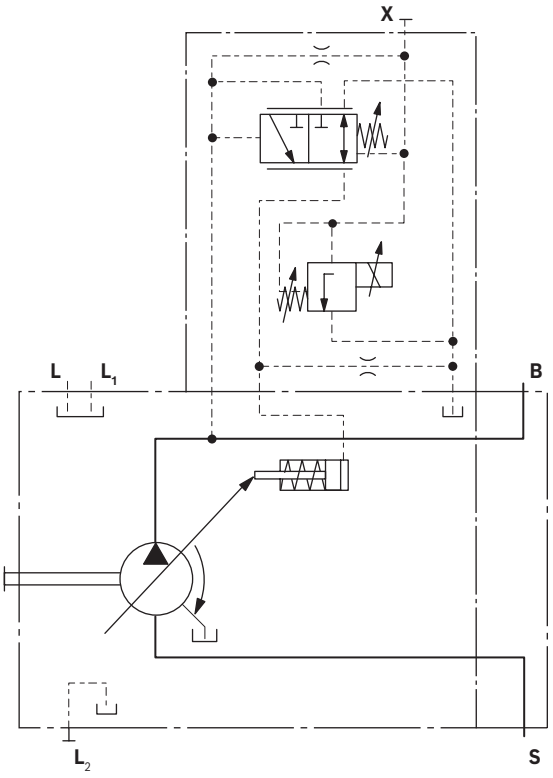
▶ Hysteresis static current-pressure characteristic curve < 25 bar (365 psi).

▼ **Flow-pressure characteristic curve**



▶ Characteristic curves valid at n_1 = 1500 rpm and ϑ_{fluid} = 50 °C (120 °F).
▶ Pilot fluid consumption 3 to 4.5 l/min (0.8 to 1.2 gpm).
▶ Standby standard 20 bar (290 psi). Other values on request.
▶ Influence of pressure setting on standby ± 2 bar (±30 psi).

▼ **Circuit diagram ER71/ER72**



Technical data, solenoids	ER71	ER72
Voltage	12 V (±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 (68 °F))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Duty cycle	100%	100%
Type of protection: see connector version page 82		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

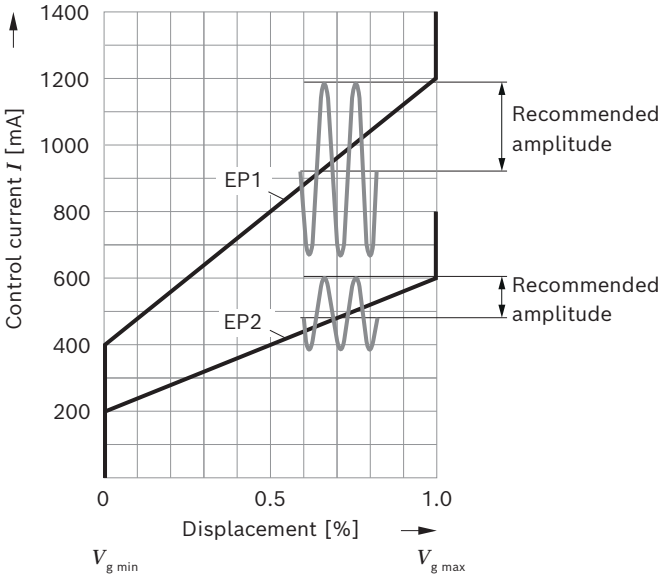
Project planning note!
Excessive current levels (I > 1200 mA at 12 V or I > 600 mA at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage. Therefore:
▶ Use I_{max} current limiter solenoids.

EP – Electro-proportional control

Electro proportional control makes a continuous and reproducible setting of the pump displacement possible directly via the cradle. The control force of the control piston is applied by a proportional solenoid. The control is proportional to the current (for start of control, see table right).
In a depressurized state, the pump is swiveled to its initial position ($V_{g\,max}$) by an adjusting spring. If the working pressure exceeds a limit value of approx. 4 bar (60 psi), the pump starts to swivel from $V_{g\,max}$ to $V_{g\,min}$ without control by the solenoid (control current <start of control). With a minimum swivel angle $V_{g\,min}$ and de-energized EP solenoids, a minimum pressure of 10 bar (145 psi) must be maintained.
A PWM signal is used to control the solenoid.

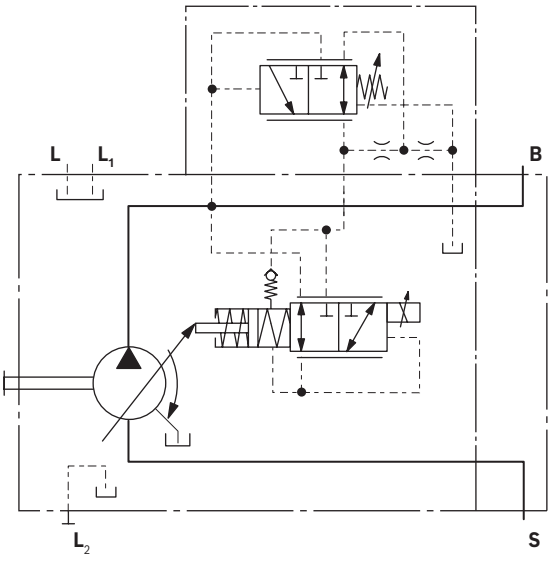
EP.D: The pressure control regulates the pump displacement back to $V_{g\,min}$ after the pressure command value has been reached.
A minimum working pressure of 14 bar (200 psi) is needed for safe and reproducible control. The required pilot fluid is taken from the high pressure.

▼ **Characteristic curve EP1/2**



▶ Hysteresis static current-displacement characteristic curve <5 %.

▼ **Circuit diagram EP.D**



Technical data, solenoids	EP1	EP2
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 82		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

Notice!
- ▶ We recommend the valve with flushing function for the EP.D control variant. Please contact us.
- ▶ For information on operating limits at 0 mA (also short-term), see page 10.

The following electronic control units are available for control:

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

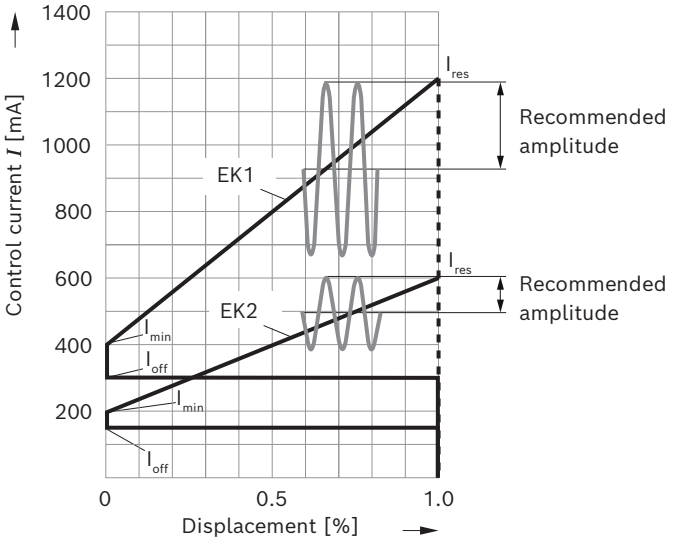
EK – Electro-proportional control with controller cut-off

Variant EK... is based completely on the variant EP... (see page 24).
In addition to the electro proportional control function, a controller cut-off is integrated in the electric characteristic curve. The pump then swivels to $V_{g\,max}$ if the pilot signal is lost (e.g. cable break) and then works with the DRF settings if necessary (see page 17). The controller cut-off is only intended for short-term use and not for continuous operation if the pilot signal is lost.
If the pilot signal is lost, the pump swivel times will be increased by the EK valve. A PWM signal is used to control the solenoid.

Notice!
A minimum working pressure of 50 bar (725 psi) is needed for safe and reproducible electro proportional control with controller cut-off. For lower pressures, a pilot signal of > 500 mA (EK2) or > 1000 mA (EK1) is required in order to avoid undesired controller cut-off. The required pilot fluid is taken from the high pressure.

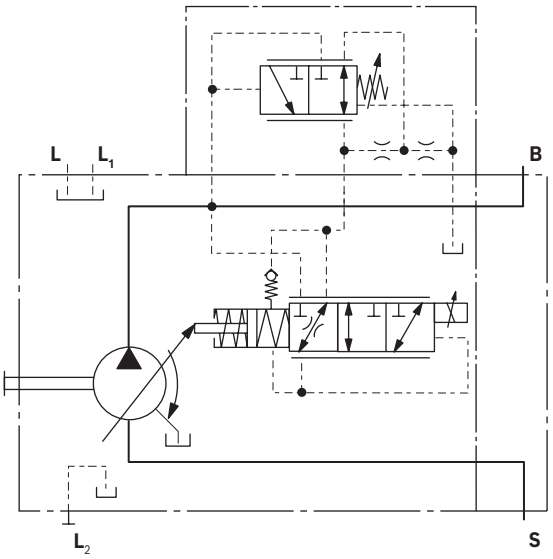
In $V_{g\,max}$ position, the spring force of the return spring is maximum. To overcome this spring force, the solenoid must be subjected to excessive current (I_{res}).

▼ **Characteristic curve EK1/2**



- Hysteresis static current-displacement characteristic curve <5 %
- For changes in current, ramp times of > 200 ms must be observed.

▼ **Circuit diagram EK.D**



Technical data, solenoids	EK1	EK2
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Dither frequency	100 Hz	100 Hz
Recommended amplitude	120 mA	60 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C (68 °F))	5.5 Ω	22.7 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 82		
Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F)		

	EK1	EK2
I_{min} [mA]	400	200
I_{max} [mA]	1200	600
I_{off} [mA]	< 300	< 150
I_{res} [mA]	> 1200	> 600

Notice!
- We recommend the valve with flushing function for the EK.D control variant. Please contact us.
- For information on operating limits at 0 mA (also short-term), see page 10.

The following electronic control units are available for control:

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

EP(K).DF / EP(K).DS / EP(K) – with pressure flow controller

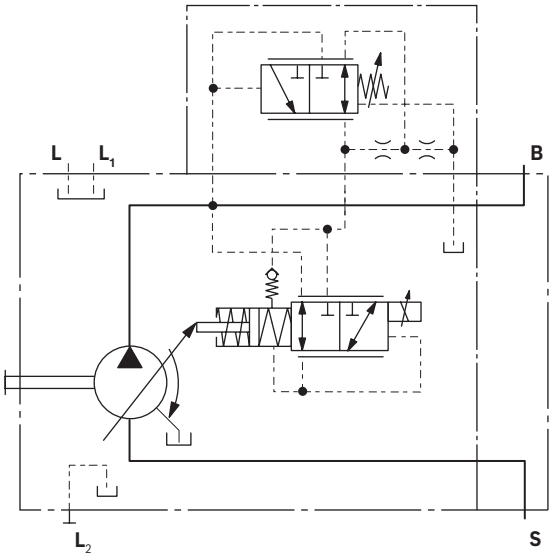
A hydraulic pressure flow control is superimposed on the electro proportional control. The pressure control regulates the pump displacement infinitely varied back to $V_{g\,min}$ after the set pressure command value has been reached. This function is super-imposed on the EP or EK control, i.e. the control-current dependent EP or EK function is executed below the pressure command value. For the setting range of the pressure flow controller, see page 15 to 17.

With all controller combinations, the V_g reduction has priority.

With flow control, the pump flow can be influenced in addition to pressure control. The pump flow is thus equal to the actual amount of hydraulic fluid required by the consumer. This is achieved using the differential pressure at the consumer (e.g. orifice).

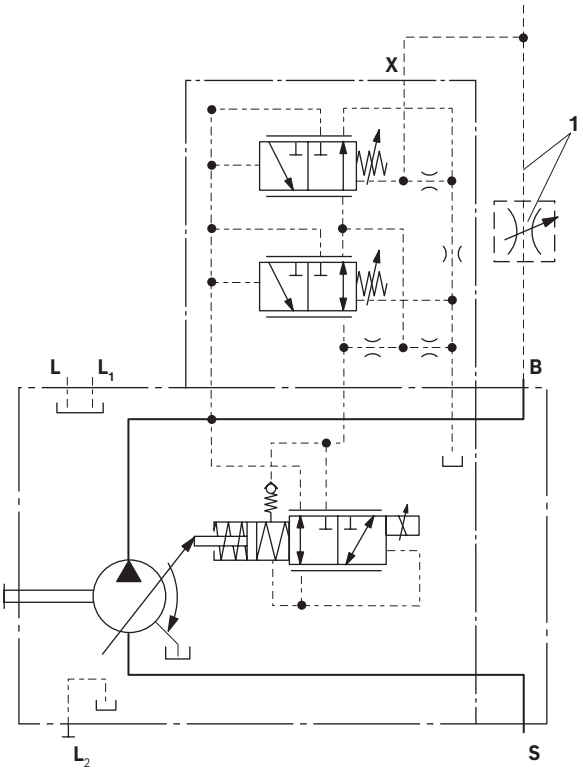
The EP.DS or EK.DS version has no connection between **X** and the reservoir (load-sensing). Please refer to the notes on page 17.

▼ **Circuit diagram EP.D**

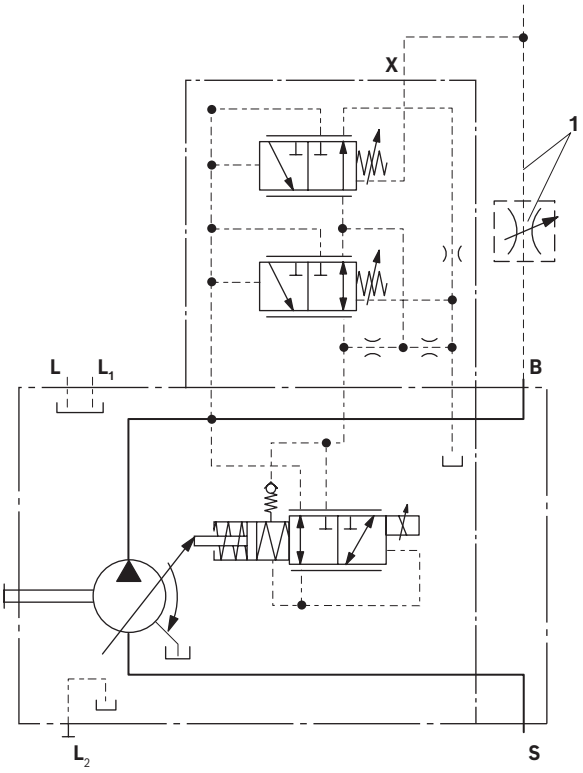


1 The metering orifice (control block) and the line is not included in the scope of delivery.

▼ **Circuit diagram EP.DF**



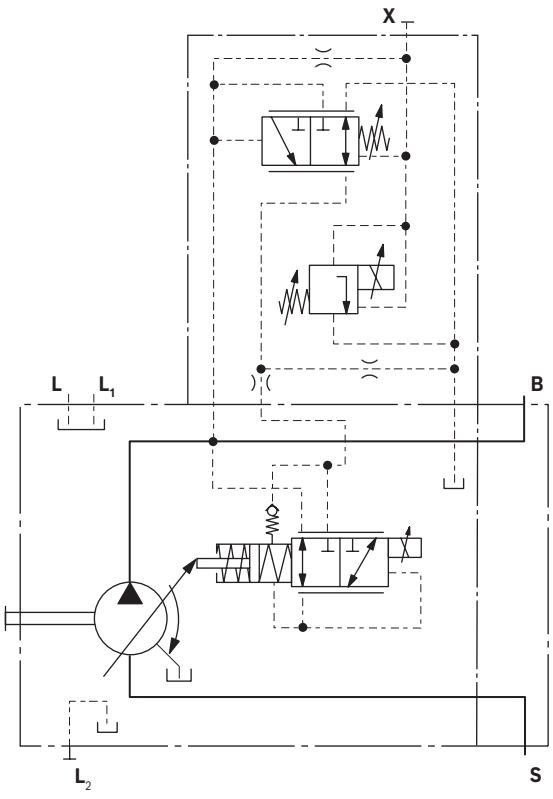
▼ **Circuit diagram EP.DS**



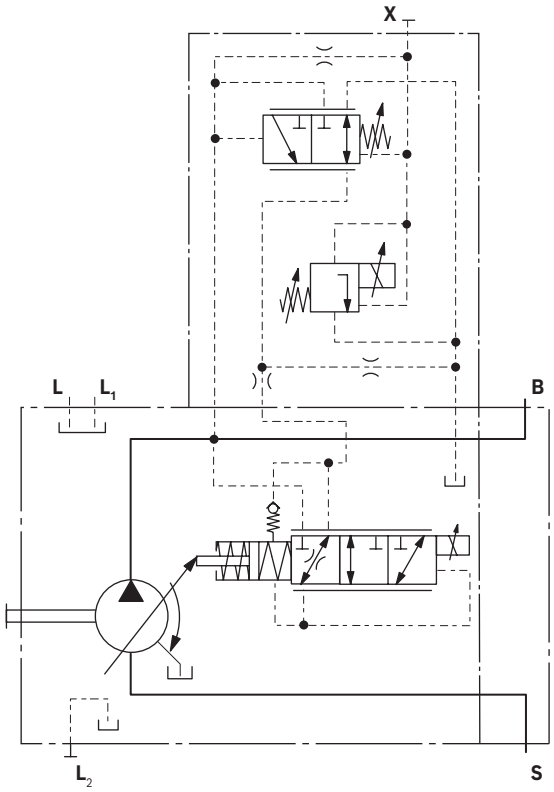
EP.ED / EK.ED – with electrohydraulic pressure control

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 pressure can be set steplessly by 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 (negative characteristic curve, e.g. for fan speed control). A PWM signal is used to control the solenoid.
For further information and technical data of the solenoids for ED(ER) control please refer to pages 21 to 25.

▼ **Circuit diagram EP.ED**



▼ **Circuit diagram EK.ED**



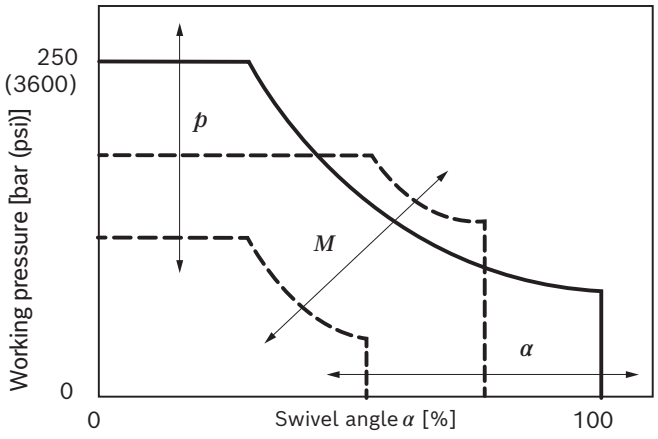
EC4 – Electrohydraulic control valve (positive control)

The proportional directional valve EC4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.
The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.
This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.
The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.
If the solenoid current is above the neutral current ($I_{neutral}$), the pump swivels in the direction of $V_{g\,max}$/100%; if it is below, the pump swivels in the direction of $V_{g\,min}$/0%.
A swivel angle sensor is required for control of the pump with BODAS eOC. It must be specified in type code position 13.
Further information about the swivel angle sensor PAL2/20 is provided on page 83 and in data sheet 95161.
Further information on project planning of the BODAS eOC control system including other required system components can be found in data sheet 95345.
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically connected control circuits:

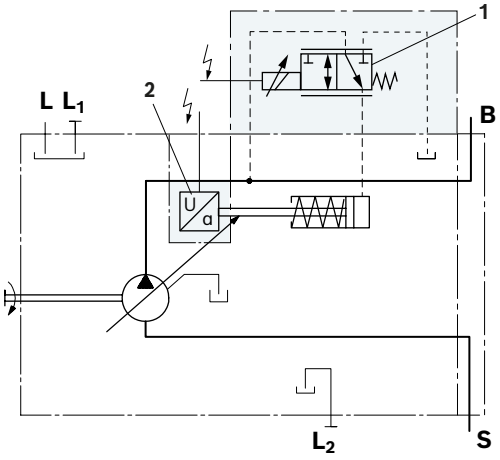
- Pressure and differential pressure regulation (p)
- Swivel angle and flow control (α)
- Torque control (M)
- Power control

▼ **Control variants with EC4**

Representation for positive quadrants 0% to +100%



▼ **Circuit diagram EC4**



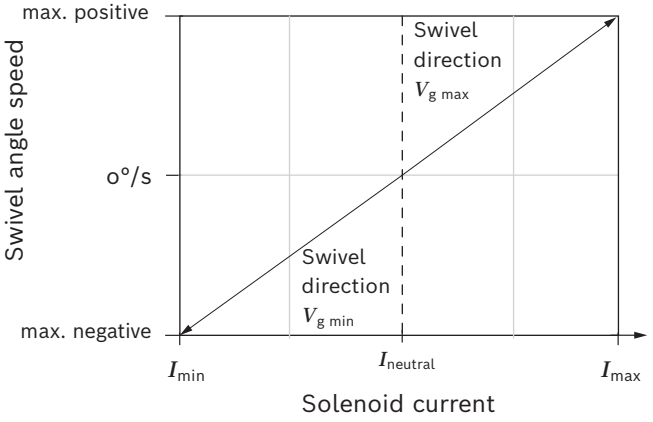
1 Proportional directional valve EC4
2 Swivel angle sensor (see data sheet 95161)

The following electronic control units are available for control:

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

For further technical data on the solenoid with respective information, see pages 29 and 82

▼ **Operating principle EC4**



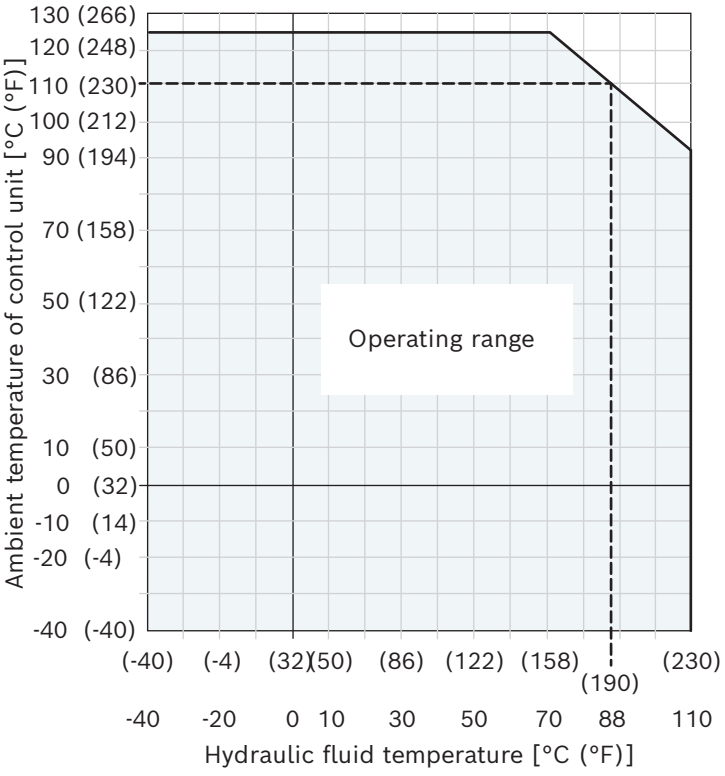
Solenoid technical data

	EC4
Permissible maximum solenoid current. The current supply time with I_{max} depends on the mean current value ($I_{permissible\ average}$ 1355 mA)	I_{max} < 1900 mA
Permissible average solenoid current over a maximum interval width of 5 s	$I_{Medium\ Perm}$ < 1355 mA
Nominal resistance at 20 °C (68 °F) winding temperature	4.26 Ω
Hot resistance at 180 °C (356 °F) winding temperature	6.92 Ω
Limit temperature for winding	Insulating material class H (180 °C (356 °F))
Hydraulic fluid or operating temperature	from - 40 °C to 110 °C (- 40 °F to 230 °F)
Type of protection: see connector version page 82	

Notice

- The limit voltage of the coil is 36 VDC. In general, the maximum current must not be exceeded by the actual current.
- For calculation of the hot resistance, a temperature coefficient of 0.0039k^{-1} is to be applied.
- A variable dither is required. The frequency and amplitude must be adapted to the respective system.
- For information on operating limits at 0 mA (also short-term), see page 10.

▼ **Characteristic curve of permitted operating range, example:** At a hydraulic fluid temperature of 88 °C (190 °F), an ambient temperature of 110 °C (230 °F) is permitted.



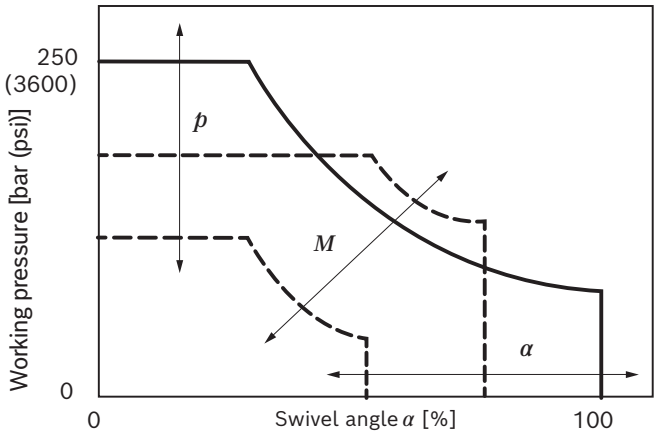
EB4 – Electrohydraulic control valve (negative control)

The proportional directional valve EB4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.
The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.
This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.
The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.
If the solenoid current is below the neutral current ($I_{neutral}$), the pump swivels in the direction of $V_{g\,max}$/100%; if it is above, the pump swivels in the direction of $V_{g\,min}$/0%.
For control of the pump with BODAS eOC, a swivel angle sensor is required.
Further information about the swivel angle sensor PAL 2/10 is provided on page 83 and in data sheet 95161.
Further information on project planning of the BODAS eOC control system including other required system components can be found in data sheet 95345.
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically connected control circuits:

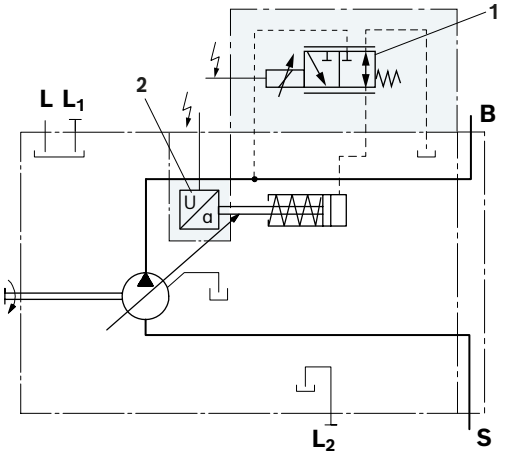
- Pressure and differential pressure regulation (p)
- Swivel angle and flow control (α)
- Torque control (M)
- Power control

▼ **Control variants with EB4**

Representation for positive quadrants 0% to +100%



▼ **Circuit diagram EB4**



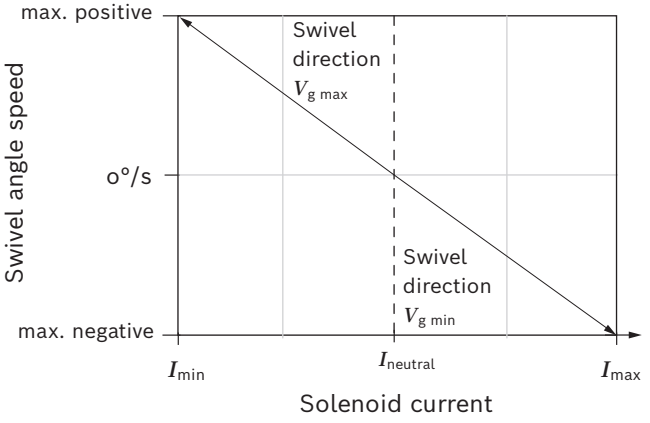
1 Proportional directional valve EB4
2 Swivel angle sensor (see data sheet 95161)

For further technical data on the solenoid with respective information, see pages 29 and 82.

The following electronic control units are available for control:

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

▼ **Operating principle EB4**



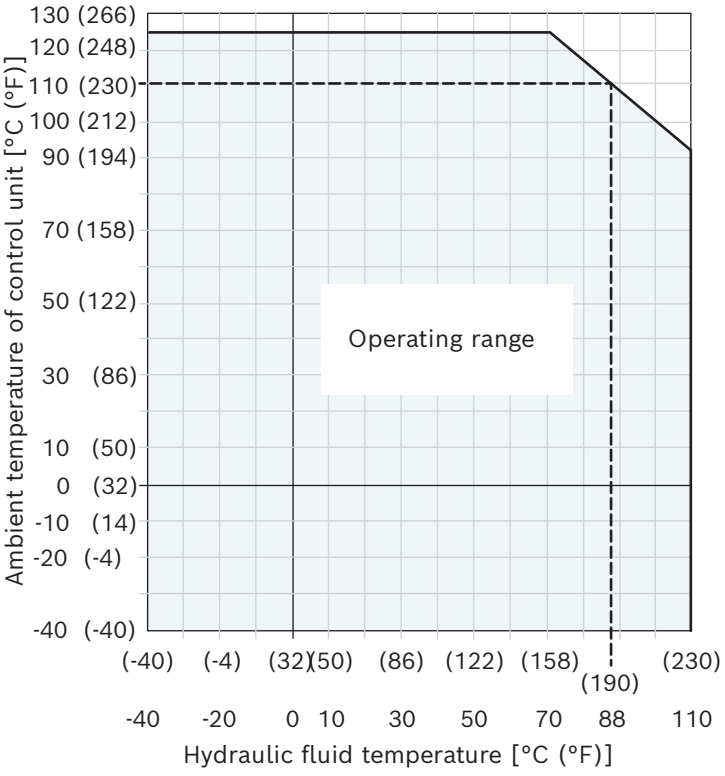
Solenoid technical data

	EB4
Permissible maximum solenoid current. The current supply time with I_{max} depends on the mean current value ($I_{permissible\ average}$ 1355 mA)	I_{max} < 4000 mA
Permissible average solenoid current over a maximum interval width of 5 s	$I_{Medium\ Perm}$ < 1355 mA
Nominal resistance at 20 °C (68 °F) winding temperature	4.26 Ω
Hot resistance at 180°C (356°F) winding temperature	6.92 Ω
Limit temperature for winding	Insulating material class H (180 °C (356 °F))
Hydraulic fluid or operating temperature	from -40 °C to 110 °C (-40 °F to +230 °F)
Type of protection: see connector version page 82	

Notice

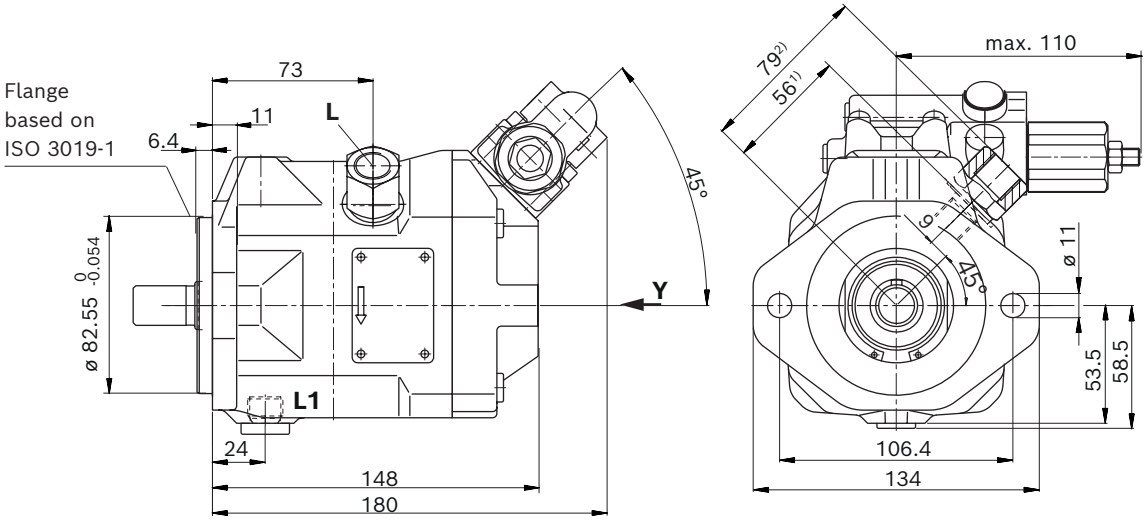
- The coil has a limit voltage of 36 VDC. In general, the maximum current must not be exceeded by the actual current.
- For calculation of the hot resistance, a temperature coefficient of 0.0039k^{-1} is to be applied.
- A variable dither is required. The frequency and amplitude must be adapted to the respective system.
- For information on operating limits at 0 mA (also short-term), see page 10.

▼ **Characteristic curve of permitted operating range, example:** At a hydraulic fluid temperature of 88 °C (190 °F), an ambient temperature of 110 °C (230 °F) is permitted.

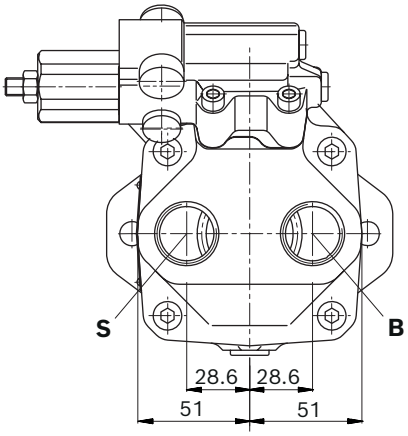


Dimensions, size 10

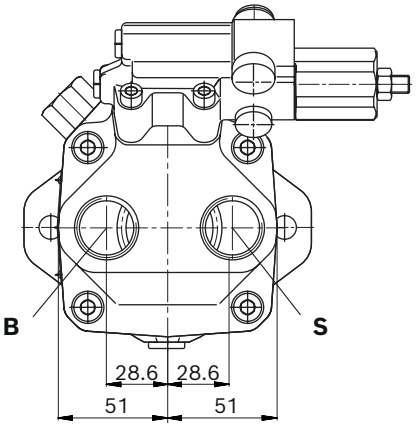
DR - Pressure controller; mounting flange C SAE version; port plate 14 (64); series 52



▼ **View Y**
Valve mounting for clockwise rotation



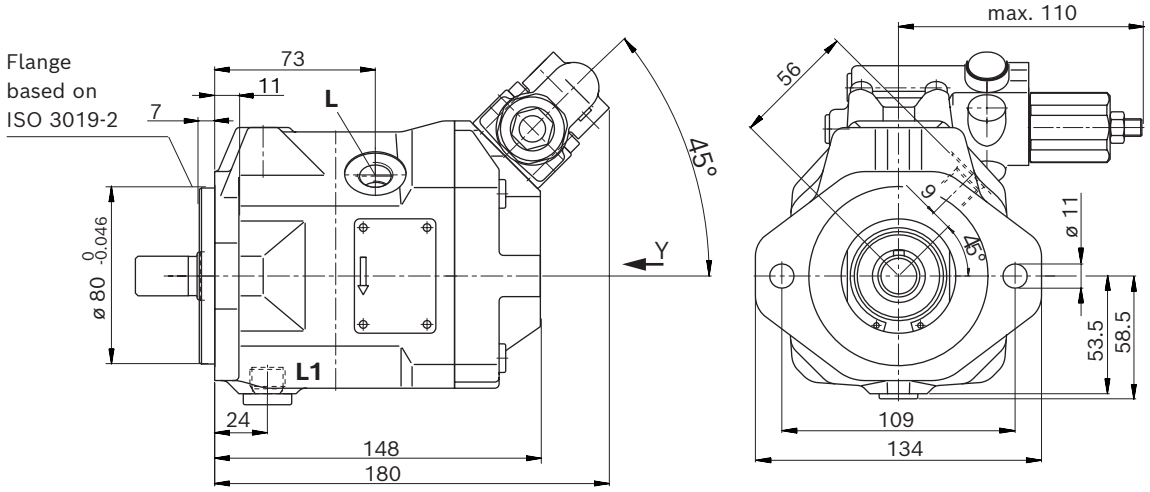
▼ **View Y**
Valve mounting for counter-clockwise rotation



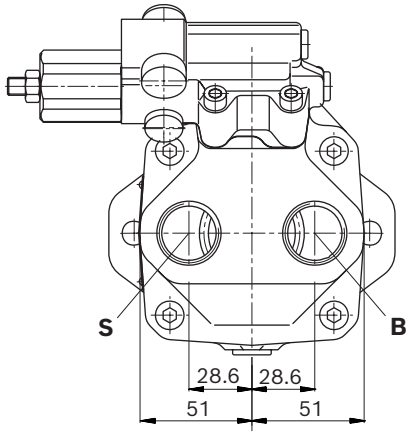
1) With port plate 64
2) With port plate 14

Dimensions, size 10

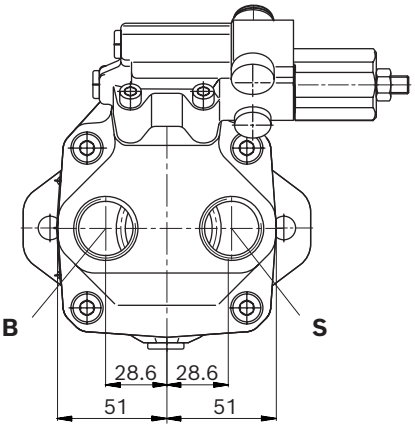
DR – Pressure controller; mounting flange A metric version; port plate 14; series 52



▼ **View Y**
Valve mounting
for clockwise
rotation

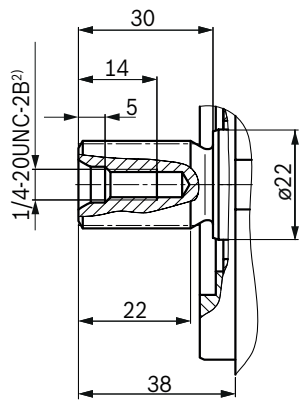


▼ **View Y**
Valve mounting for
counter-clockwise
rotation



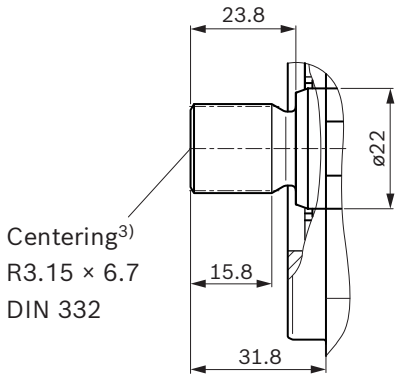
▼ **Splined shaft 3/4 in (19-4, ISO 3019-1)**

S – 11T 16/32DP[1)]



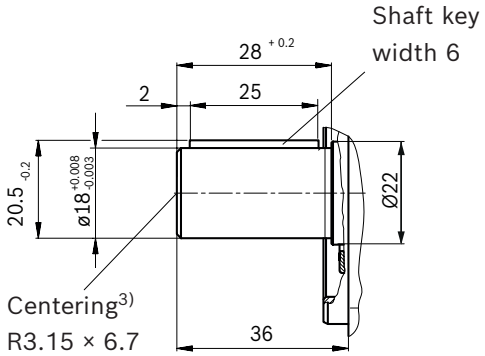
▼ **Splined shaft 5/8 in (16-4, ISO 3019-1)**

U – 9T 16/32DP[1)]



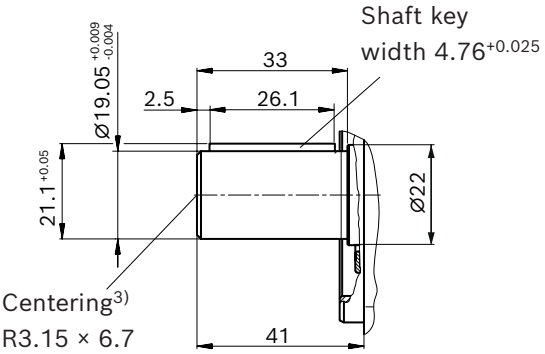
▼ **Parallel keyed shaft DIN 6885**

P – A6x6x25



▼ **Parallel keyed shaft ISO 3019-1**

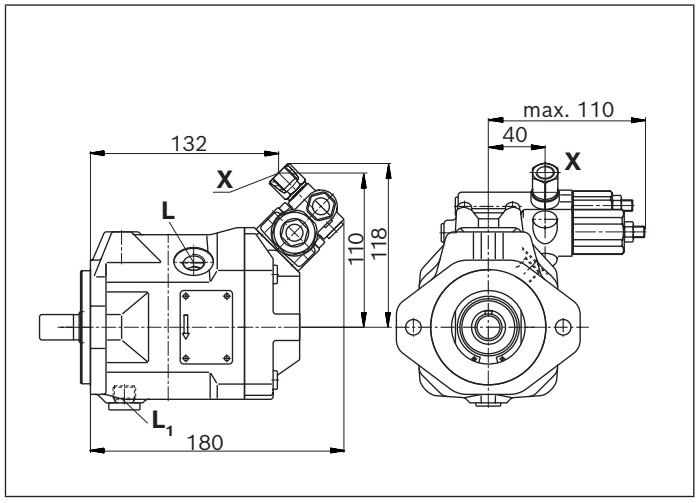
K – 19-1



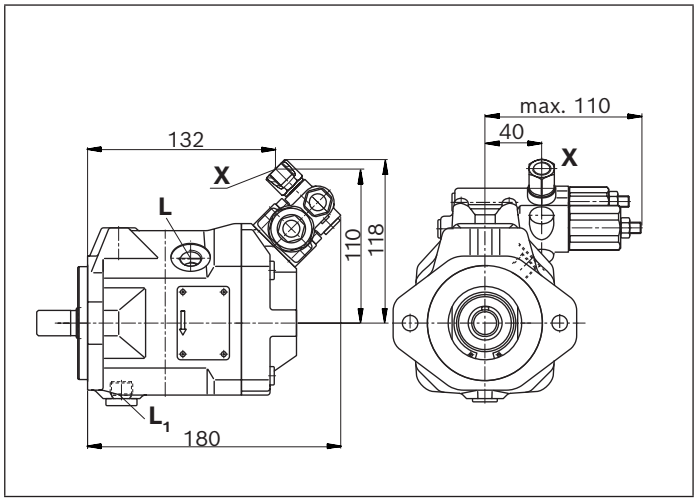
Mounting flange A ports (metric); port plate 14		**Standard**	**Size**	p_{max} **[bar (psi)]**[4)]	**State**[7)]
B	Working port	DIN 3852	M27 × 2; 16 (0.63) deep	315 (4550)	O
S	Suction port	DIN 3852	M27 × 2; 16 (0.63) deep	5 (75)	O
L	Drain port	DIN 3852[5)]	M16 × 1.5; 12 (0.47) deep	2 (30)	O[6)]
L_1	Drain port	DIN 3852[5)]	M16 × 1.5; 12 (0.47) deep	2 (30)	X[6)]
X with adapter	Pilot pressure	DIN 3852	M14 × 1.5; 12 (0.47) deep	315 (4550)	O
Mounting flange C ports (SAE); port plate 64		**Standard**	**Size**	p_{max} **[bar (psi)]**[4)]	**State**[7)]
B	Working port	ISO 11926	1 1/16-12UNF-2B; 20 (0.79) low	315 (4550)	O
S	Suction port	ISO 11926	1 1/16-12UNF-2B; 20 (0.79) low	5 (75)	O
L without adapter (standard)	Drain port	ISO 11926[5)]	9/16-18UNF-2B; 12 (0.47) deep	2 (30)	O[6)]
L with adapter	Drain port	ISO 3852[5)]	M16 × 1.5; 12 (0.47) deep	2 (30)	O[6)]
L_1 without adapter	Drain port	ISO 11926[5)]	9/16-18UNF-2B; 12 (0.47) deep	2 (30)	X[6)]
X without adapter (standard)	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O
X with adapter	Pilot pressure	ISO 3852	M14 × 1.5; 12 (0.47) deep	315 (4550)	O

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (also see installation instructions on page 84).
7) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

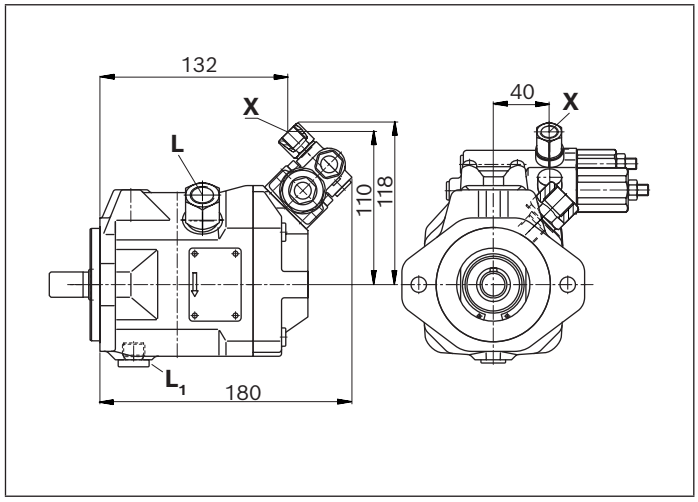
▼ **DRG – Pressure controller, remote controlled (mounting flange A)[1)]**



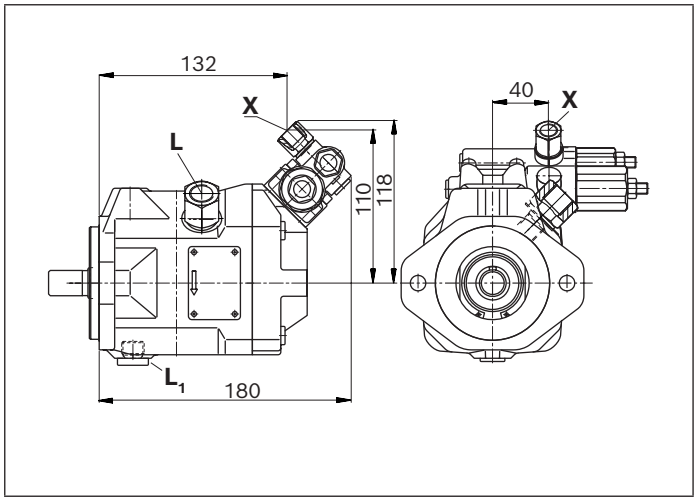
▼ **DFR/DFR1 – Pressure, flow controller (mounting flange A)[1)]**



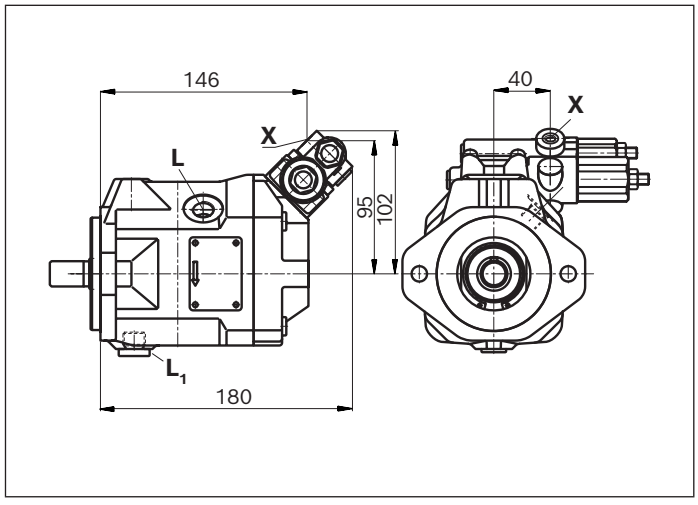
▼ **DRG – Pressure controller, remote controlled (mounting flange C)[1)2)]**



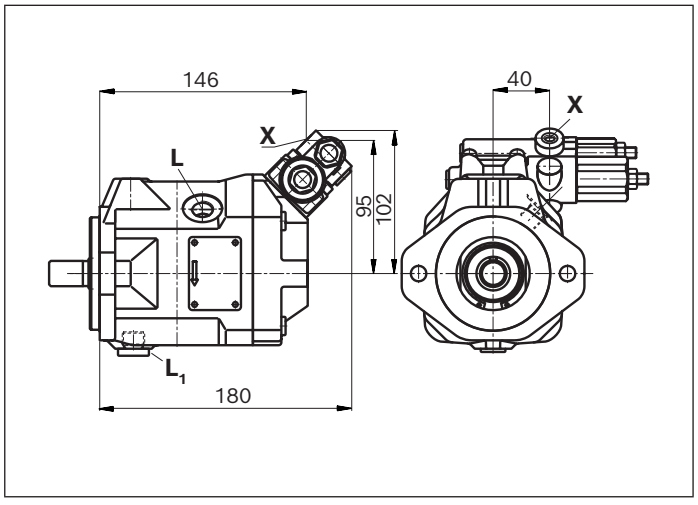
▼ **DFR/DFR1 – Pressure, flow controller (mounting flange C)[1)2)]**



▼ **DRG – Pressure controller, remote controlled (mounting flange C)[1)3)]**



▼ **DFR/DFR1 – Pressure, flow controller (mounting flange C)[1)3)]**

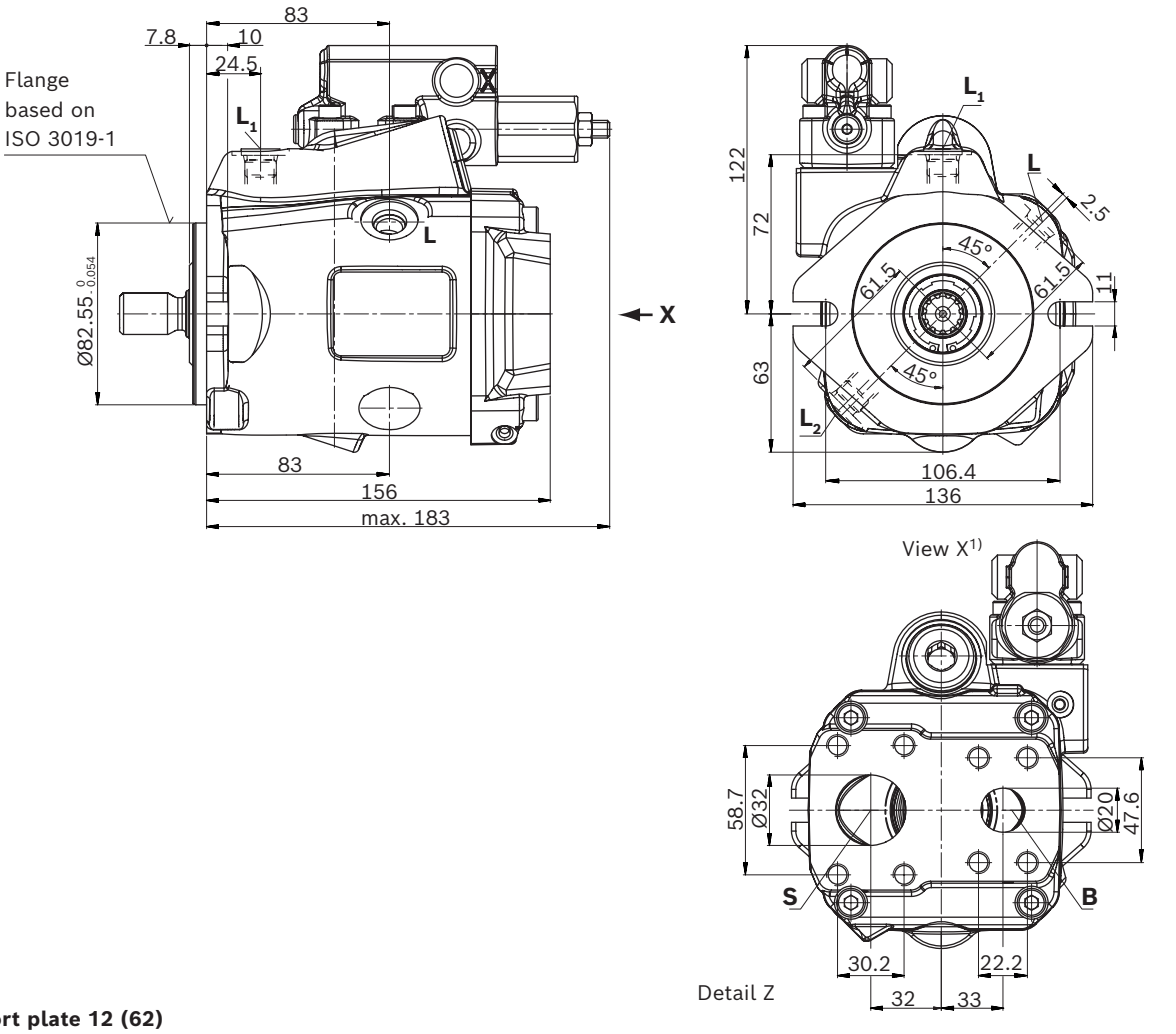


1) Valve mounting for clockwise or counter-clockwise rotation
see page 32 and 33
2) With metric adapter
3) Version complete SAE without adapter

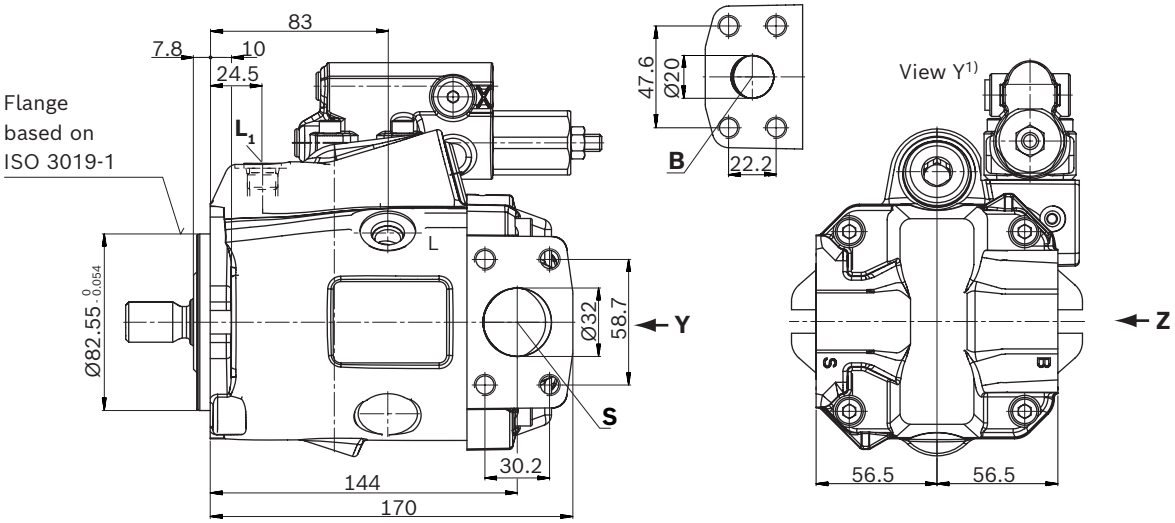
Dimensions, size 18

DR – Hydraulic pressure controller; clockwise rotation, series 53

▼ **Port plate 11 (61)**



▼ **Port plate 12 (62)**

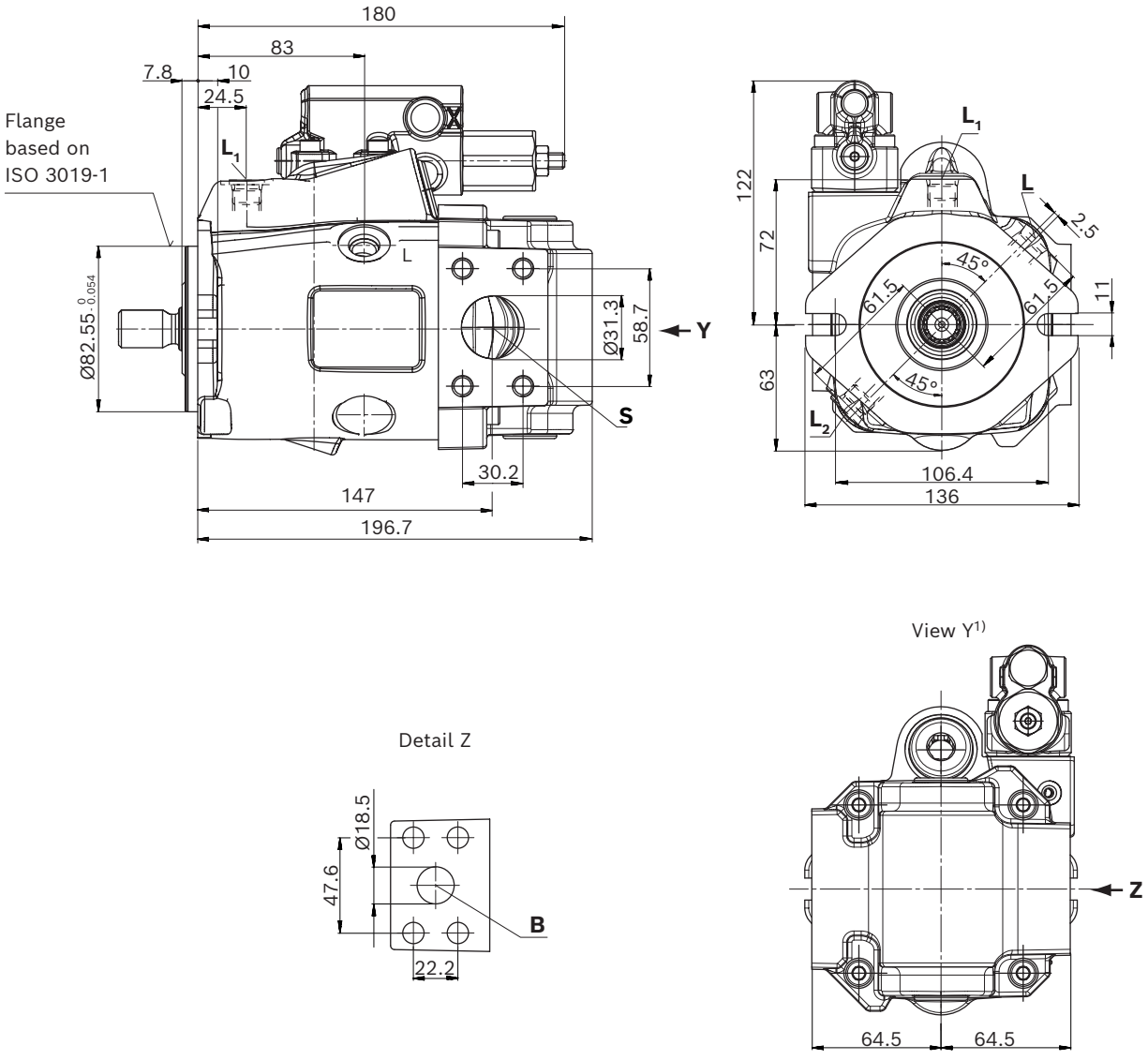


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 18

DR – Hydraulic pressure controller; clockwise rotation, with pre compression volume (PCV), series 53

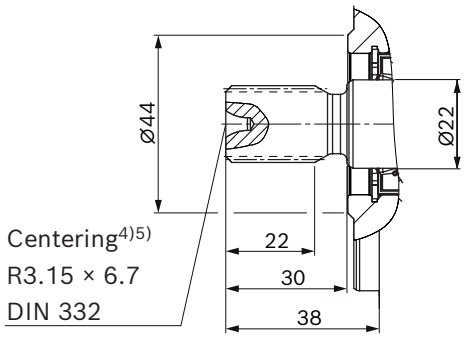
▼ **Port plate 32 (82)**



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

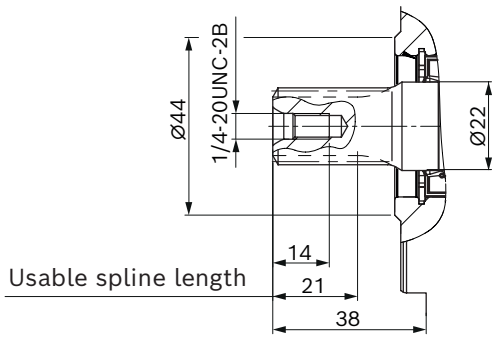
▼ **Splined shaft 3/4 in (19-4, ISO 3019-1)**

S – 11T 16/32DP[1)]



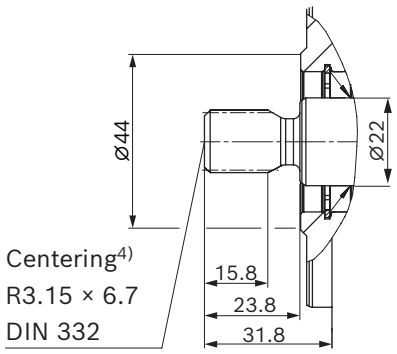
▼ **Splined shaft 3/4 in (similar to ISO 3019-1)**

R – 11T 16/32DP[1)2)]



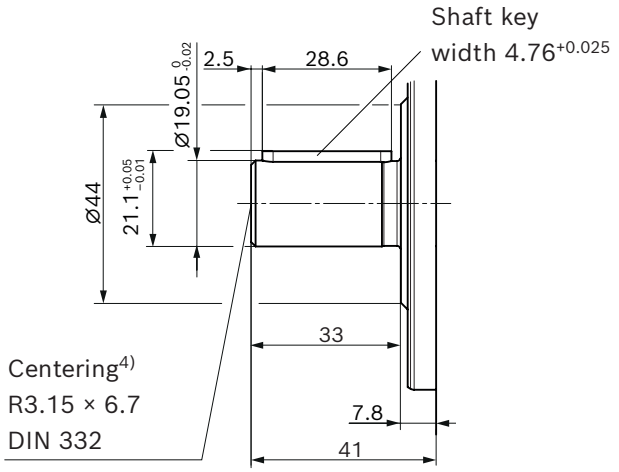
▼ **Splined shaft 5/8 in (16-4, ISO 3019-1)**

U – 9T 16/32DP[1)]



▼ **Parallel keyed shaft ISO 3019-1**

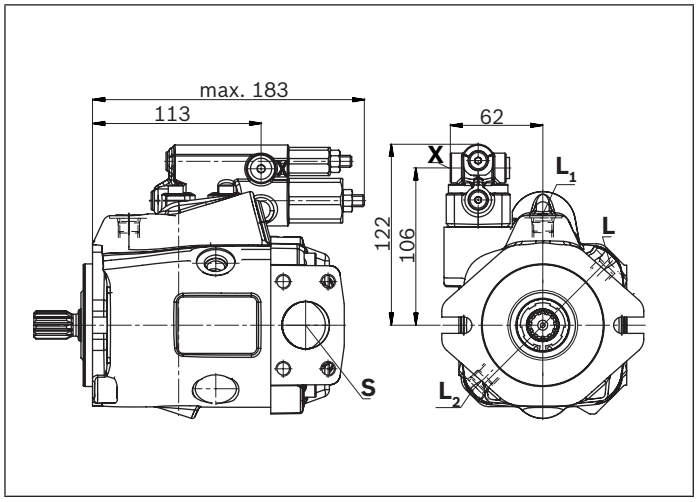
K - 19-1



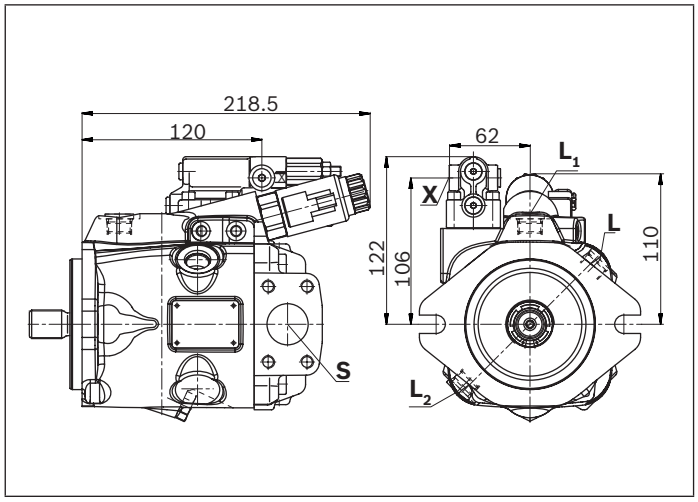
Port plate 11, 12		**Standard**	**Size**	p_{max} **[bar (psi)]**[6)]	**State**[9)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	3/4 in M10 × 1.5; 17 (0.67) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/4 in M10 × 1.5; 17 (0.67) deep	5 (75)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} **[bar (psi)]**[6)]	**State**[9)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	3/4 in 3/8-16UNC-2B; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 24 (0.94) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[6)]	**State**[9)]
L	Drain port	ISO 11926[7)]	3/4-16UNF-2B; 12 (0.47) deep	2 (30)	O[8)]
L_1, L_2	Drain port	ISO 11926[7)]	3/4-16UNF-2B; 12 (0.47) deep	2 (30)	X[8)]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
5) Thread 1/4-20UNC-2B for units with through drive present, see valid EBZ
6) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
7) The countersink may be deeper than specified in the standard.
8) Depending on the installation position, **L**, L_1 or L_2 must be connected (also see installation instructions starting on page 84).
9) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

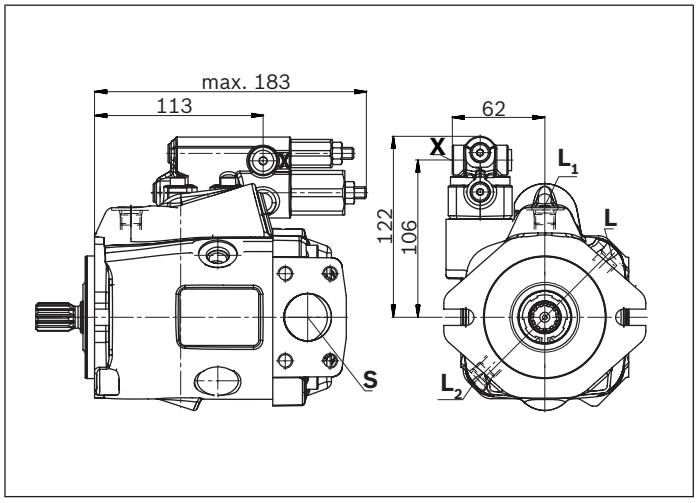
▼ **DRG – Pressure controller, remote controlled, series 53**



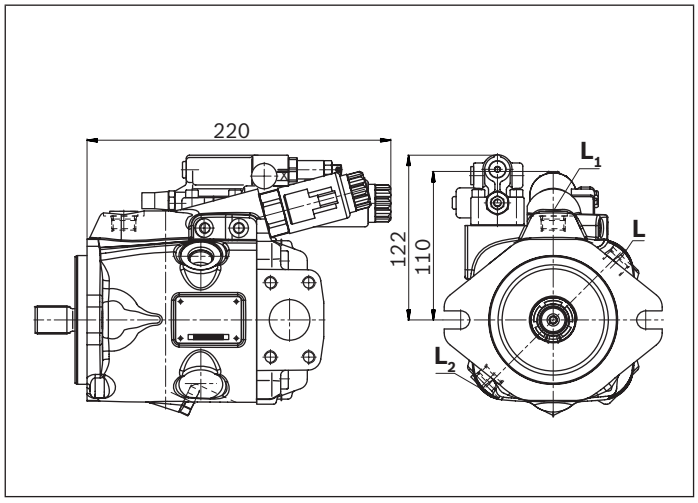
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



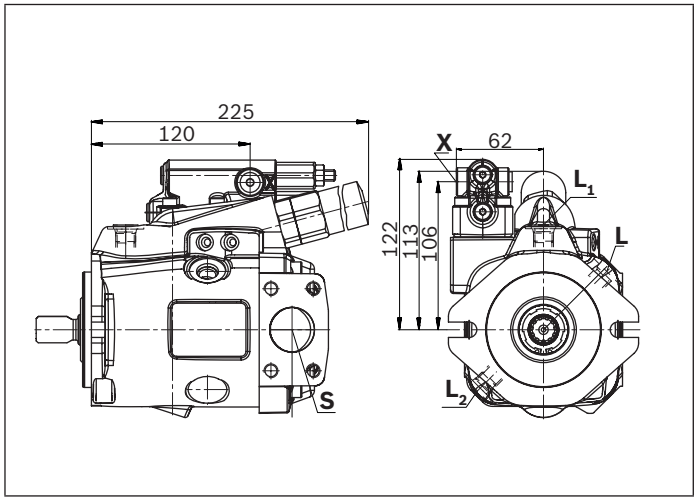
▼ **DRF/DRS/DRSC – Pressure flow controller, series 53**



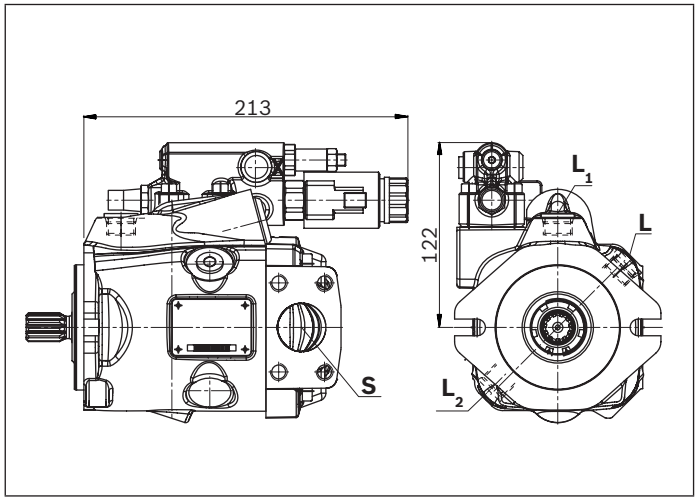
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power controller, series 53**



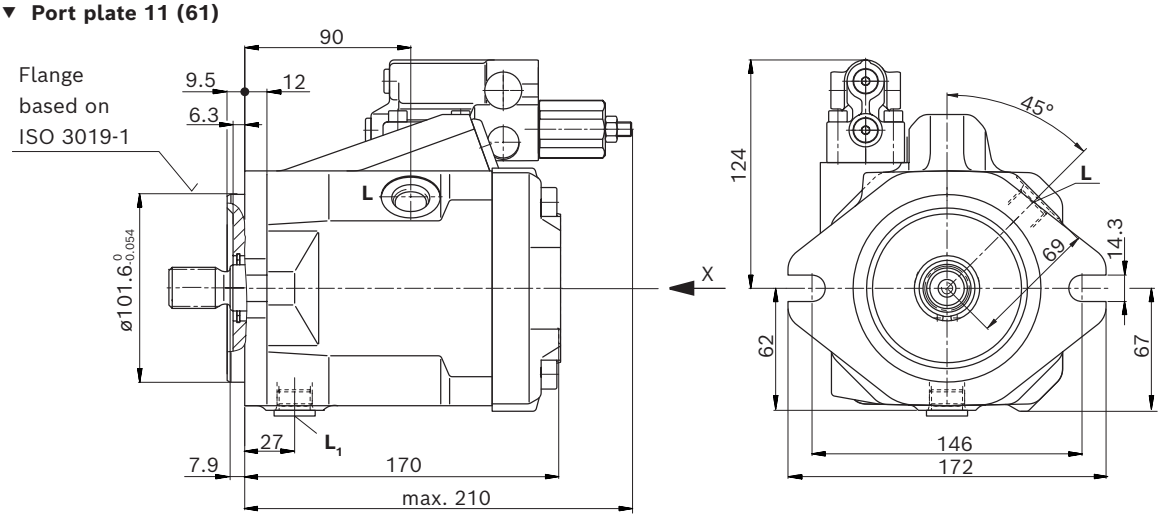
▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**



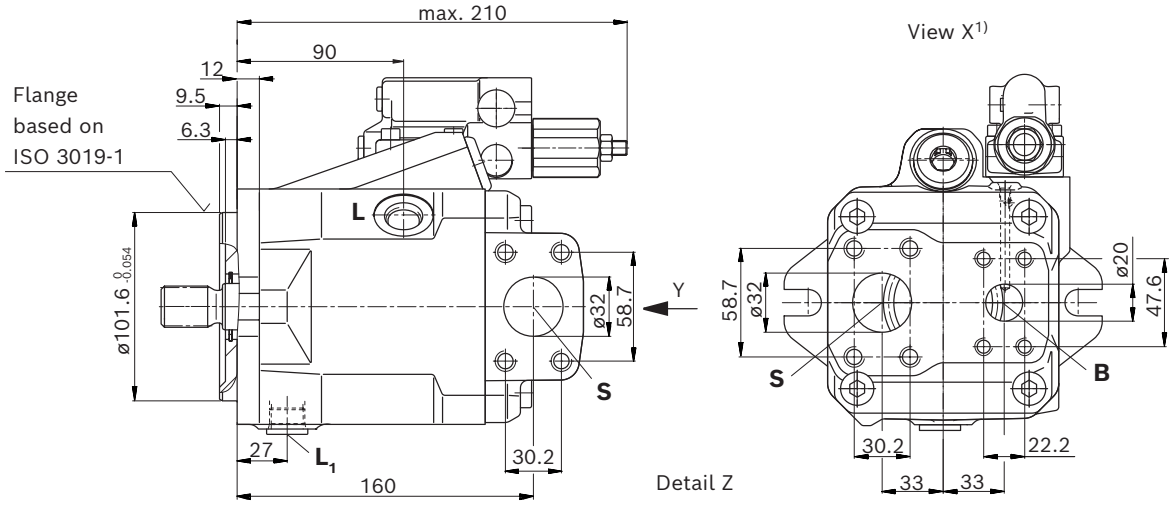
Dimensions, size 28

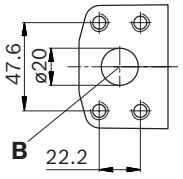
DR – Hydraulic pressure controller; clockwise rotation, series 52

▼ **Port plate 11 (61)**

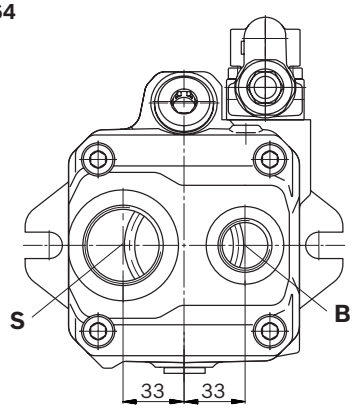


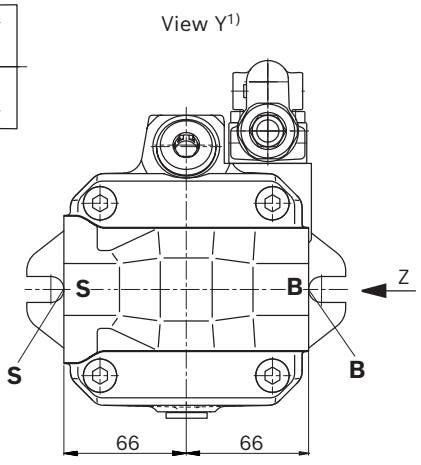
▼ **Port plate 12 (62)**





▼ **Port plate 64**



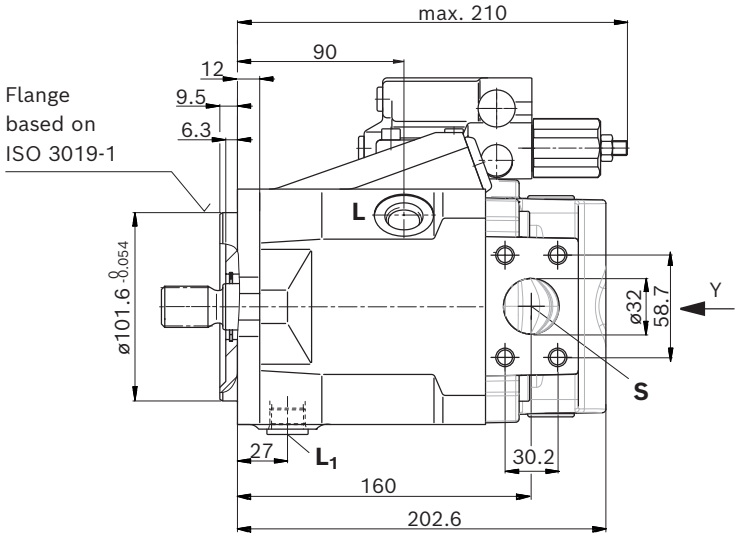


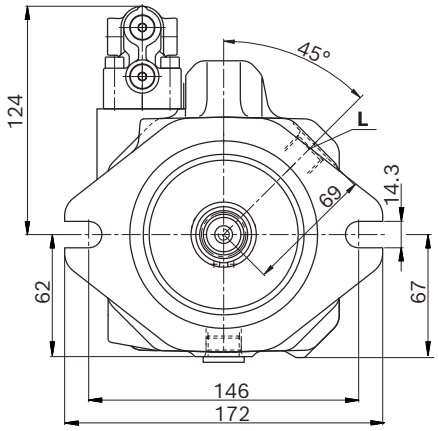
1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 28

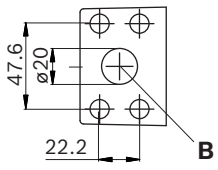
DR – Hydraulic pressure controller; clockwise rotation, with pre compression volume (PCV), series 52

▼ **Port plate 32 (82)**

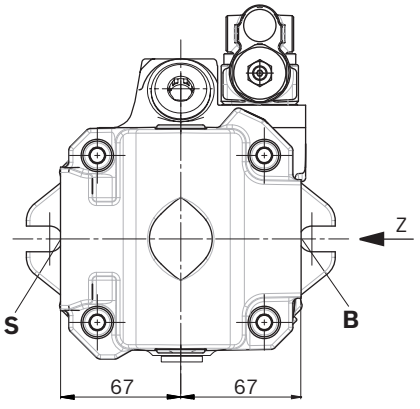




Detail Z



View Y[1)]

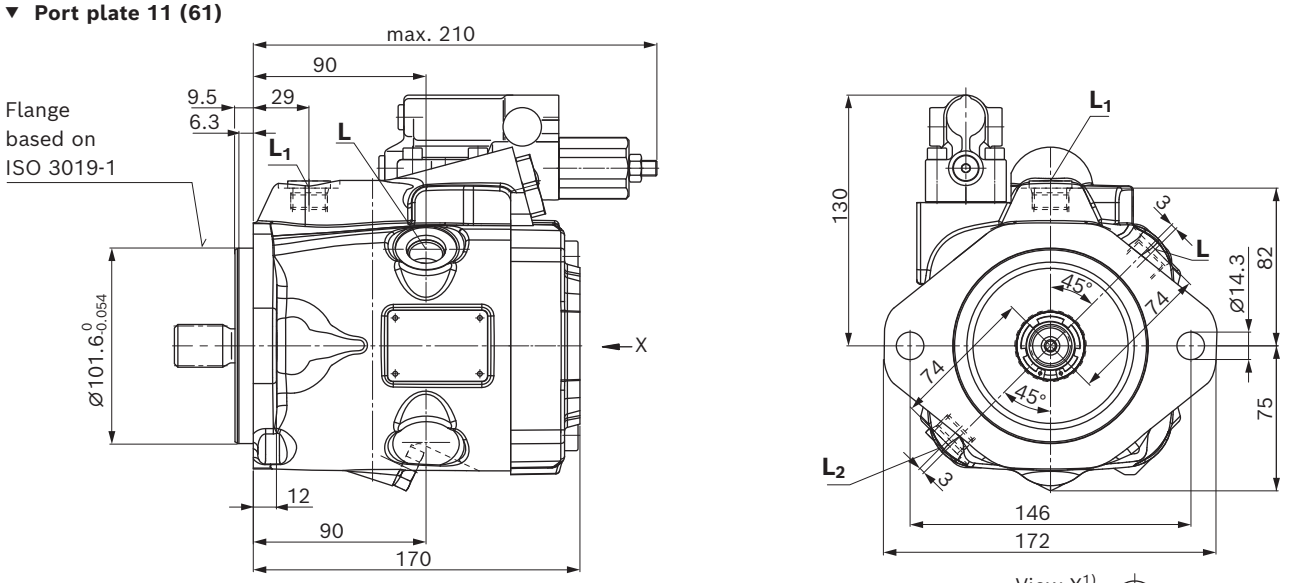


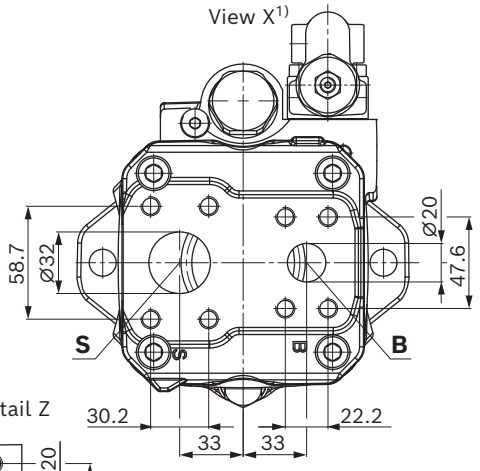
1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 28

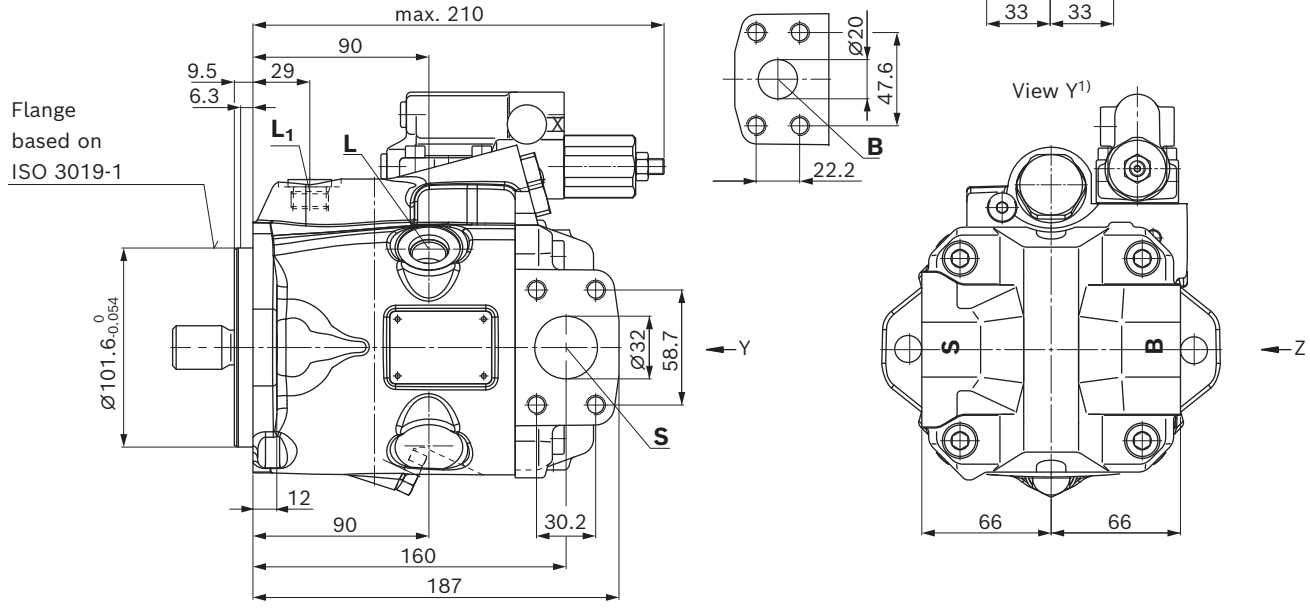
DR – Hydraulic pressure controller; clockwise rotation, series 53

▼ **Port plate 11 (61)**





▼ **Port plate 12 (62)**

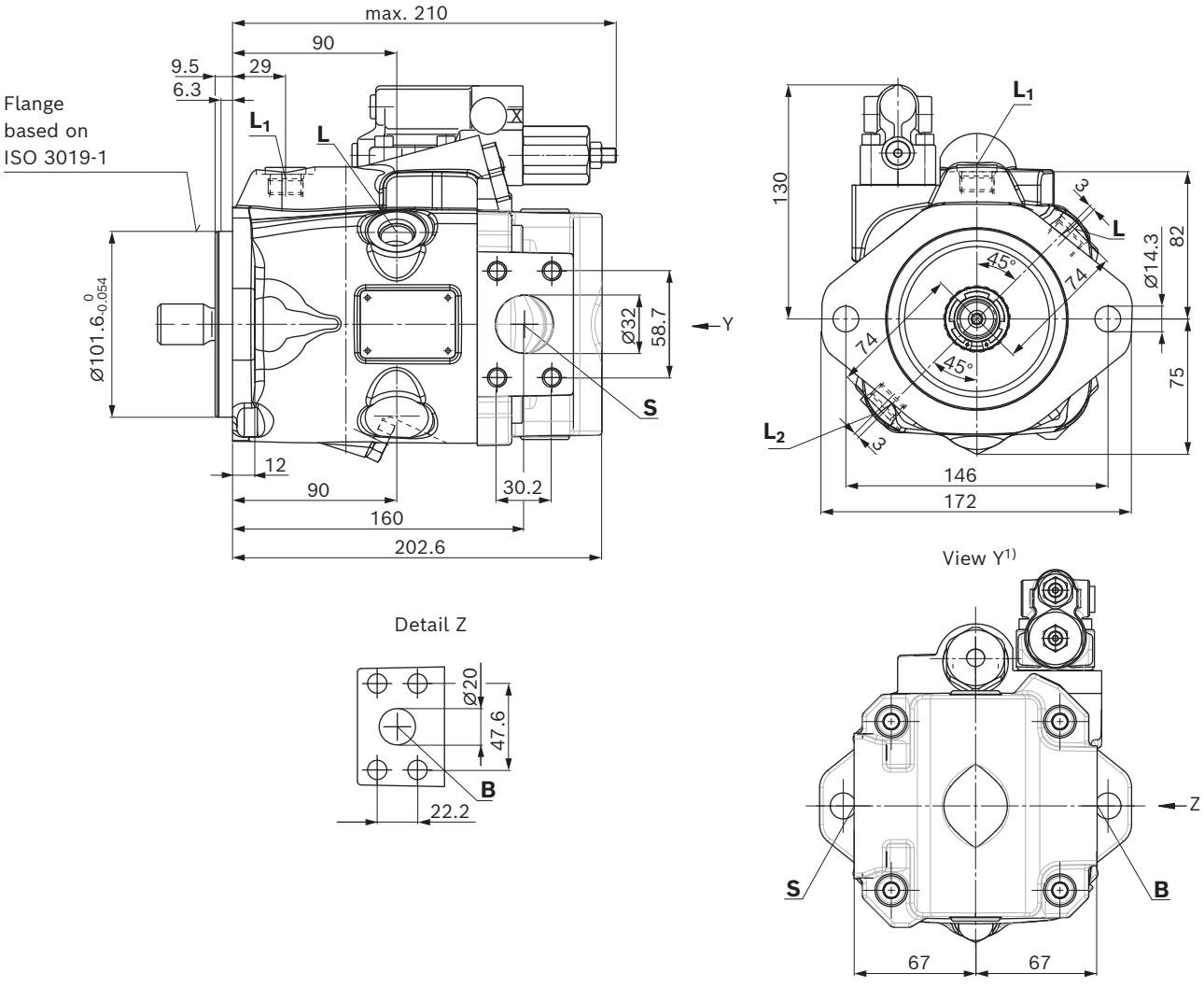


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 28

DR – Hydraulic pressure controller; clockwise rotation, with pre compression volume (PCV), series 53

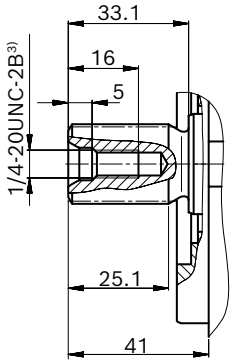
▼ **Port plate 32 (82)**



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

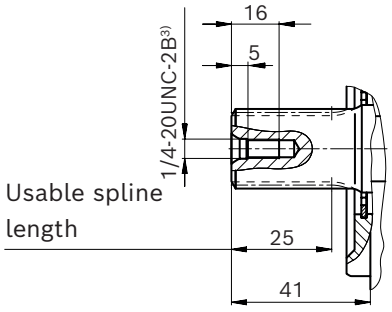
▼ **Splined shaft 7/8 in (22-4, ISO 3019-1)**

S – 13T 16/32DP[1)]



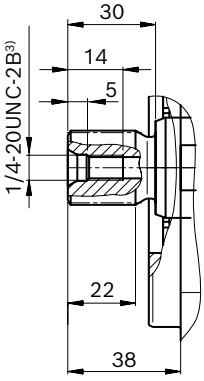
▼ **Splined shaft 7/8 in (similar to ISO 3019-1)**

R – 13T 16/32DP[1)2)]



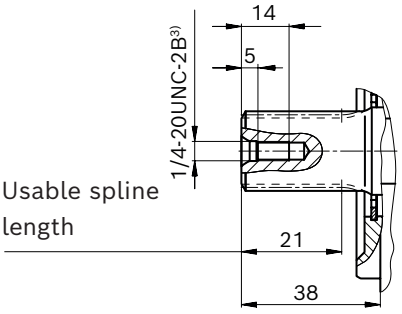
▼ **Splined shaft 3/4 in (19-4, ISO 3019-1)**

U – 11T 16/32DP[1)]



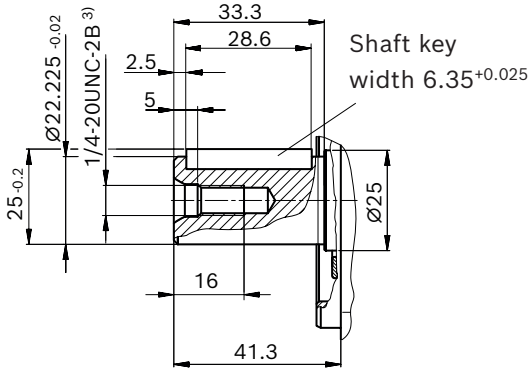
▼ **Splined shaft 3/4 in (similar to ISO 3019-1)**

W – 11T 16/32DP[1)2)]



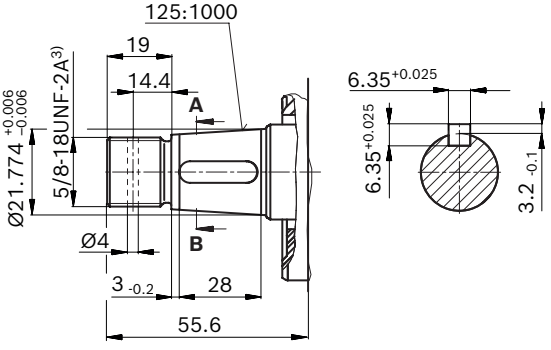
▼ **Parallel keyed shaft ISO 3019-1**

K – 22-1



▼ **Tapered keyed shaft (ISO 3019-1)[4)]**

C

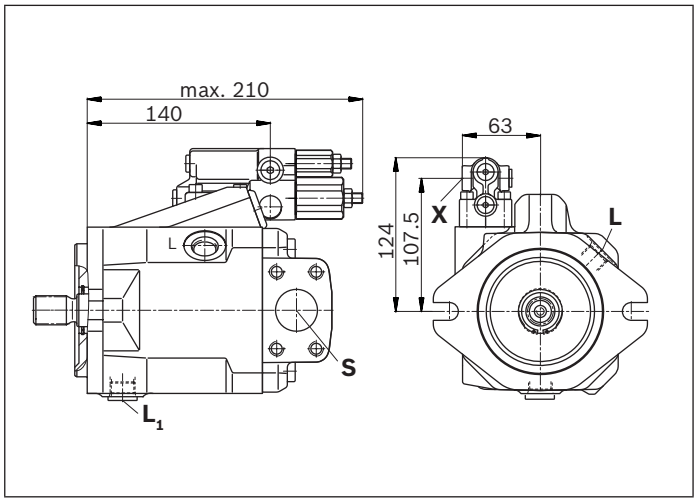


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Only available in series 52

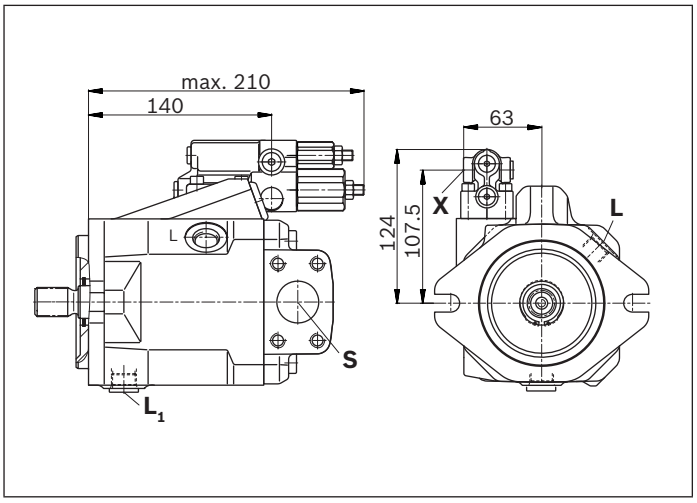
Port plate 11, 12, 32		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	3/4 in M10 × 1.5; 17 (0.67) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/4 in M10 × 1.5; 17 (0.67) deep	5 (75)	O
Port plate 61, 62, 82		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	3/4 in 3/8-16UNC-2B; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 1/4 in 7/16-14UNC-2B; 24 (0.94) deep	5 (75)	O
Port plate 64		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port	ISO 11926	1 1/16 12 UN-2B; 20 (0.79) deep	315 (4550)	O
S	Suction port	ISO 11926	1 5/8 12UN-2B; 17 (0.67) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
L	Drain port	ISO 11926[2]	3/4-16UNF-2B; 12 (0.47) deep	2 (30)	O[3]
L_1, L_2[4]	Drain port	ISO 11926[2]	3/4-16UNF-2B; 12 (0.47) deep	2 (30)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) The countersink may be deeper than specified in the standard.
3) Depending on the installation position, **L**, L_1 or L_2 must be connected (also see installation instructions starting on page 84).
4) Only for series 53
5) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

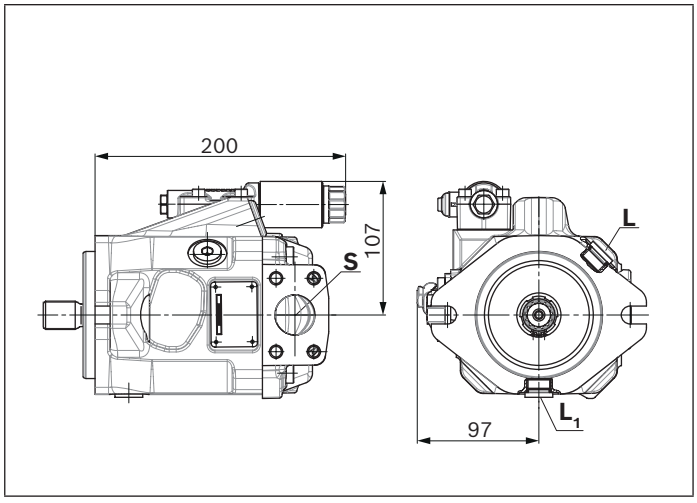
▼ **DRG – Pressure controller, remote controlled, series 52**



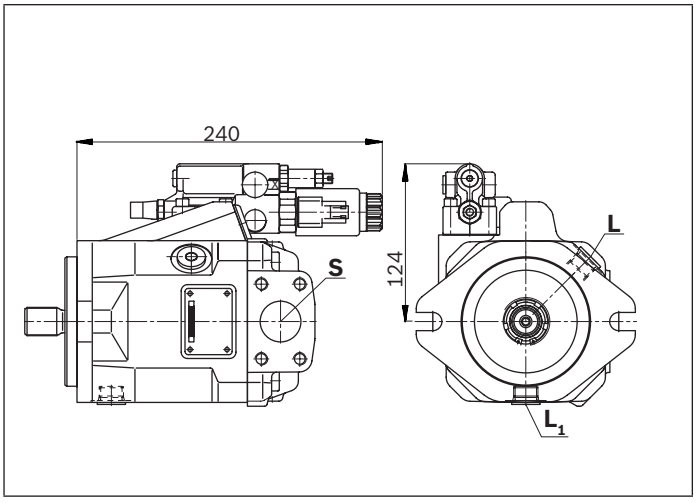
▼ **DFR/DFR1 – Pressure flow controller, series 52**



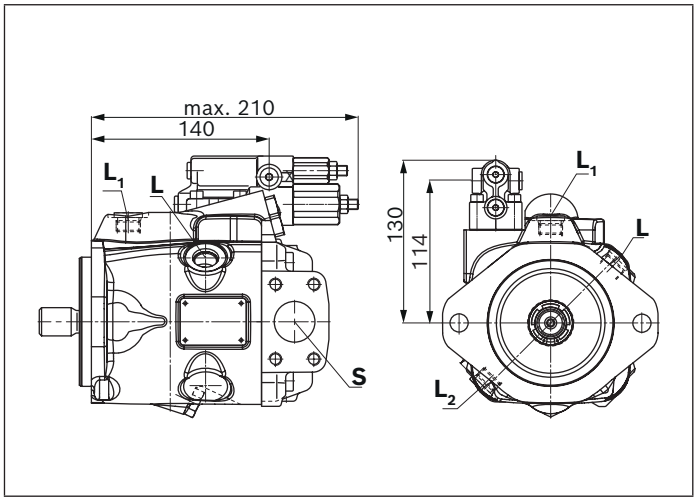
▼ **EC4/EB4 – Electrohydraulic control valve, series 52**



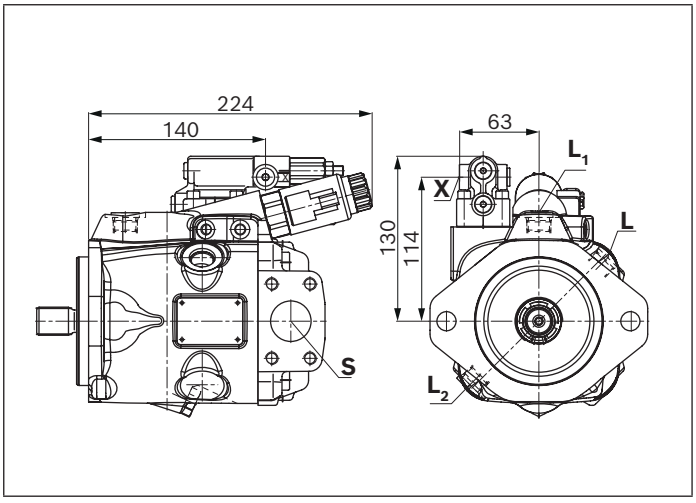
▼ **ED7. / ER7. – Electro-proportional pressure control, series 52**



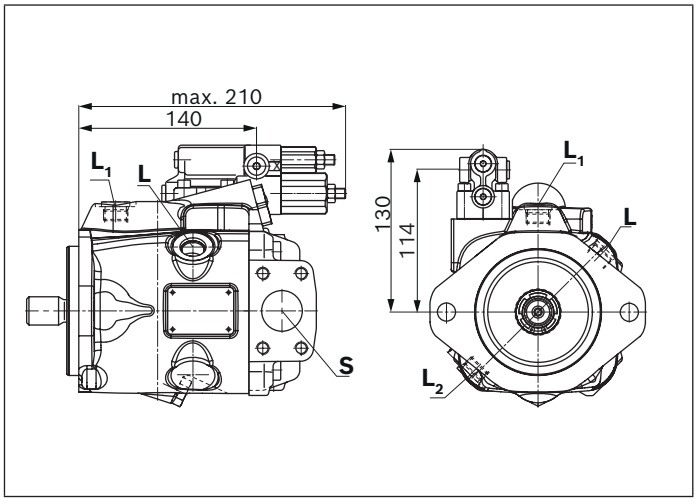
▼ **DRG – Pressure controller, remote controlled, series 53**



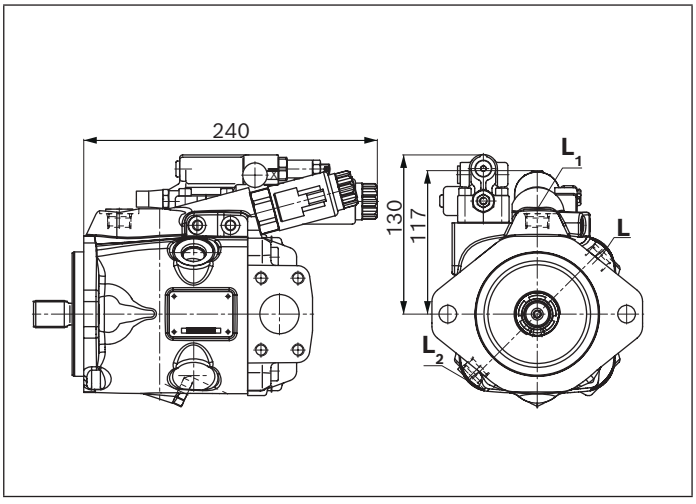
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



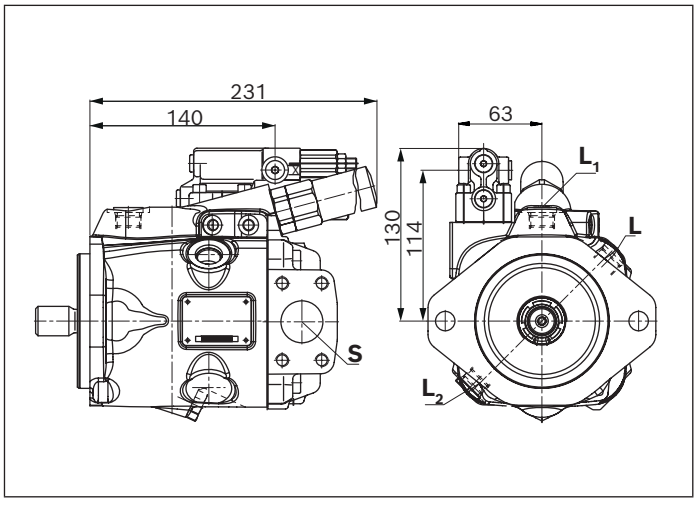
▼ **DRF/DRS/DRSC – Pressure flow controller, series 53**



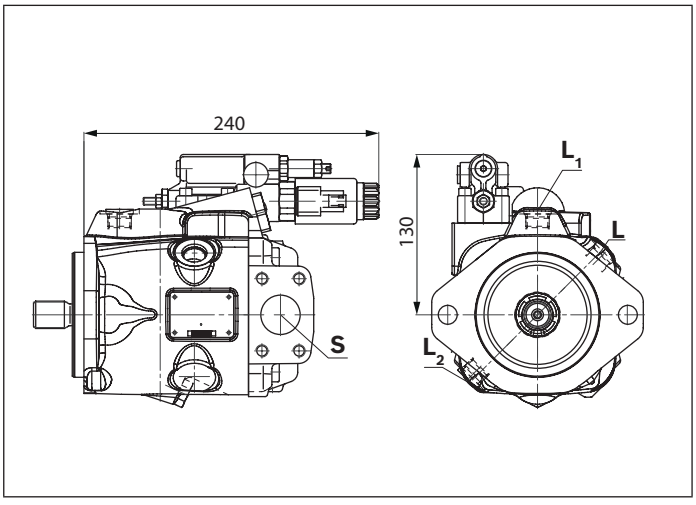
▼ **EP.ED. / EK.ED. – Electro proportional control, series 53**



▼ **LA.D. – Pressure, flow and power controller, series 53**



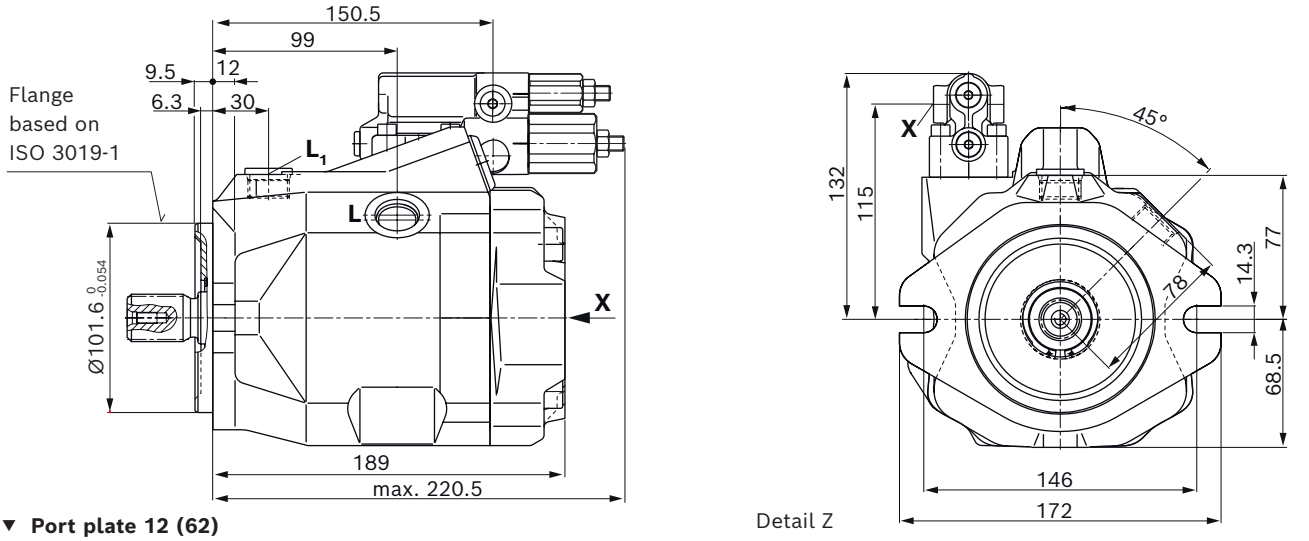
▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**



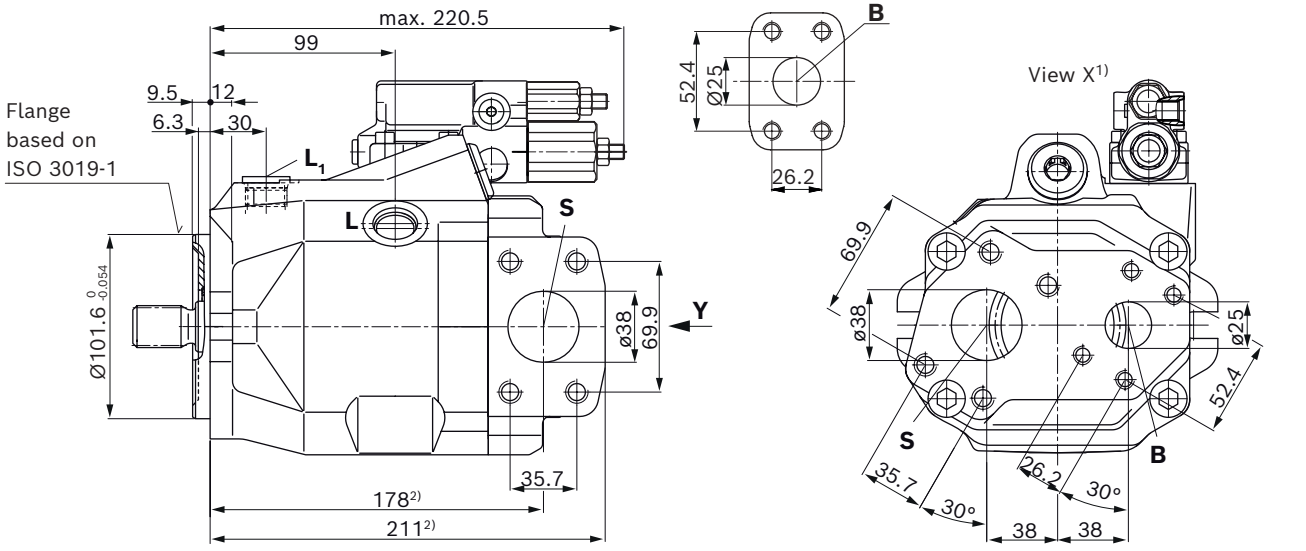
Dimensions, size 45

DRG – hydraulic pressure controller, with pressure cut-off, remote controlled, clockwise rotation, series 52

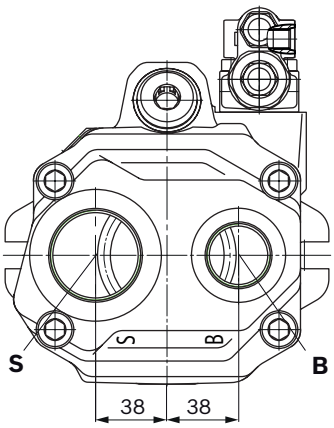
▼ **Port plate 11 (61)**



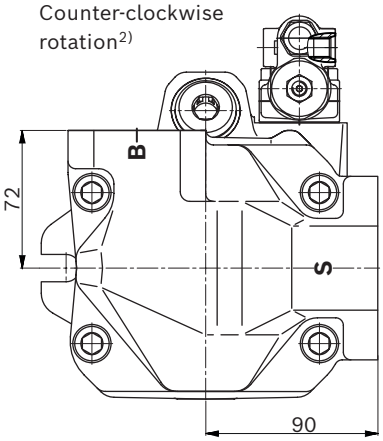
▼ **Port plate 12 (62)**



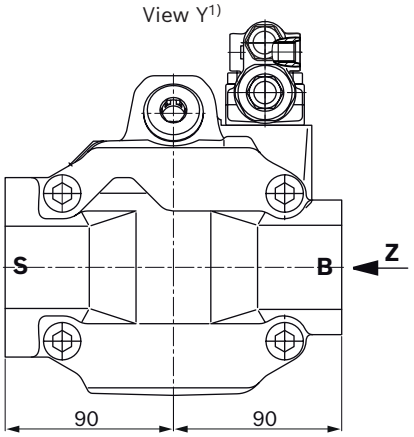
▼ **Port plate 64**



▼ **Port plate 13**
Counter-clockwise rotation 2)



View Y 1)

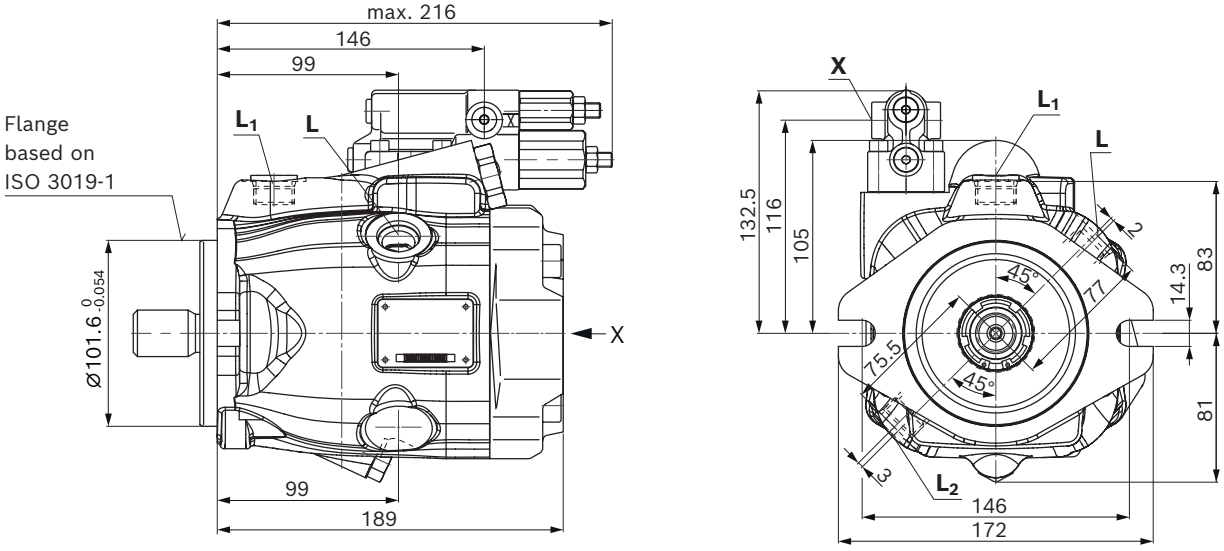


1) Dimensions of working ports turned through 180° for counter-clockwise rotation
2) For dimensions of working ports **S** and **B** for port plate 13 identical as for port plate 12

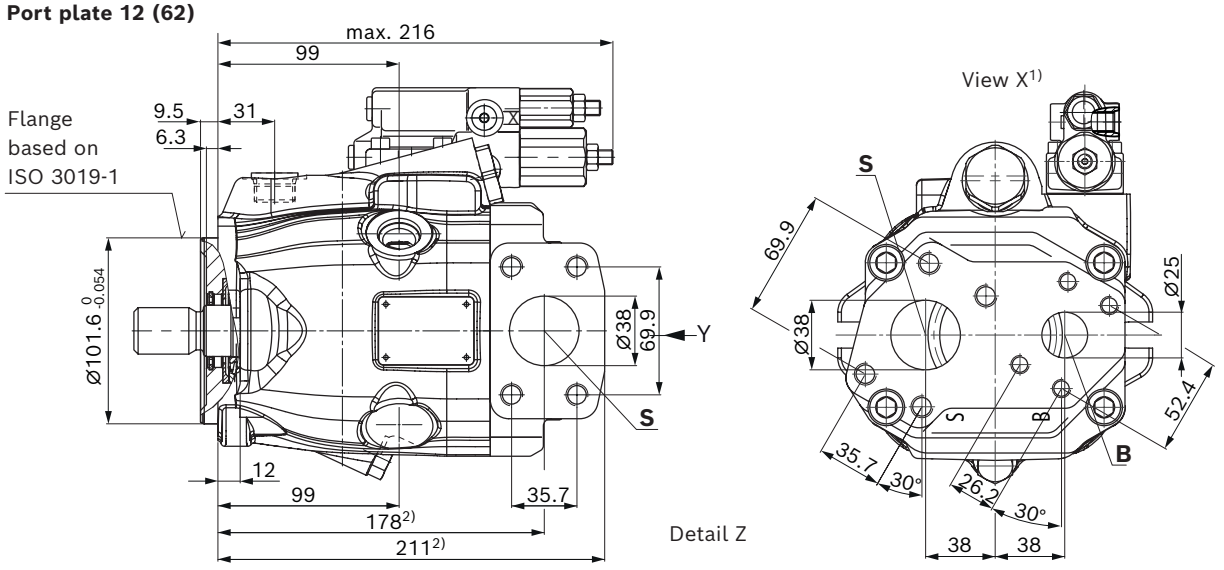
Dimensions, size 45

DRG – hydraulic pressure controller, with pressure cut-off, remote controlled, clockwise rotation, series 53

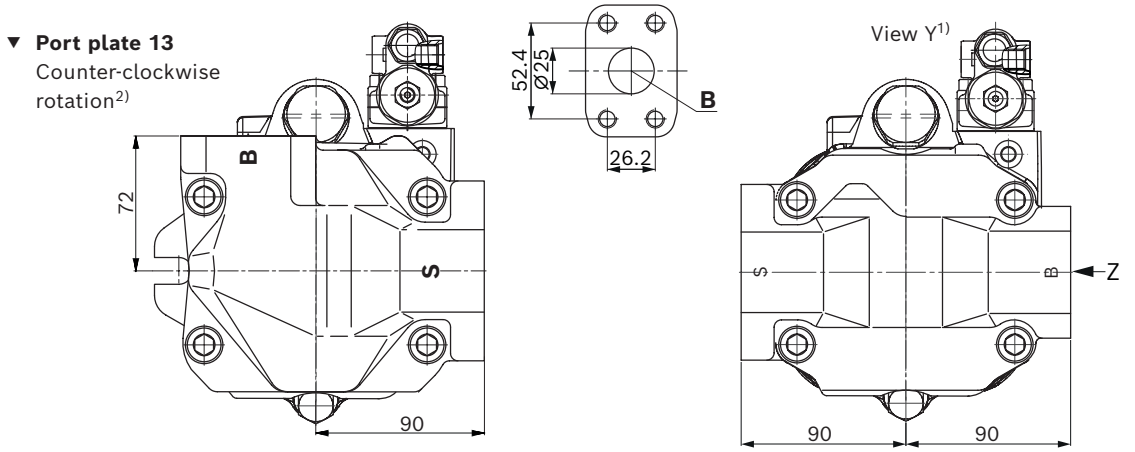
▼ **Port plate 11 (61)**



▼ **Port plate 12 (62)**



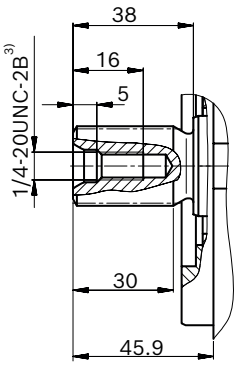
▼ **Port plate 13**
Counter-clockwise rotation 2)



1) Dimensions of working ports turned through 180° for counter-clockwise rotation
2) For dimensions of working ports **S** and **B** for port plate 13 identical as for port plate 12

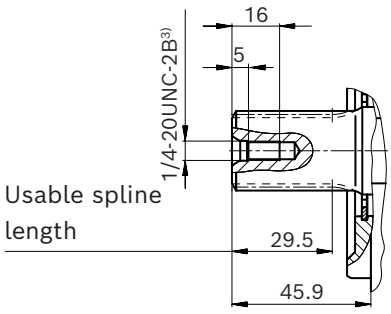
▼ **Splined shaft 1 in (25-4, ISO 3019-1)**

S – 15T 16/32DP[1)]



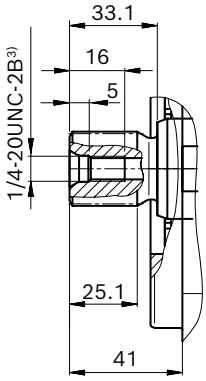
▼ **Splined shaft 1 in (similar to ISO 3019-1)**

R – 15T 16/32DP[1)2)]



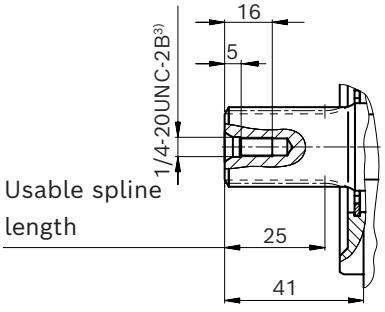
▼ **Splined shaft 7/8 in (22-4, ISO 3019-1)**

U – 13T 16/32DP[1)]



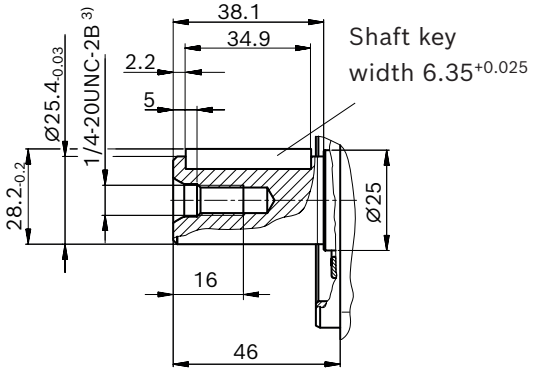
▼ **Splined shaft 7/8 in (similar to ISO 3019-1)**

W – 13T 16/32DP[1)2)]



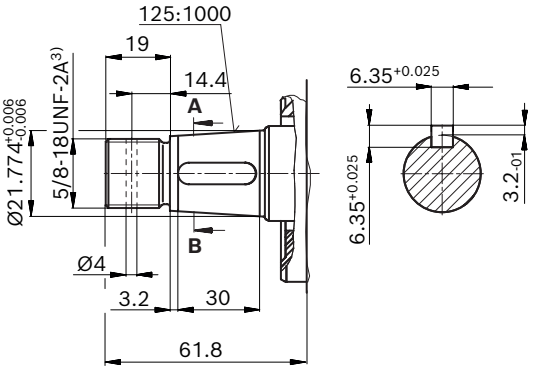
▼ **Parallel keyed shaft ISO 3019-1**

K – 25-1



▼ **Tapered keyed shaft (ISO 3019-1)[4)]**

C

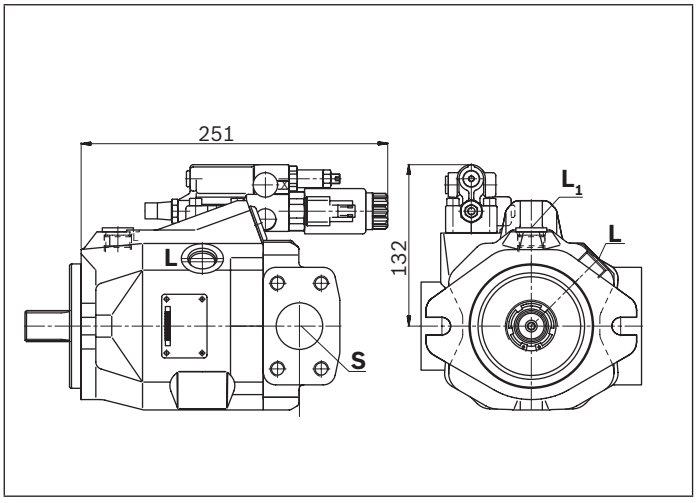


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Only available in series 52

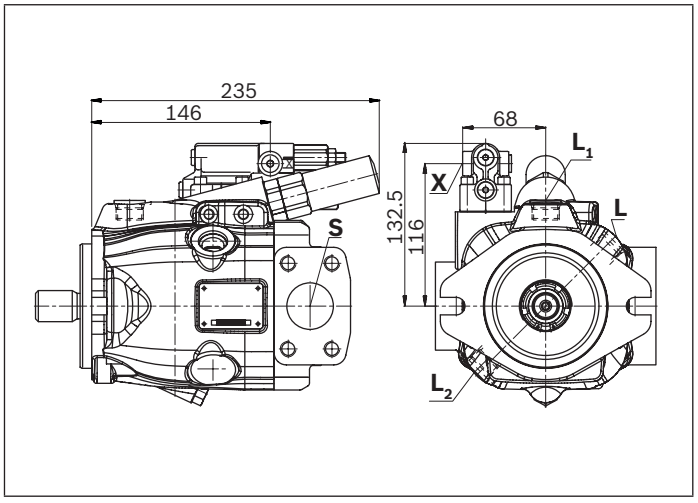
Port plate 11, 12, 13		**Standard**	**Size**	p_{max} **[bar (psi)]**[1)]	**State**[5)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 (0.67) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 1/2 in M12 × 1.75; 20 (0.79) deep	5 (75)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} **[bar (psi)]**[1)]	**State**[5)]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16UNC-2B 18 (0.71) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 1/2 in 1/2-13 UNC-2B; 22 (0.87) deep	5 (75)	O
Port plate 64		**Standard**	**Size**	p_{max} **[bar (psi)]**[1)]	**State**[5)]
B	Working port	ISO 11926	1 5/16 12UN-2B; 20 (0.79) deep	315 (4550)	O
S	Suction port	ISO 11926	1 7/8 12UN-2B; 20 (0.79) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[1)]	**State**[5)]
L	Drain port	ISO 11926[2)]	7/8-14UNF-2B; 13 (0.51) deep	2 (30)	O[3)]
L_1, L_2[4)]	Drain port	ISO 11926[2)]	7/8-14UNF-2B; 13 (0.51) deep	2 (30)	X[3)]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) The countersink may be deeper than specified in the standard.
3) Depending on the installation position, **L**, L_1 or L_2 must be connected (also see installation instructions starting on page 84).
4) Only for series 53
5) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

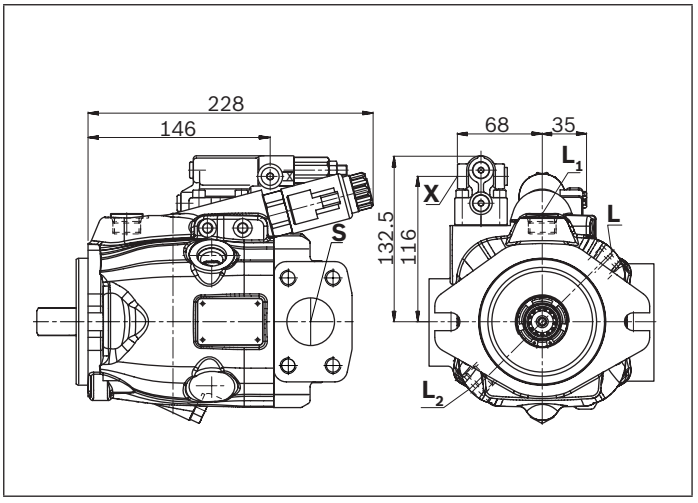
▼ **ED7. / ER7. – Electro-proportional pressure control, series 52**



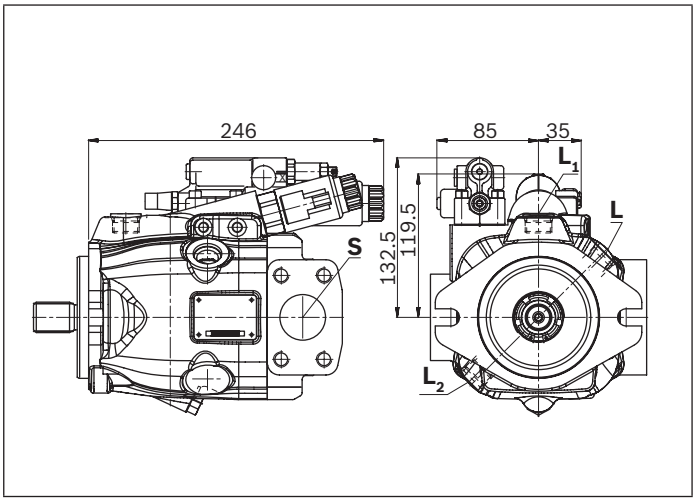
▼ **LA.D. – Pressure, flow and power controller, series 53**



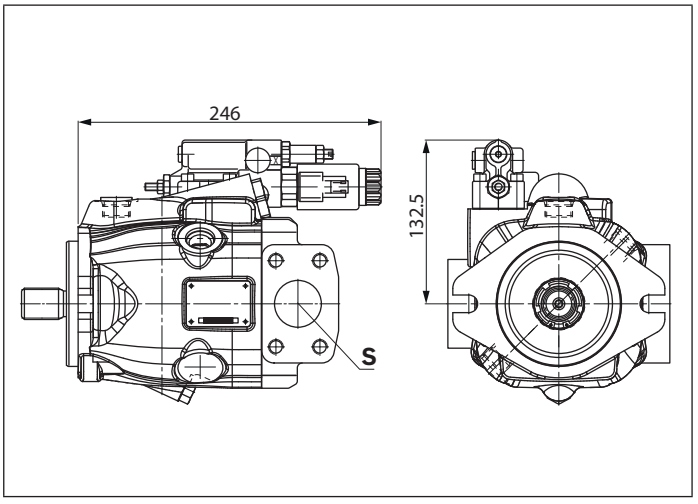
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



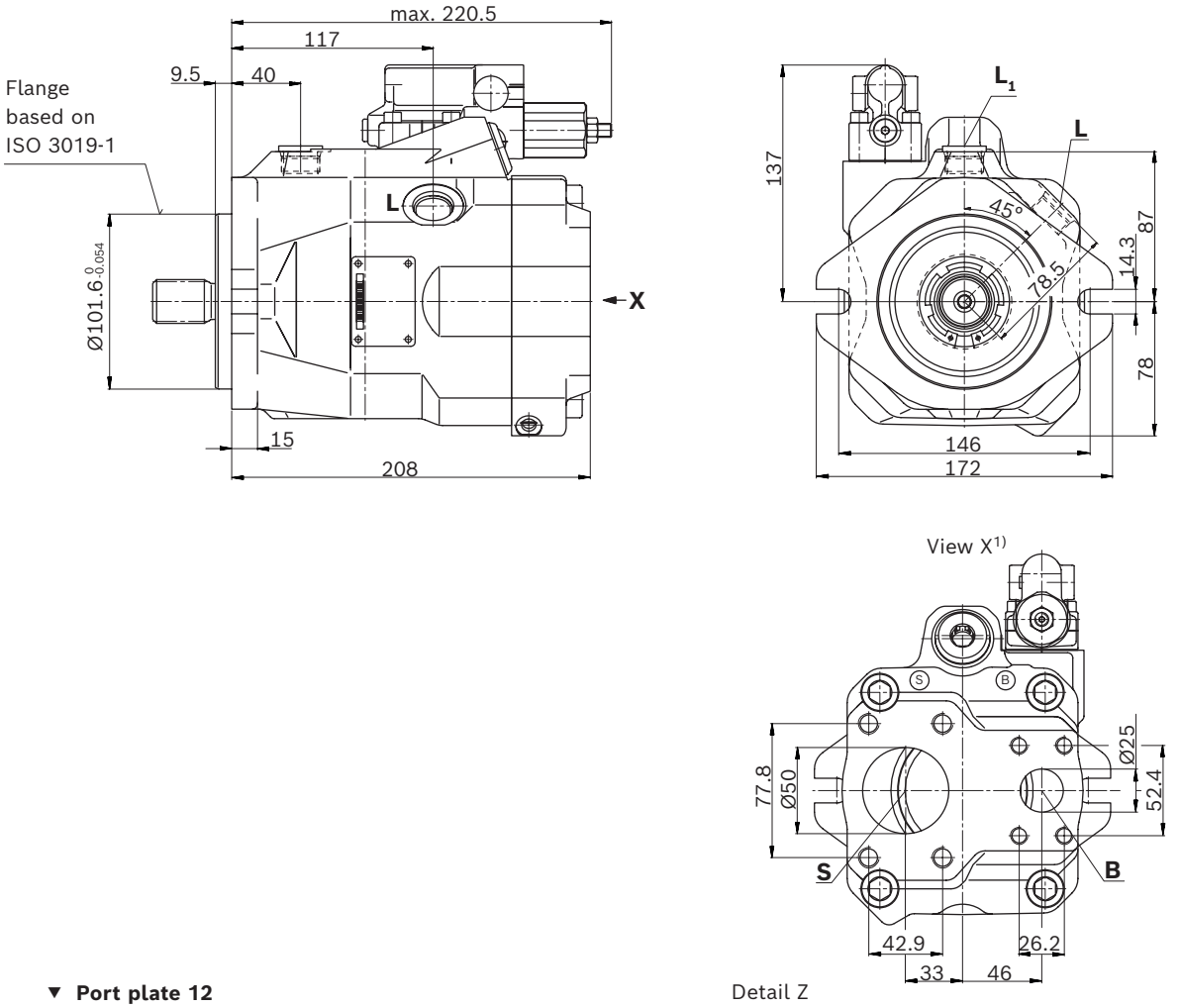
▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**



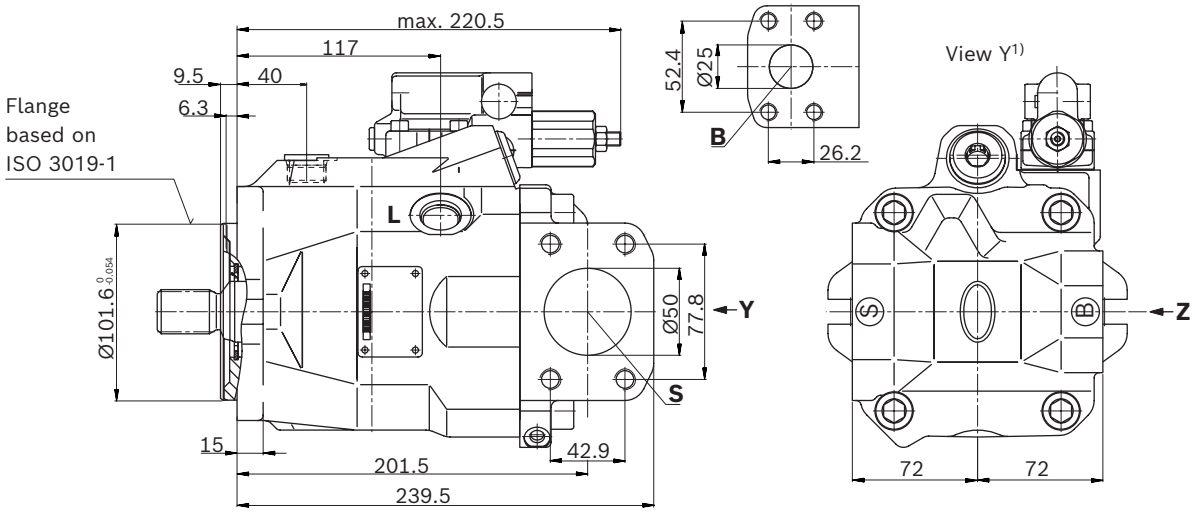
Dimensions, size 60

DR – Hydraulic pressure controller; clockwise rotation, mounting flange C series 52

▼ **Port plate 11**



▼ **Port plate 12**

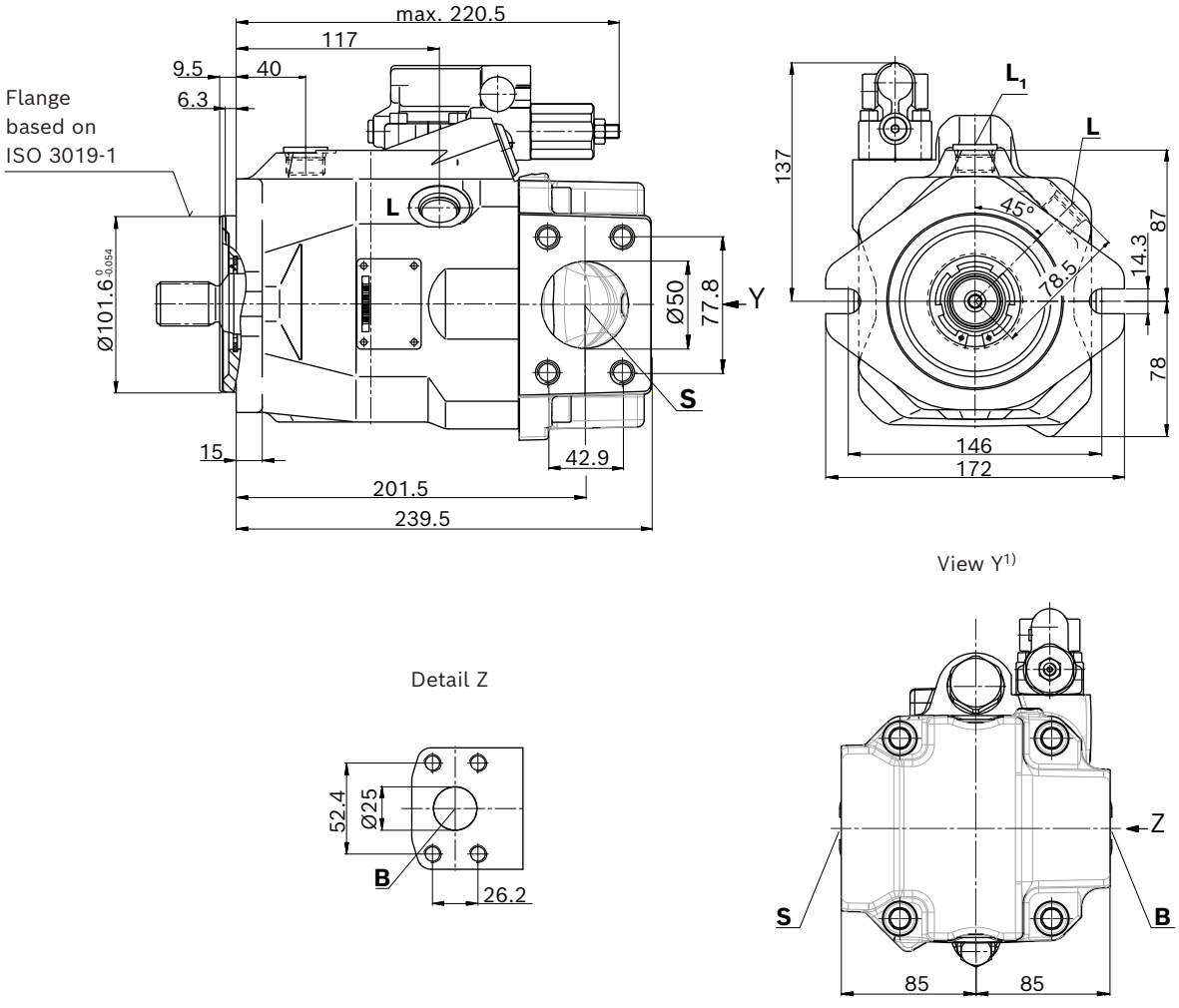


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 60

DR – Hydraulic pressure controller; clockwise rotation, pre compression volume (PCV), mounting flange C, series 52

▼ **Port plate 32 (82)**

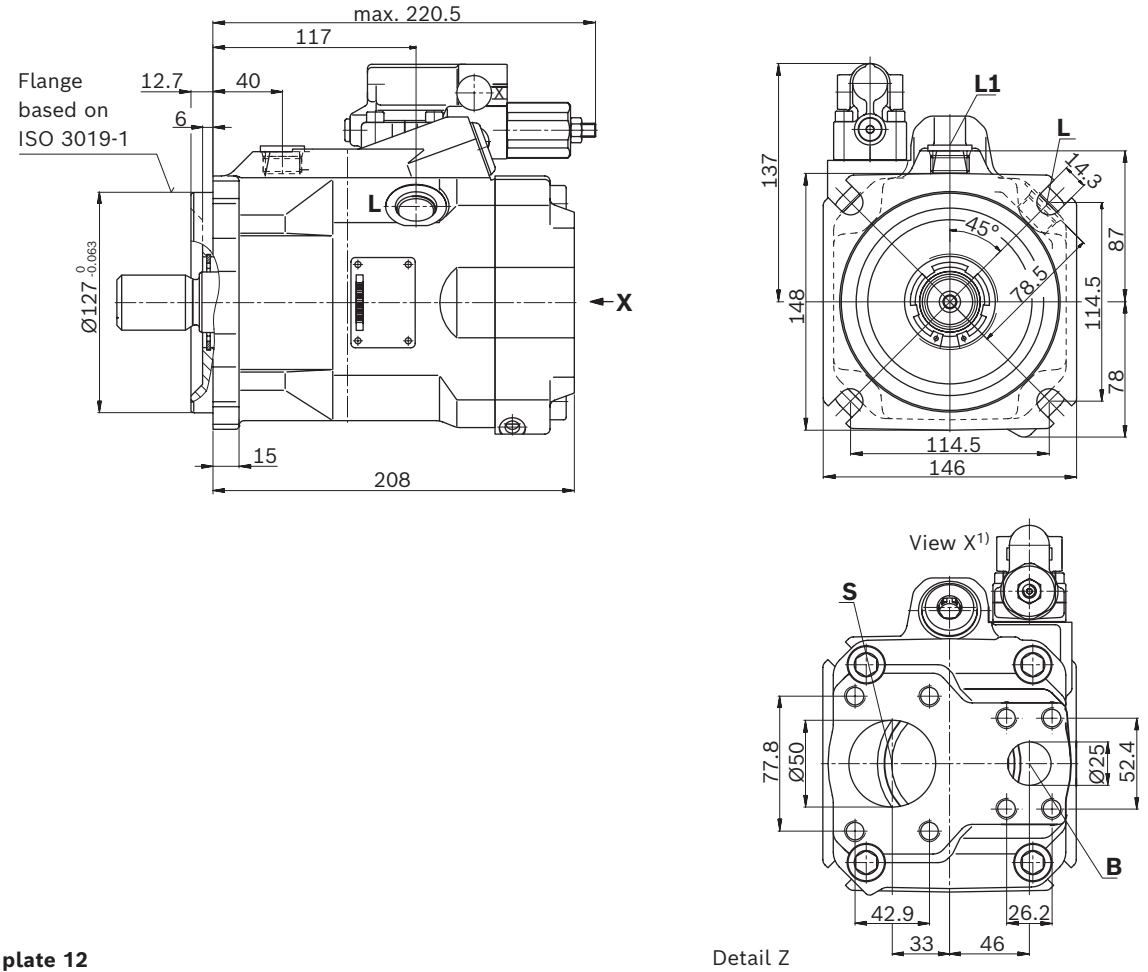


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

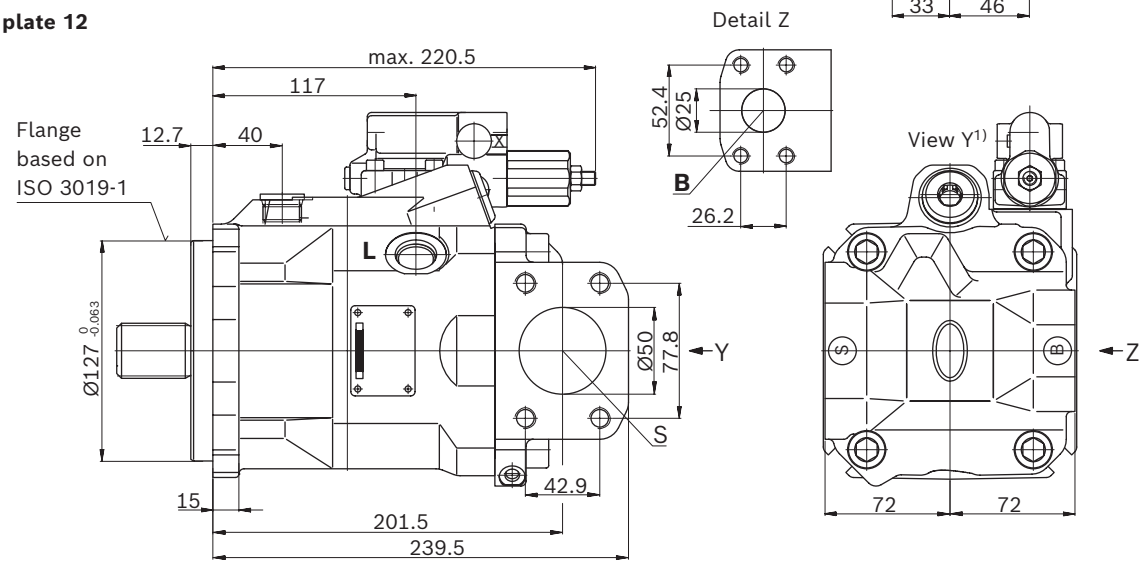
Dimensions, size 60

DR – Hydraulic pressure controller; clockwise rotation, mounting flange D series 52

▼ **Port plate 11**



▼ **Port plate 12**

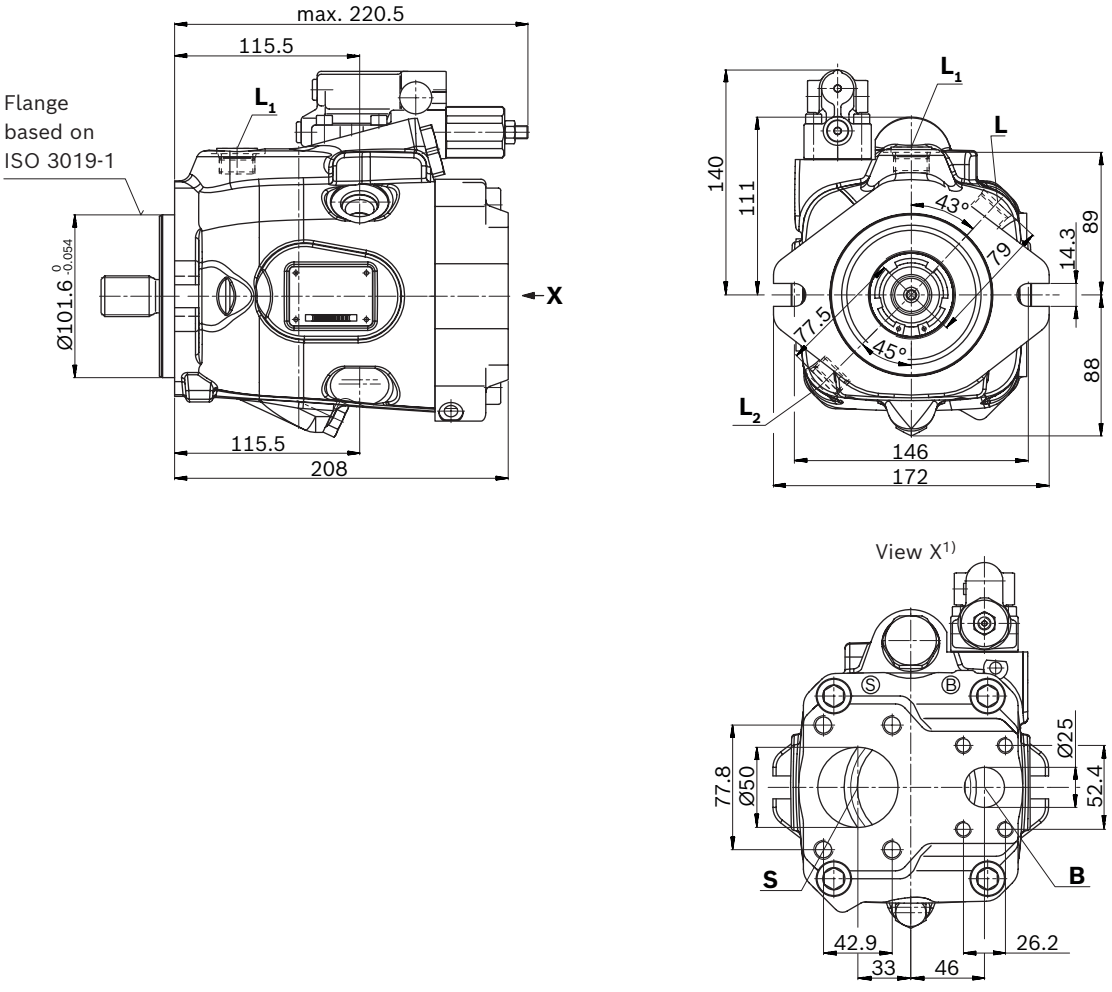


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

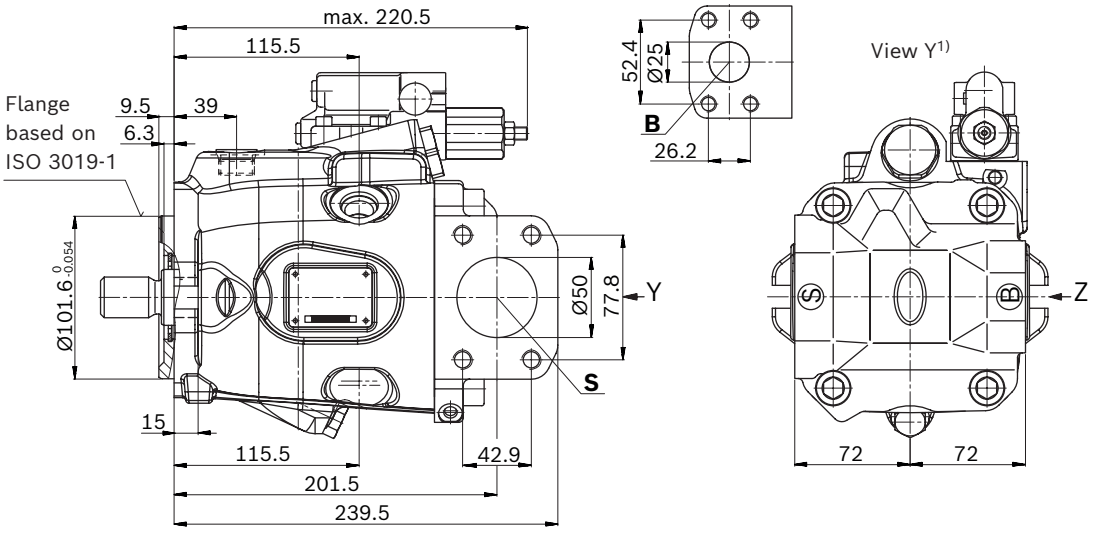
Dimensions, sizes 63 and 72

DR – Hydraulic pressure controller; clockwise rotation, mounting flange C series 53

▼ **Port plate 11 (61)**



▼ **Port plate 12 (62)**

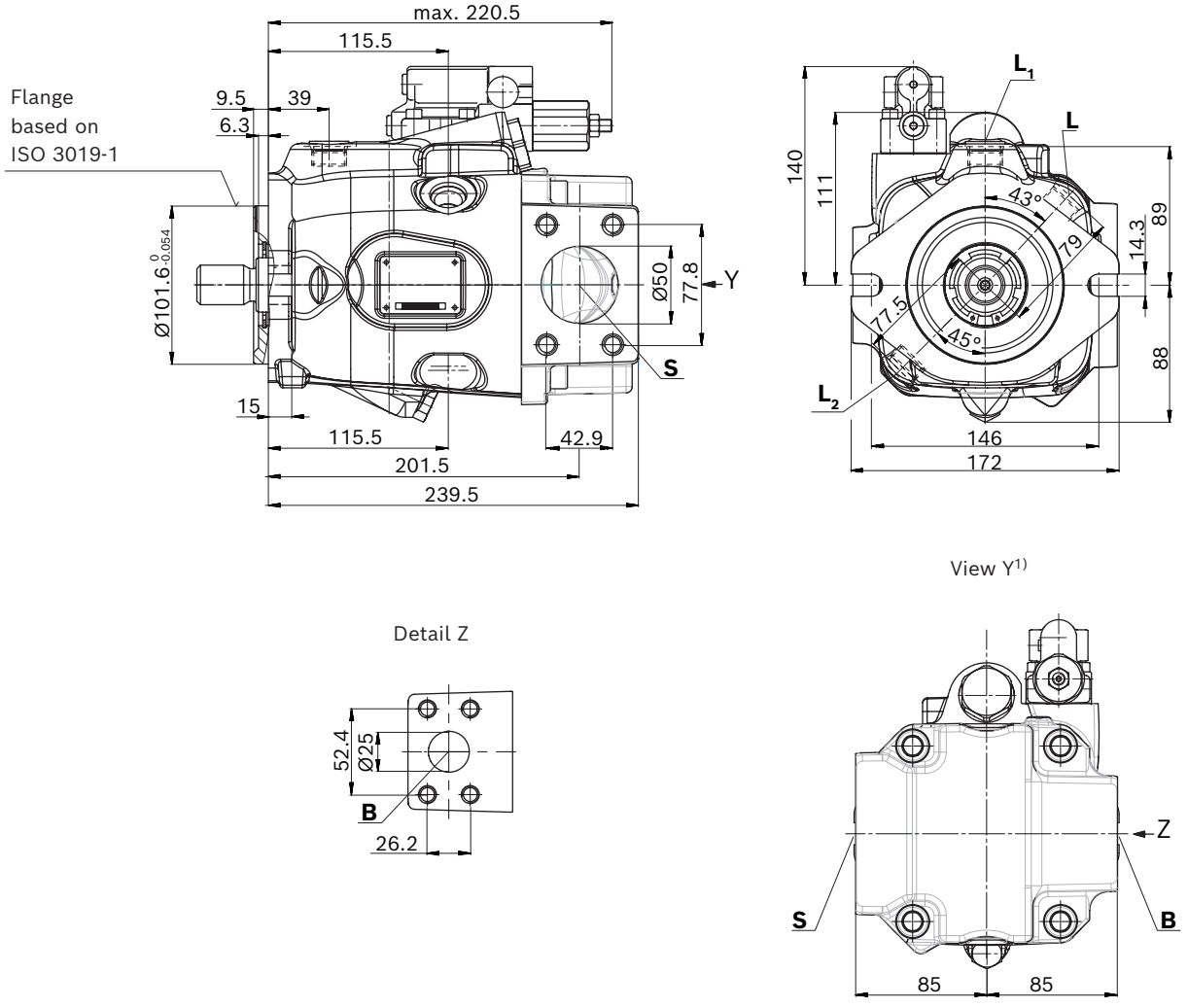


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, sizes 63 and 72

DR – Hydraulic pressure controller; clockwise rotation, pre compression volume (PCV), mounting flange C, series 53

▼ **Port plate 32 (82)**

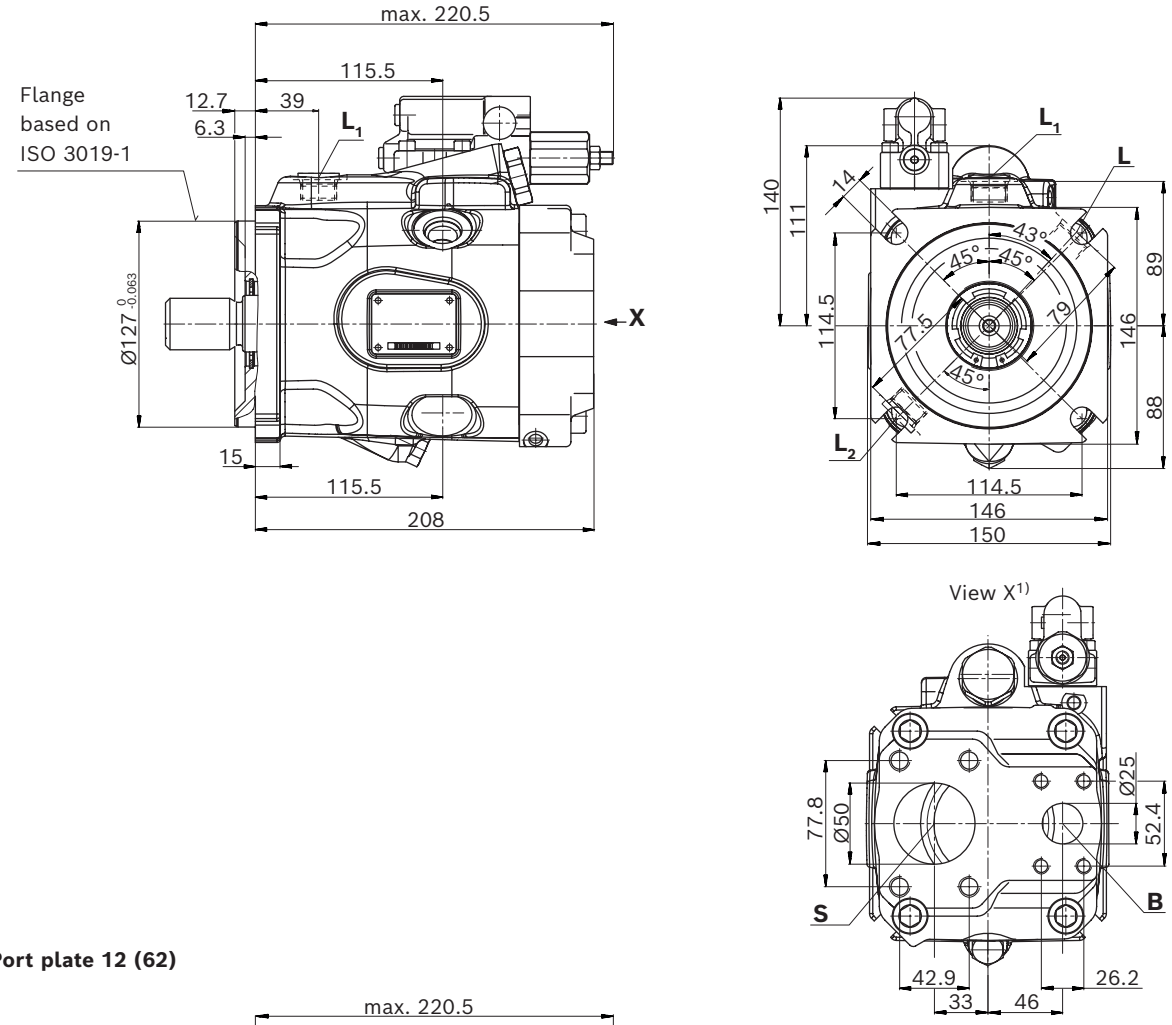


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

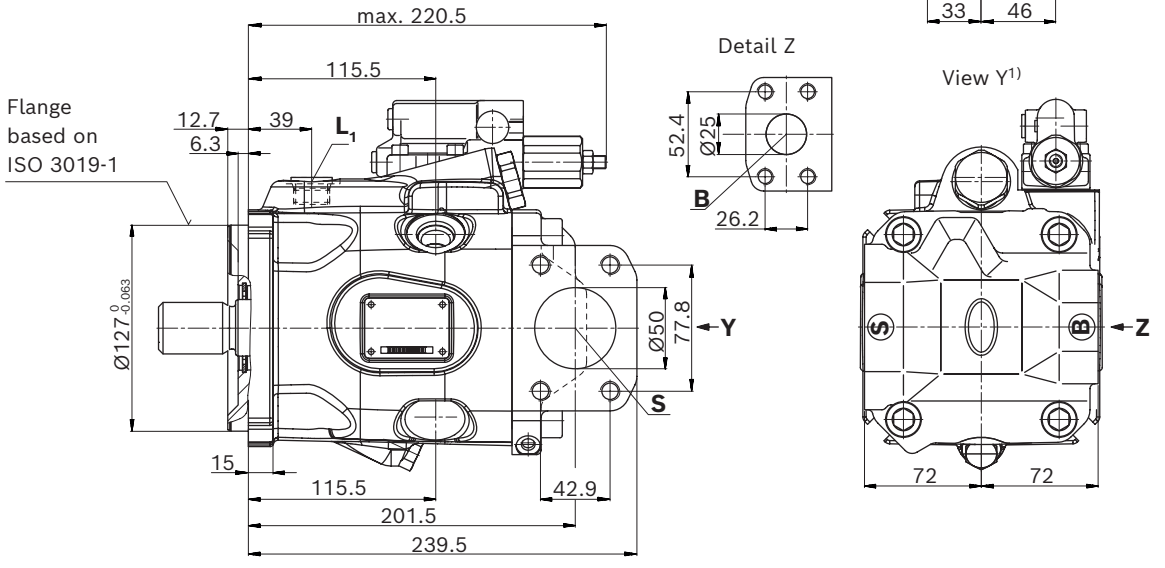
Dimensions, sizes 63 and 72

DR – Hydraulic pressure controller; clockwise rotation, mounting flange D series 53

▼ **Port plate 11 (61)**



▼ **Port plate 12 (62)**

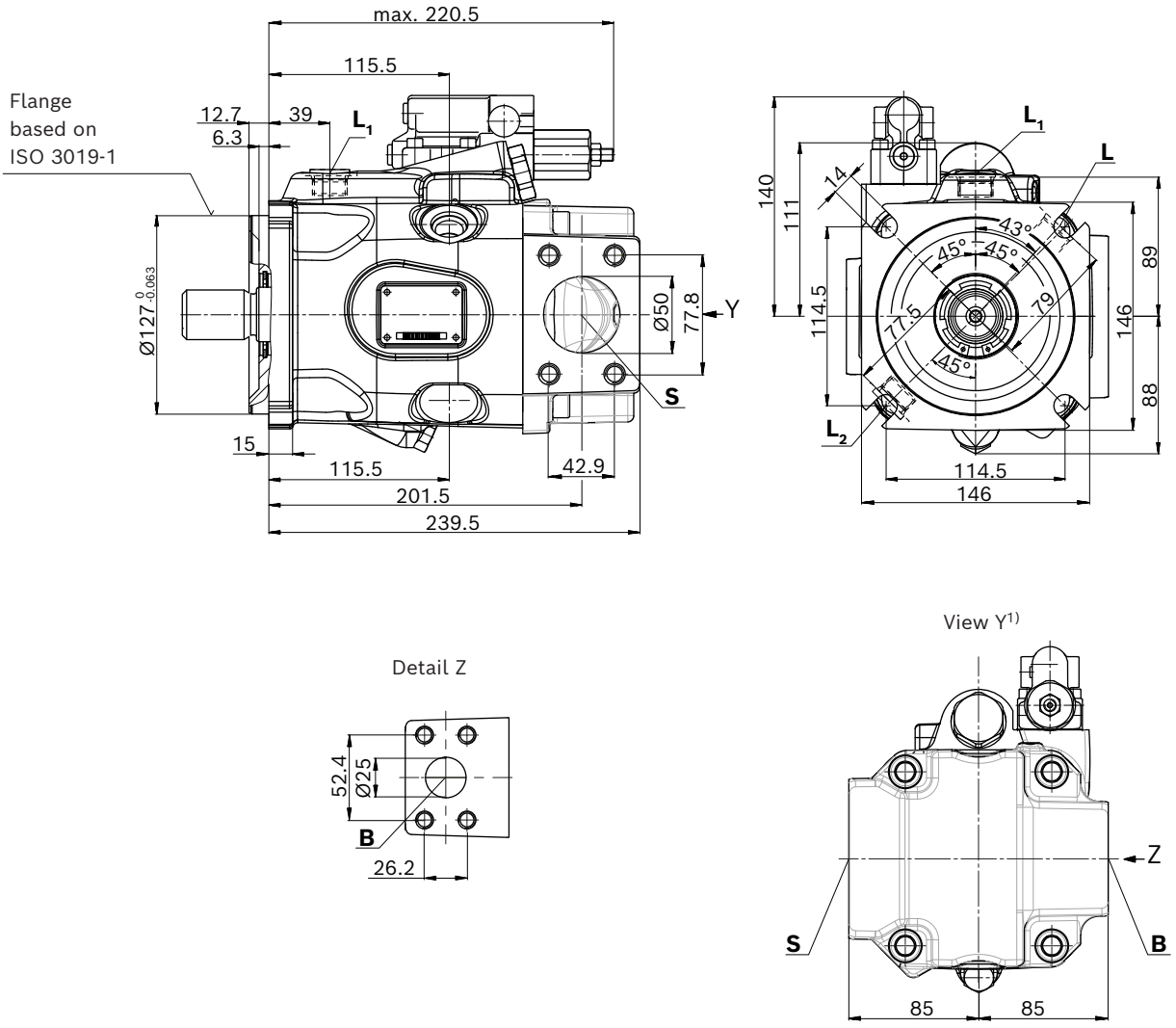


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, sizes 63 and 72

DR – Hydraulic pressure controller; clockwise rotation, pre compression volume (PCV), mounting flange D, series 53

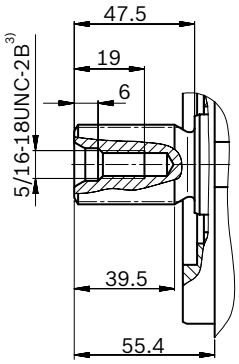
▼ **Port plate 32 (82)**



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

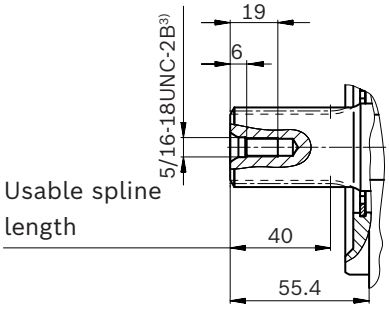
▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)**

S – 14T 12/24DP[1)]



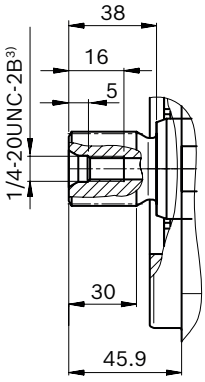
▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)**

R – 14T 12/24DP[1)2)]



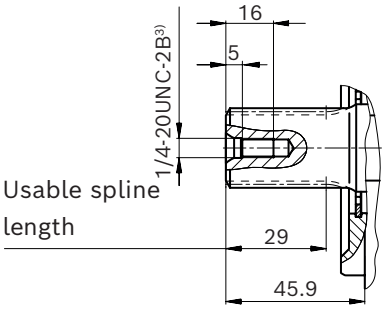
▼ **Splined shaft 1 in (25-4, ISO 3019-1)**

U – 15T 16/32DP[1)]



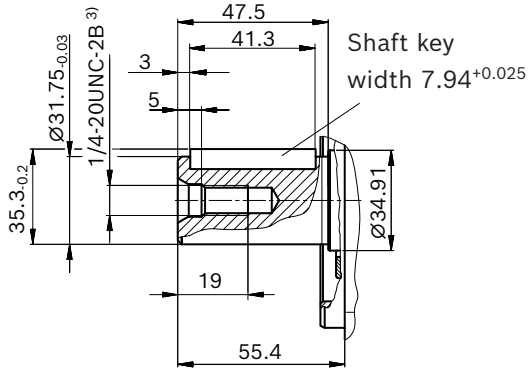
▼ **Splined shaft 1 in (similar to ISO 3019-1)**

W – 15T 16/32DP[1)2)]



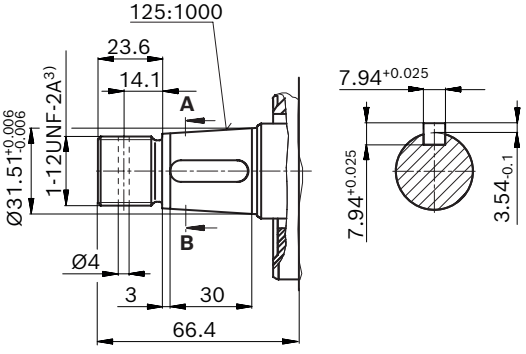
▼ **Parallel keyed shaft ISO 3019-1**

K – 32-1



▼ **Tapered keyed shaft (ISO 3019-1)[4)]**

C

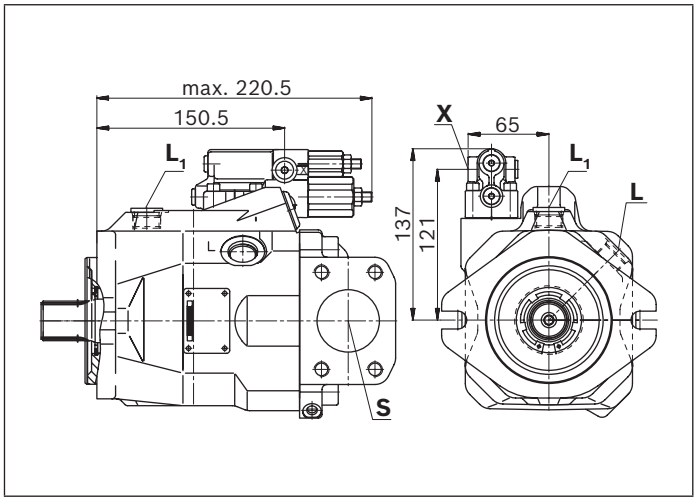


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Only available in size 60 and series 52

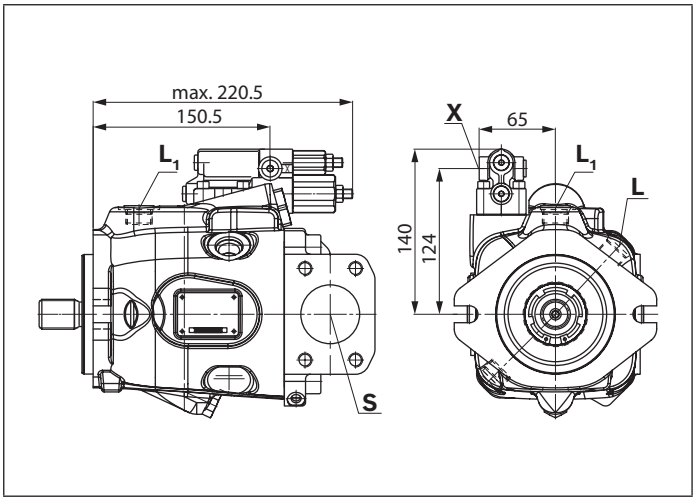
Port plate 11, 12, 32		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	1 in M10 × 1.5; 17 deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 in M12 × 1.75; 20 deep	5 (75)	O
Port plate 61, 62, 82		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	1 in 3/8-16UNC-2B; 18 (0.71) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 in 1/2-13 UNC-2B; 22 (0.87) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
L	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 deep	2 (30)	O[3]
L_1, L_2[4]	Drain port	ISO 11926[2]	7/8-14UNF-2B; 13 deep	2 (30)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 deep	315 (4550)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) The countersink may be deeper than specified in the standard.
3) Depending on the installation position, **L**, L_1 or L_2 must be connected (also see installation instructions starting on page 17).
4) Only series 53
5) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

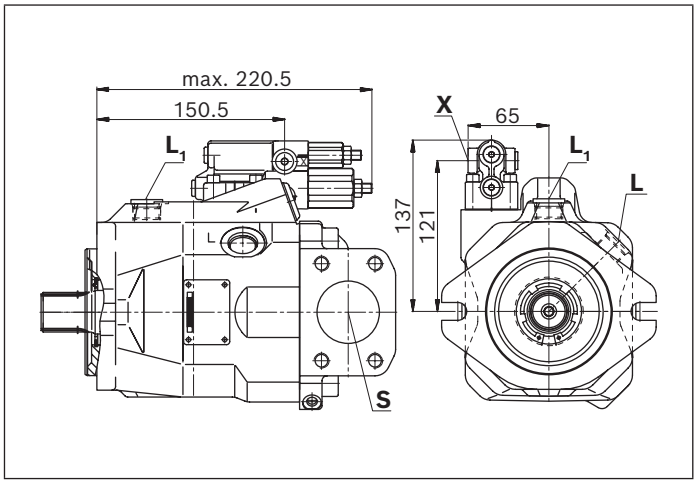
▼ **DRG – Pressure controller, remote controlled, series 52**



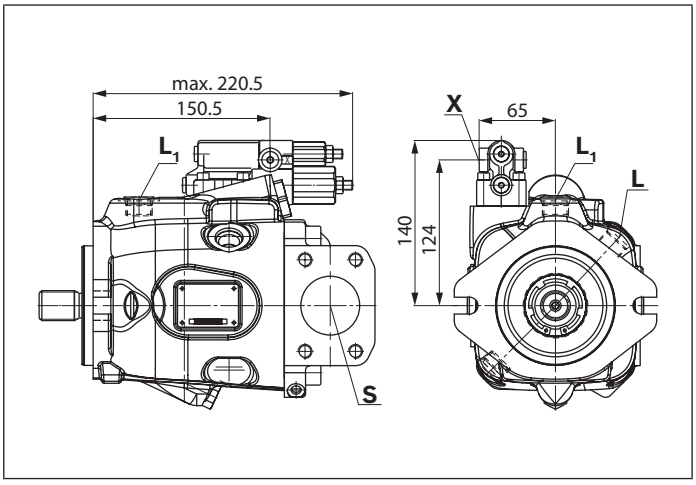
▼ **DRG – Pressure controller, remote controlled, series 53**



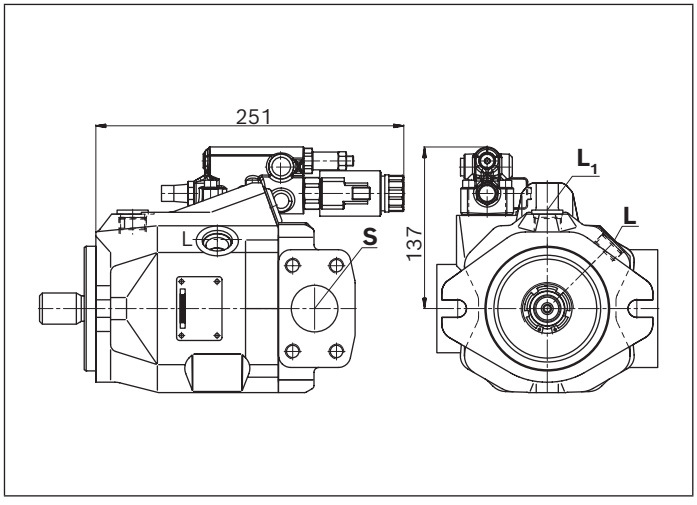
▼ **~~DFR/DFR1/DRSC~~ – pressure flow controller, series 52**



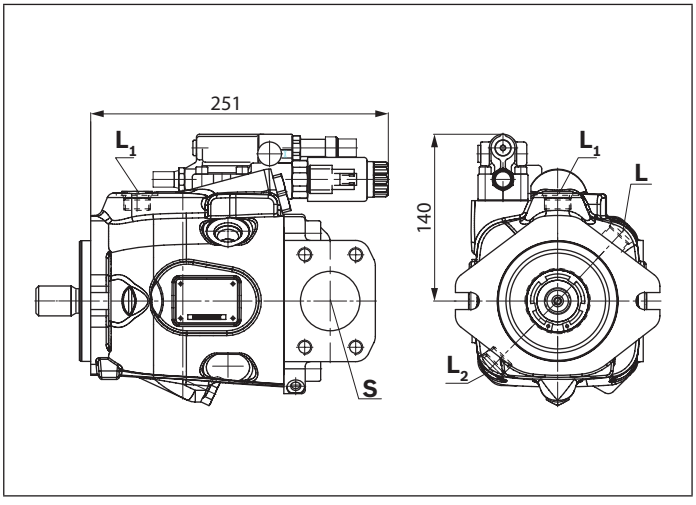
▼ **~~DRF/DRS/DRSC~~ – pressure flow controller, series 53**



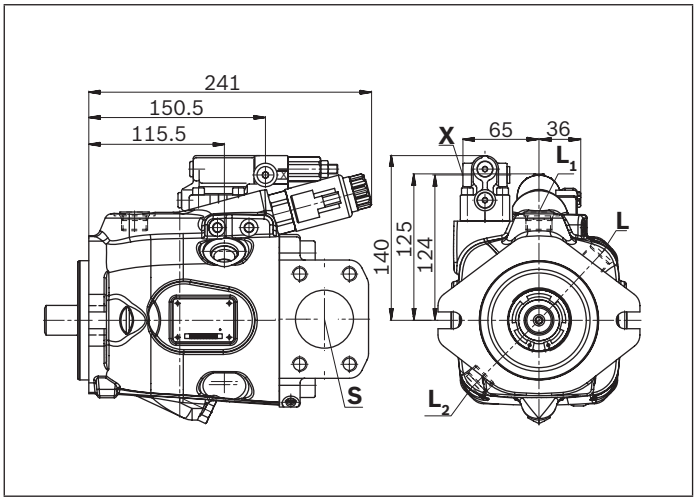
▼ **~~ED7./ER7.~~ – Electro-proportional pressure control, series 52**



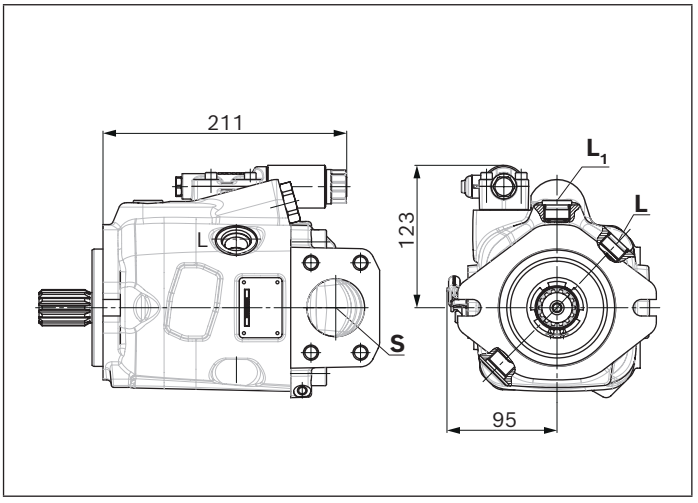
▼ **~~ED7./ER7.~~ – Electro-proportional Pressure control, series 53**



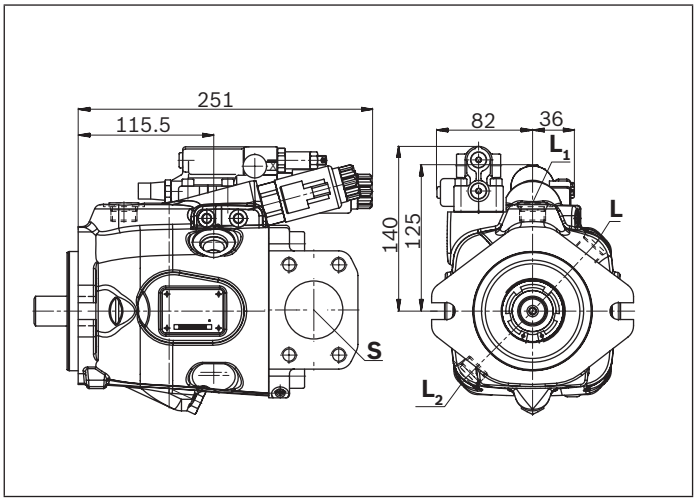
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



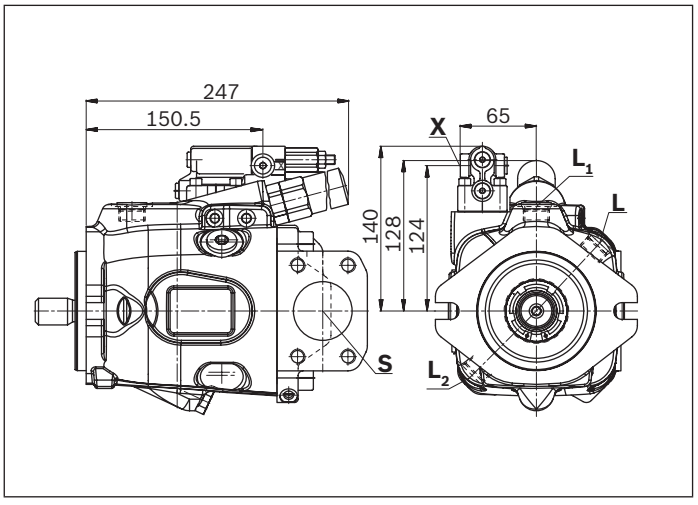
▼ **EC4/EB4 – Electrohydraulic control valve, series 53[1)]**



▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power controller, series 53**

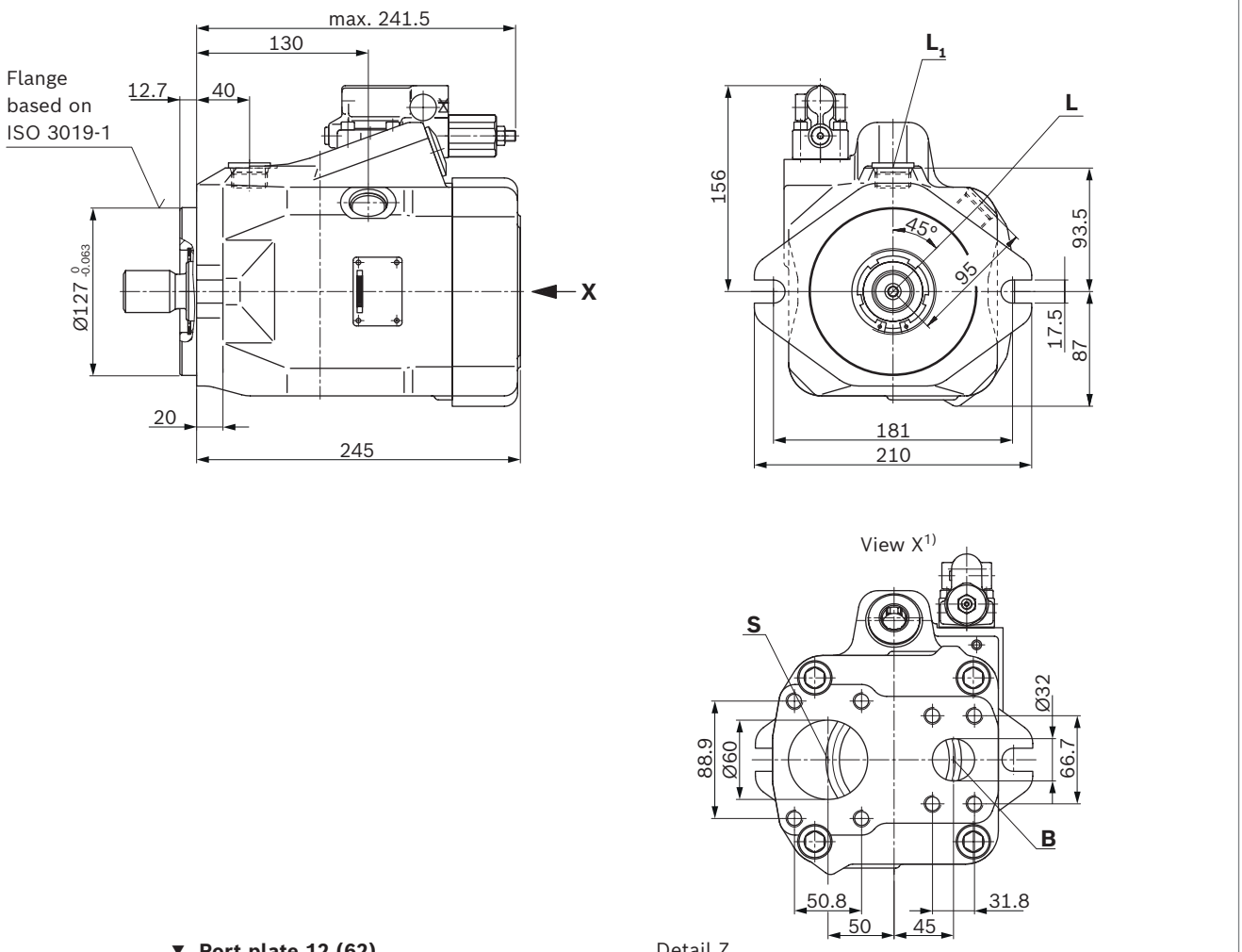


1) Only available in size 63 and series 53

Dimensions, size 85

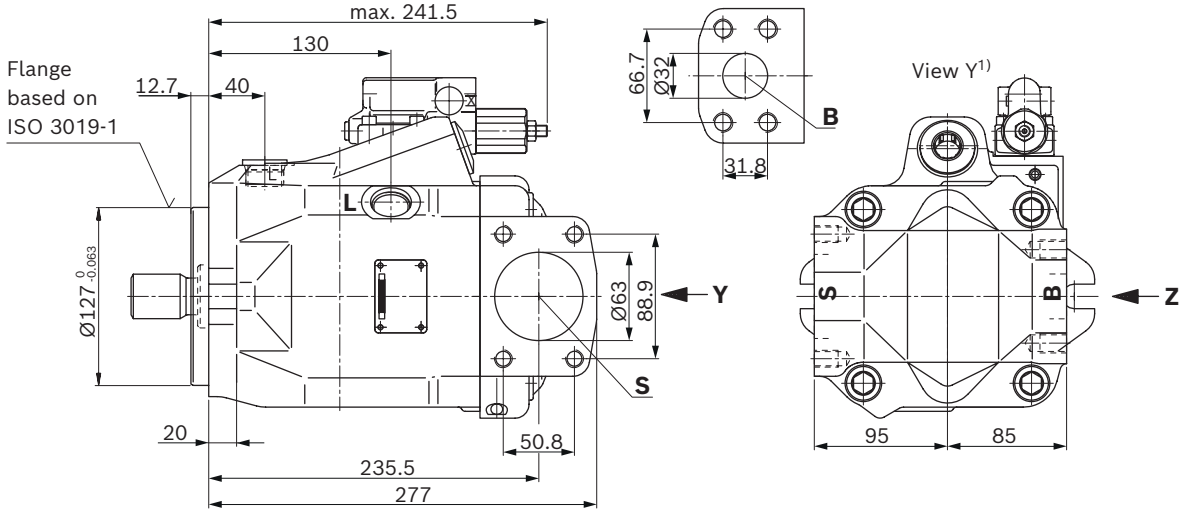
DR – Hydraulic pressure controller; clockwise rotation, mounting flange C series 52

▼ **Port plate 11 (61)**



▼ **Port plate 12 (62)**

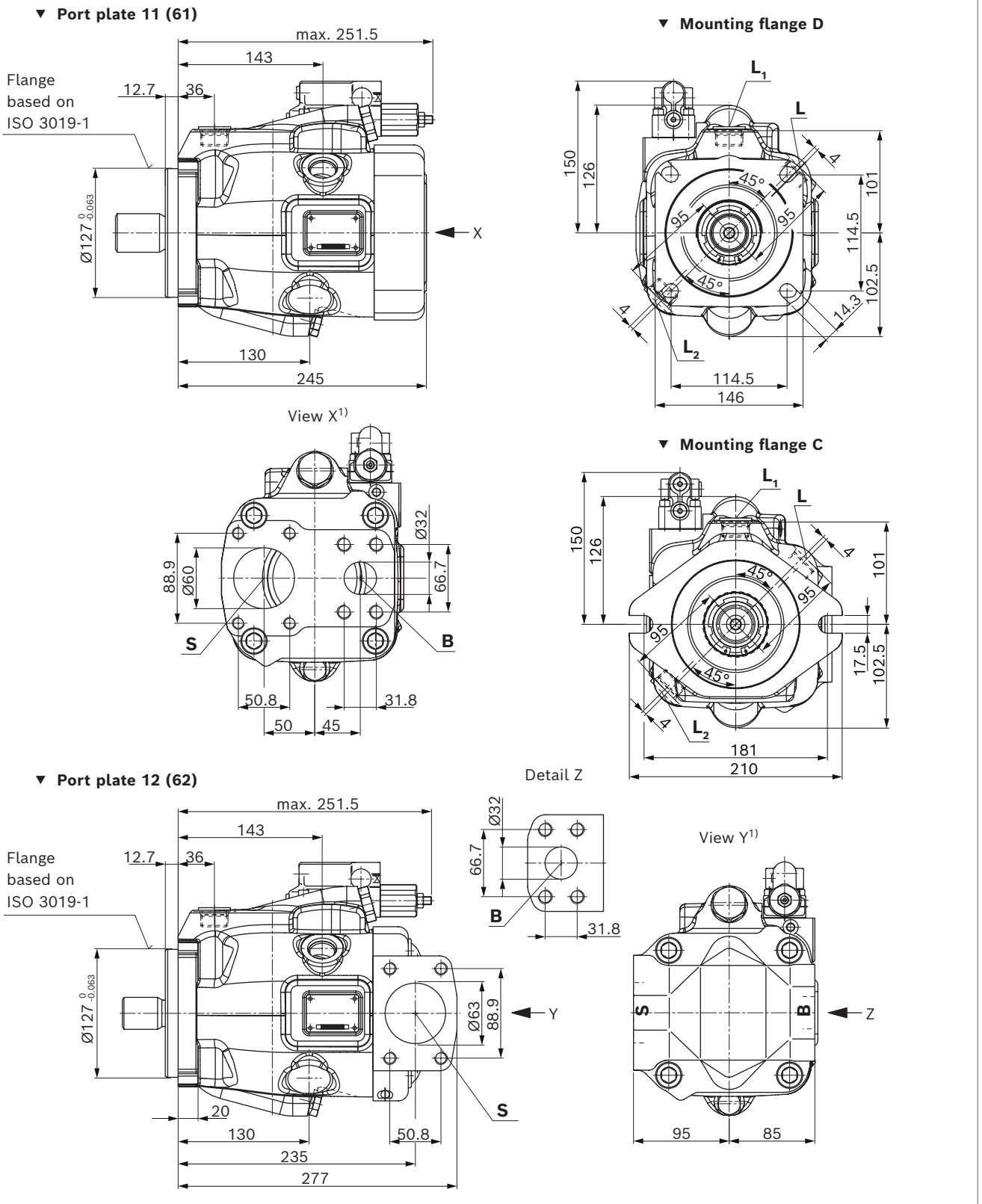
Detail Z



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

Dimensions, size 85

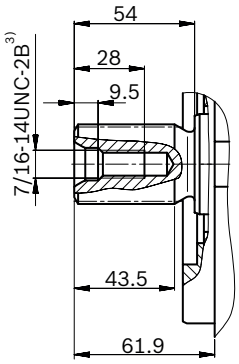
DR – Hydraulic pressure controller; clockwise rotation, mounting flange C and D series 53



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

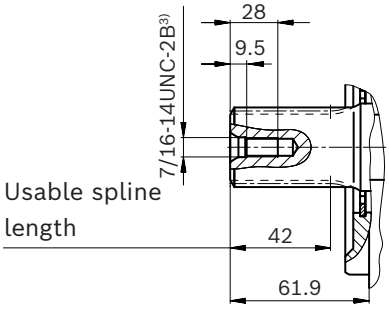
▼ **Splined shaft 1 1/2 in (38-4, ISO 3019-1)**

S – 17T 12/24DP[1)]



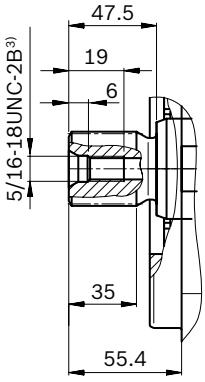
▼ **Splined shaft 1 1/2 in (similar to ISO 3019-1)**

R – 17T 12/24DP[1)2)]



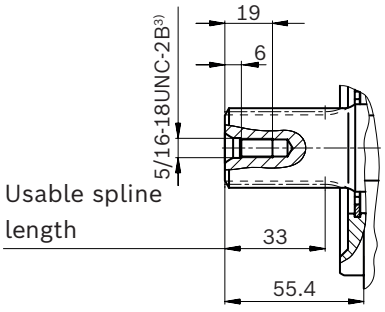
▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)**

U – 14T 12/24DP[1)]



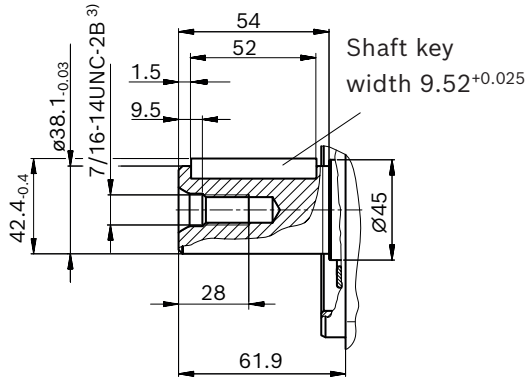
▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)**

W – 14T 12/24DP[1)2)]



▼ **Parallel keyed shaft ISO 3019-1**

K – 38-1

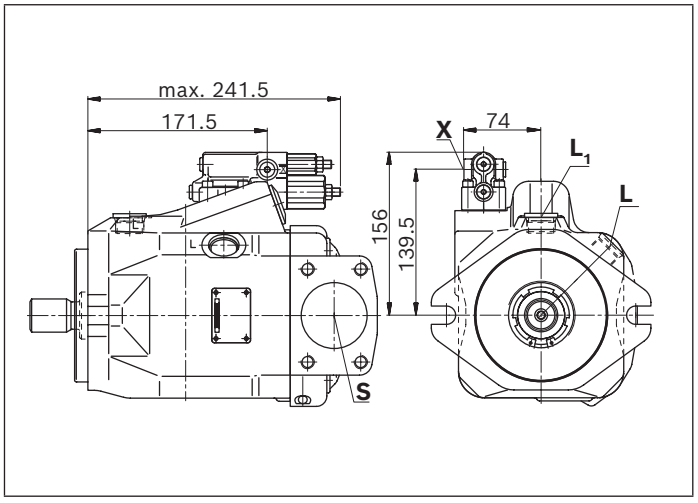


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1

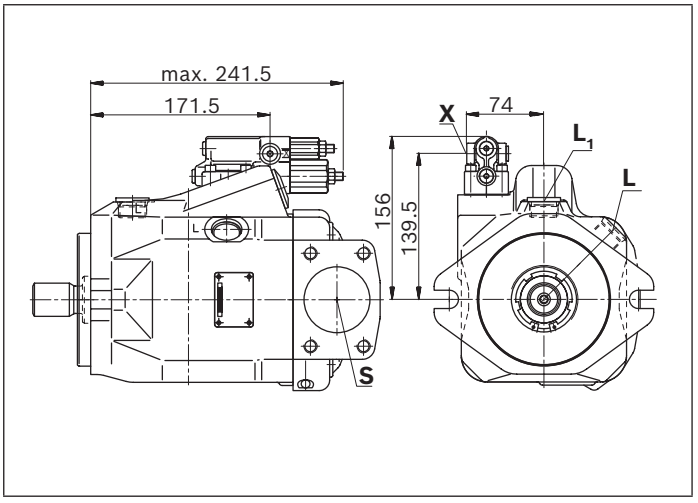
Port plate 11, 12		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (high-pressure series) fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 × 2[6]; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 × 1.75; 17 (0.67) deep	5 (75)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (high-pressure series) fastening thread	ISO 6162-2 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 27 (1.06) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
L	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	2 (30)	O[3]
$\mathbf{L_1}$, $\mathbf{L_2}$[4]	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	2 (30)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) The countersink may be deeper than specified in the standard.
3) Depending on the installation position, **L**, $\mathbf{L_1}$ or $\mathbf{L_2}$ must be connected (also see installation instructions starting on page 84).
4) Only series 53
5) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)
6) Fastening thread M14 deviating from standard ISO 6162-2.

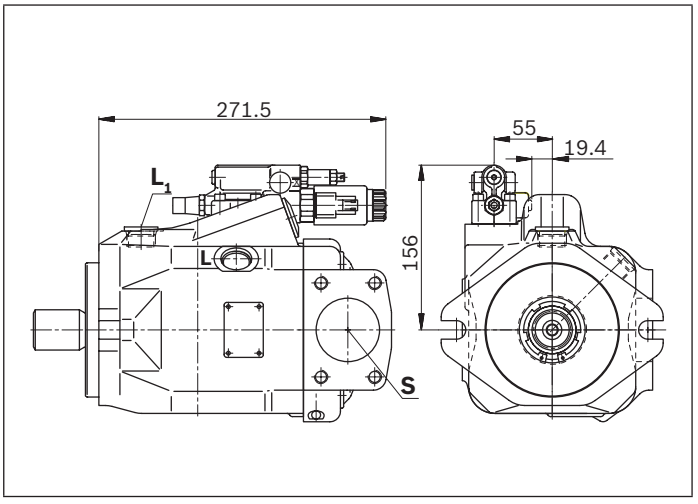
▼ **DRG – Pressure controller, remote controlled, series 52**



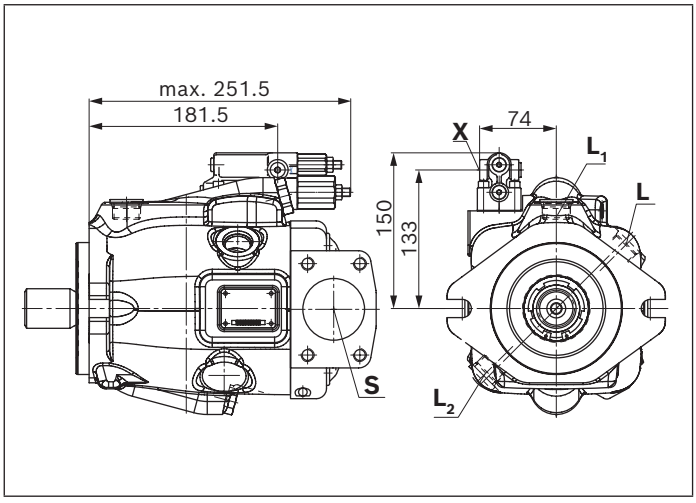
▼ **DFR/DFR1/DRSC – Pressure flow controller, series 52**



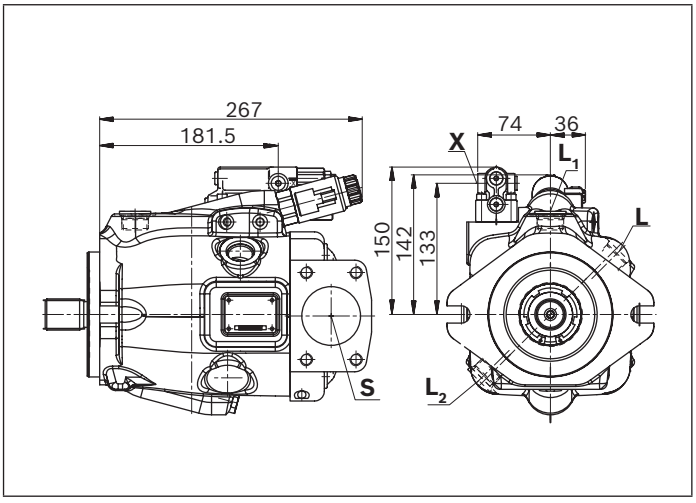
▼ **ED7. / ER7. – Electro-proportional pressure control, series 52**



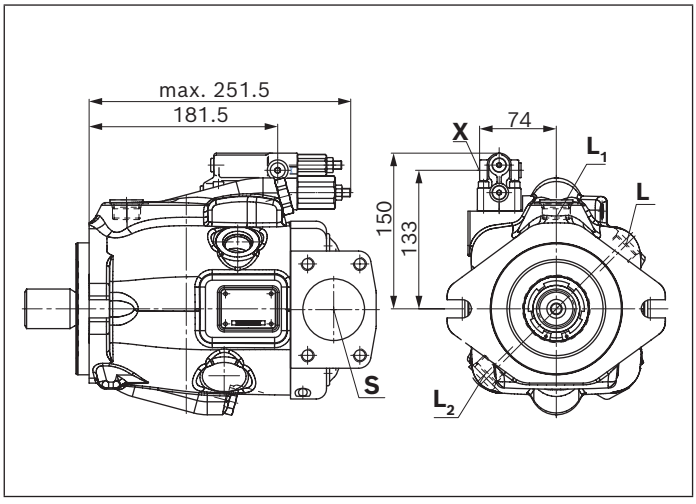
▼ **DRG – Pressure controller, remote controlled, series 53**



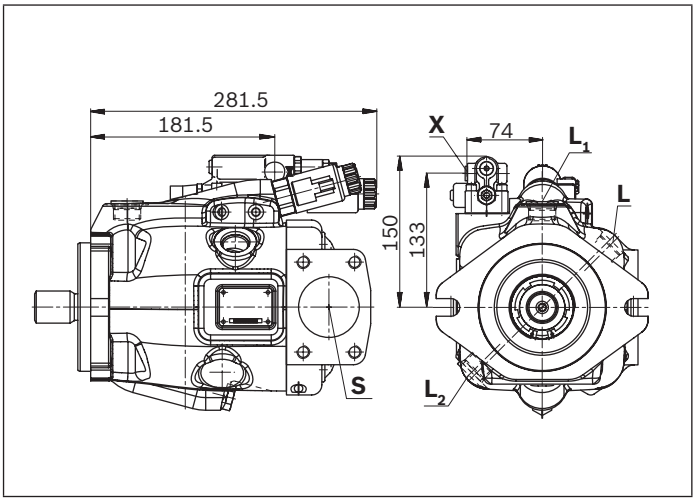
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



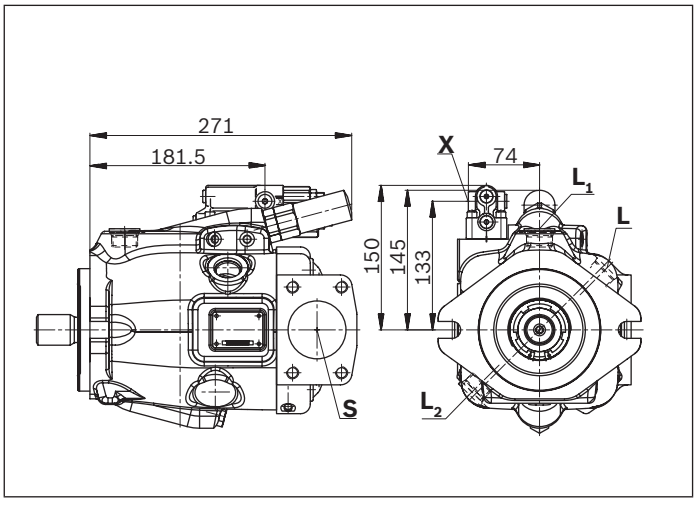
▼ **DRF/DRS/DRSC – Pressure flow controller, series 53**



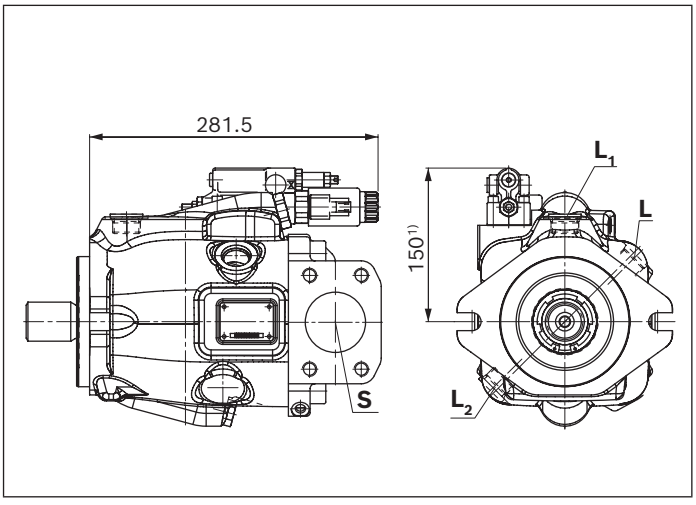
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power controller, series 53**



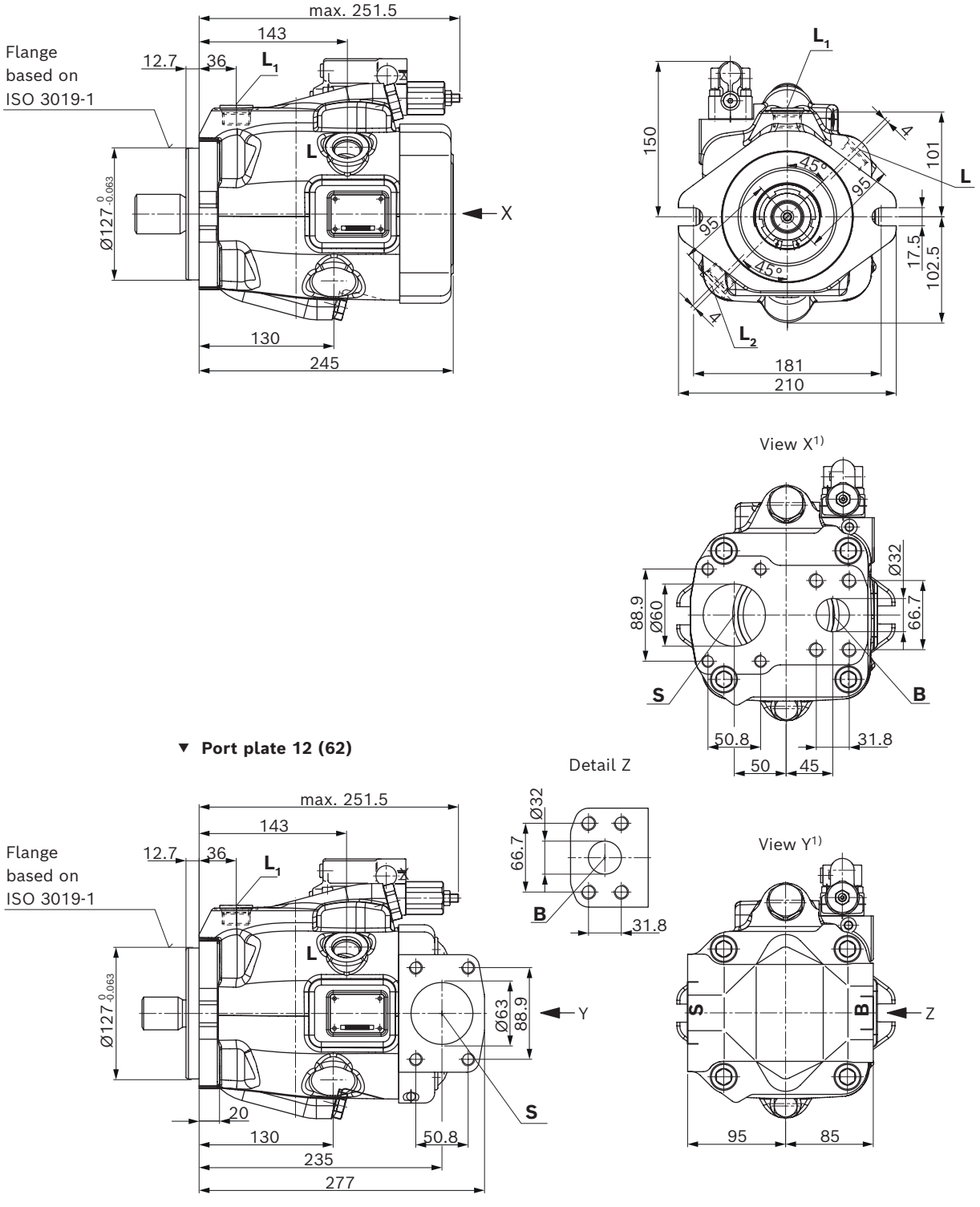
▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**



Dimensions, size 100

DR – Hydraulic pressure controller; clockwise rotation, mounting flange C series 53

▼ **Port plate 11 (61)**

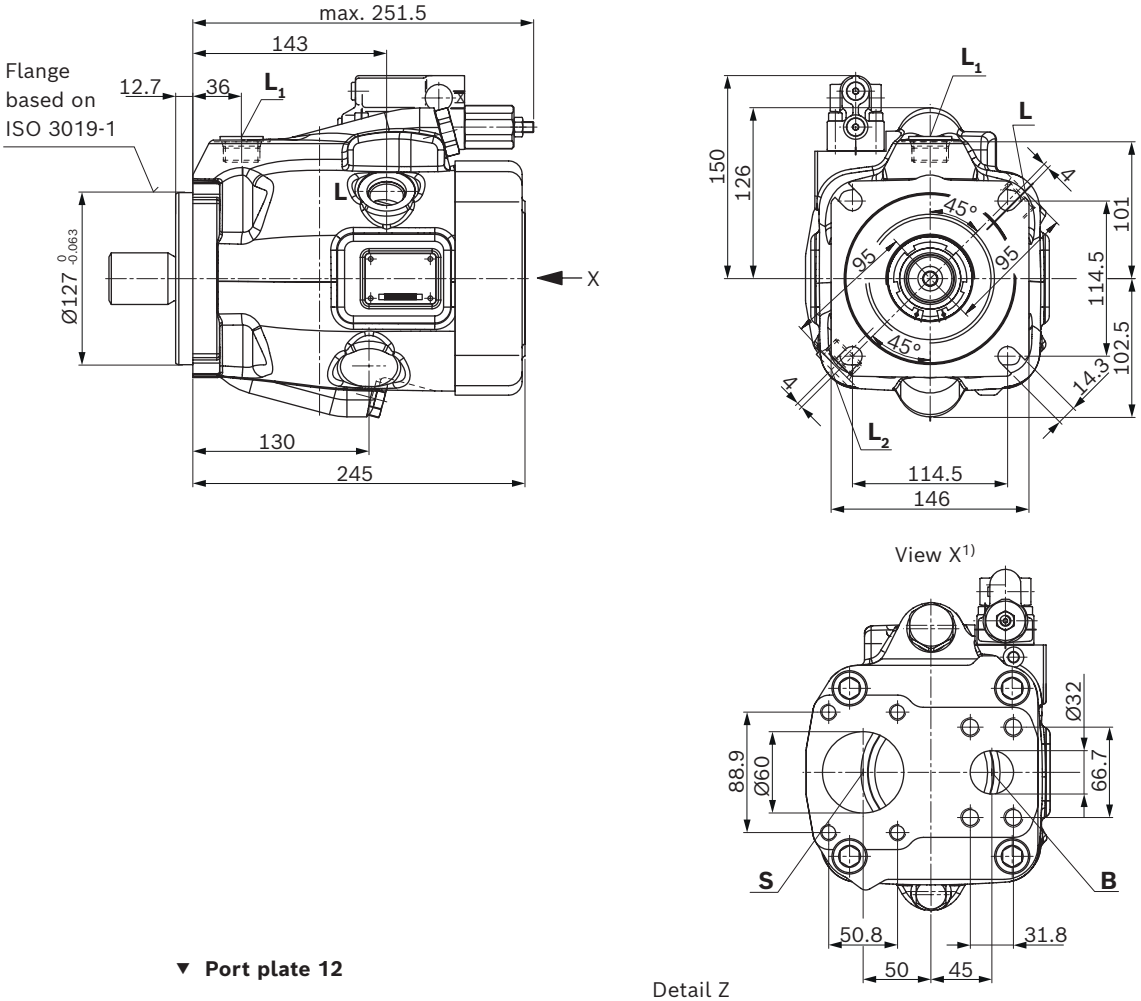


1) Dimensions of working ports turned through 180° for counter-clockwise rotation

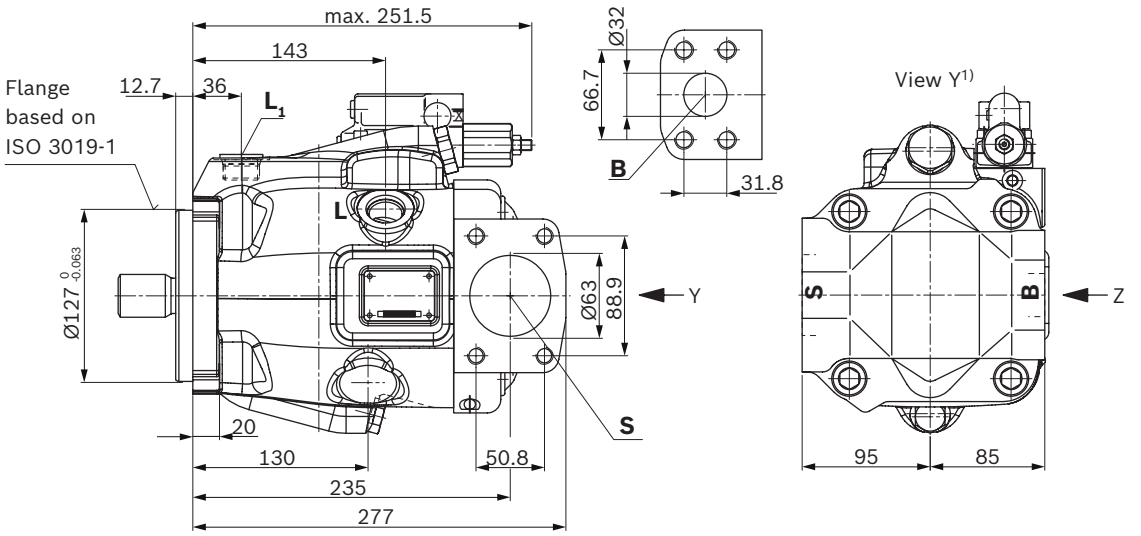
Dimensions, size 100

DR – Hydraulic pressure controller; clockwise rotation, mounting flange D series 53

▼ **Port plate 11**



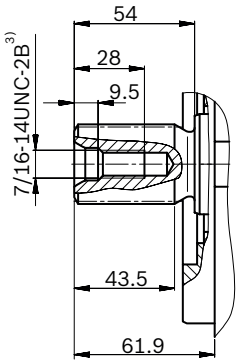
▼ **Port plate 12**



1) Dimensions of working ports turned through 180° for counter-clockwise rotation

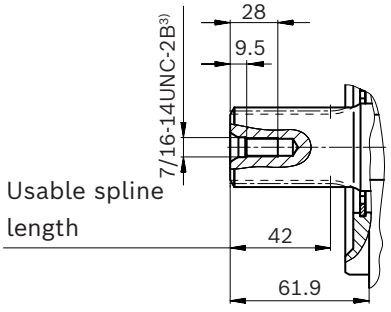
▼ **Splined shaft 1 1/2 in (38-4, ISO 3019-1)**

S – 17T 12/24DP[1)]



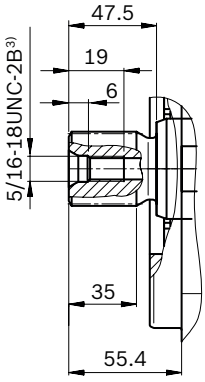
▼ **Splined shaft 1 1/2 in (similar to ISO 3019-1)**

R – 17T 12/24DP[1)2)]



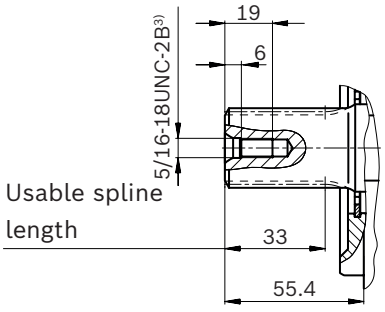
▼ **Splined shaft 1 1/4 in (32-4, ISO 3019-1)**

U – 14T 12/24DP[1)]



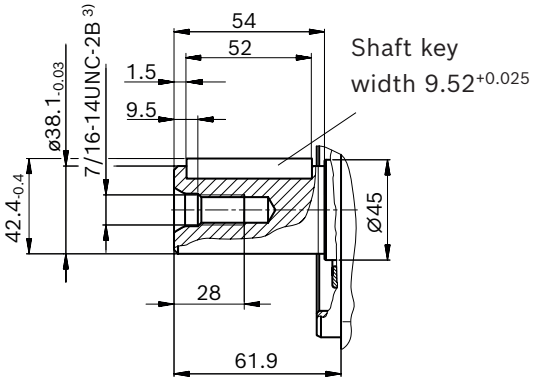
▼ **Splined shaft 1 1/4 in (similar to ISO 3019-1)**

W – 14T 12/24DP[1)2)]



▼ **Parallel keyed shaft ISO 3019-1**

K – 38-1

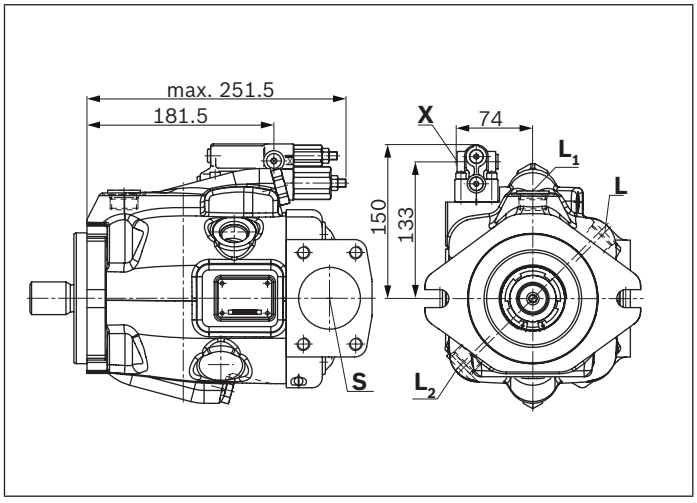


1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1

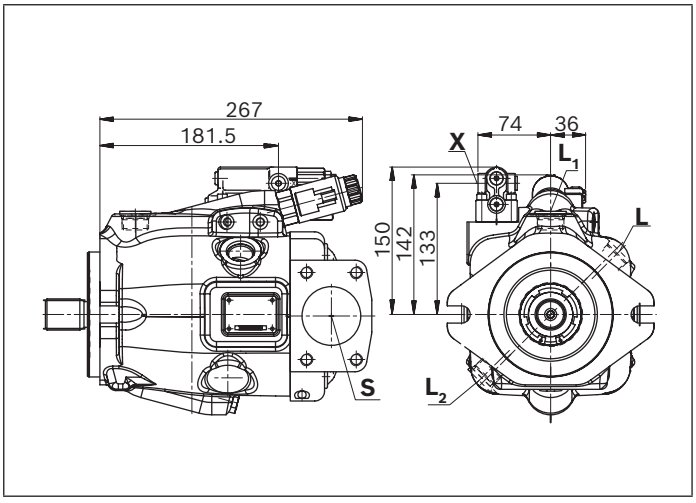
Port plate 11, 12		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (high-pressure series) fastening thread	ISO 6162-2 DIN 13	1 1/4 in M14 × 2[6]; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 DIN 13	2 1/2 in M12 × 1.75; 17 (0.67) deep	5 (75)	O
Port plate 61, 62		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
B	Working port (high-pressure series) fastening thread	ISO 6162-2 ASME B1.1	1 1/4 in 1/2-13UNC-2B; 19 (0.75) deep	315 (4550)	O
S	Suction port (standard pressure series) Fastening thread	ISO 6162-1 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 27 (1.06) deep	5 (75)	O
Other ports		**Standard**	**Size**	p_{max} **[bar (psi)]**[1]	**State**[5]
L	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	2 (30)	O[3]
$\mathbf{L_1}$, $\mathbf{L_2}$[4]	Drain port	ISO 11926[2]	1 1/16-12UNF-2B; 15 (0.59) deep	2 (30)	X[3]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 11.5 (0.45) deep	315 (4550)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) The countersink may be deeper than specified in the standard.
3) Depending on the installation position, **L**, $\mathbf{L_1}$ or $\mathbf{L_2}$ must be connected (also see installation instructions starting on page 84).
4) Only series 53
5) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)
6) Fastening thread M14 deviating from standard ISO 6162-2.

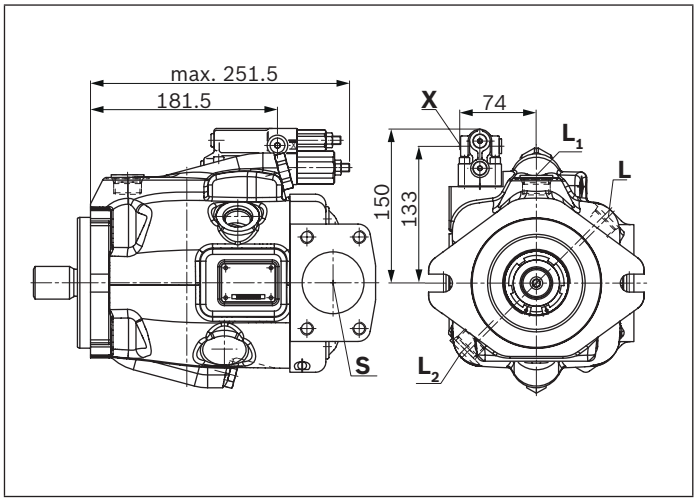
▼ **DRG – Pressure controller, remote controlled, series 53**



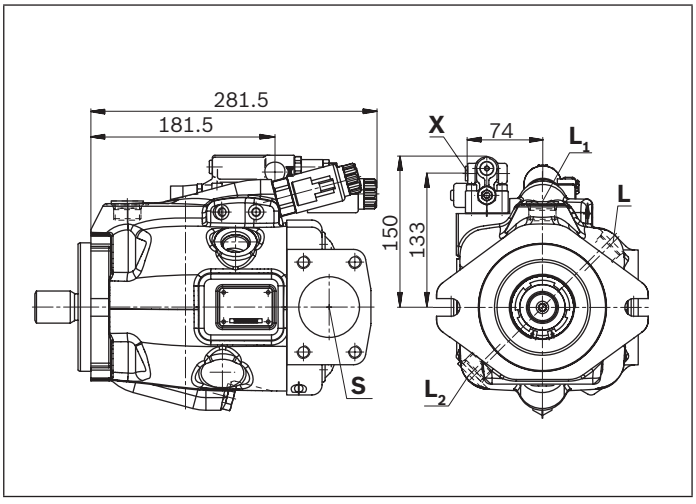
▼ **EP.D. / EK.D. – Electro proportional control, series 53**



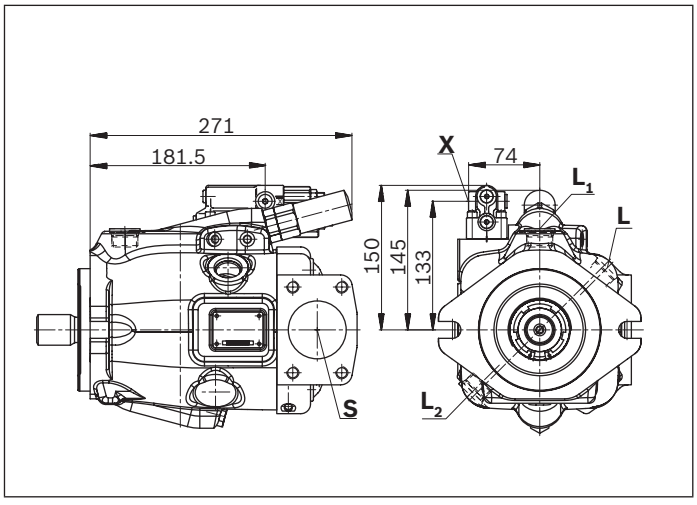
▼ **DRF/DRS/DRSC – Pressure flow controller, series 53**



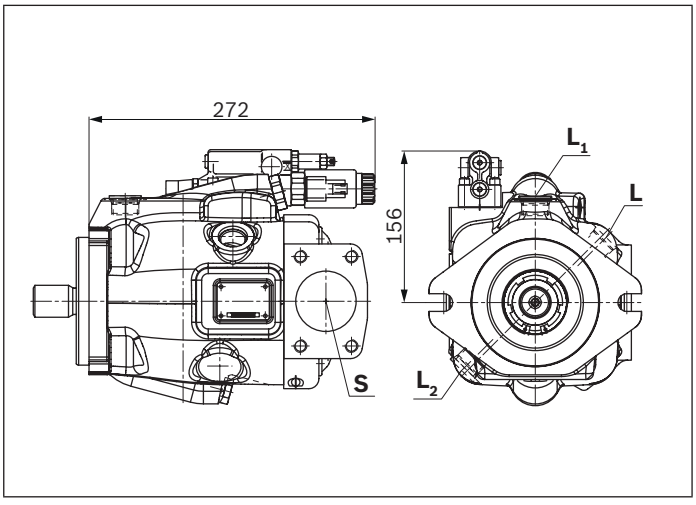
▼ **EP.ED. / EK.ED. – Electro-proportional control, series 53**



▼ **LA.D. – Pressure, flow and power controller, series 53**



▼ **ED7. / ER7. – Electro-proportional Pressure control, series 53**

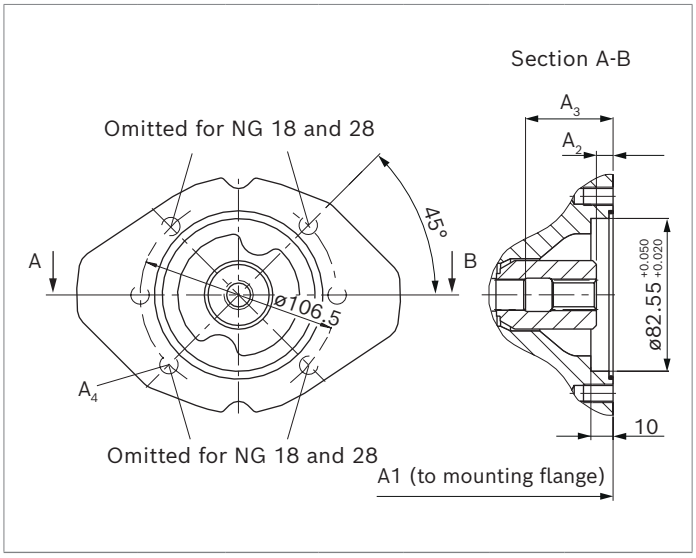


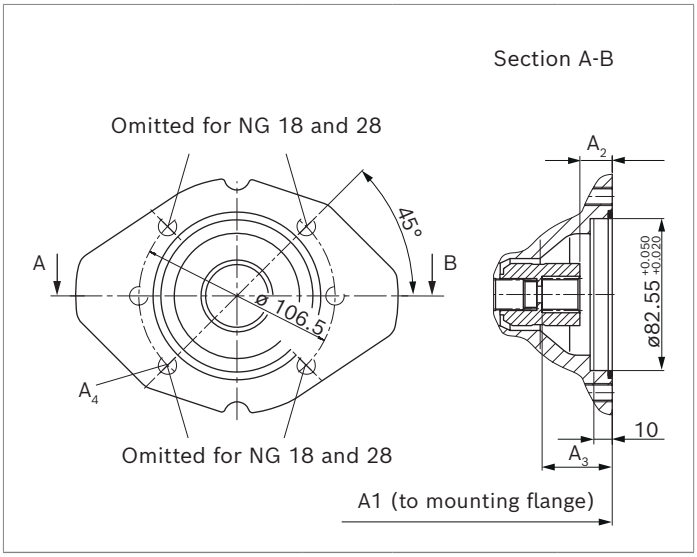
Dimensions of through drive

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability across sizes							Code
Diameter	Mounting[2]	Diameter		18	28	45	60/63	72	85	100	
82-2 (A)	☍, ⚮	5/8 in	9T 16/32DP	●	●	●	●	●	●	●	K01
		3/4 in	11T 16/32DP	●	●	●	●	●	●	●	K52

● = Available ○ = On request – = Not available

▼ **82-2**





K01 (SAE J744 16-4 (A))	NG	A1	A2[4]	A3[4]	A4[3][5]
	18	182	9.3	42.5	M10 × 1.5;
		(7.17)	(0.37)	(1.67)	14.5 (0.57) deep
	28	204	9.2	36.2	M10 × 1.5;
		(8.03)	(0.36)	(1.43)	16 (0.63) deep
	45	229	10	52.7	M10 × 1.5;
		(9.02)	(0.39)	(2.07)	16 (0.63) deep
	60/	255	8.7	58.2	M10 × 1.5;
	63	(10.04)	(0.34)	(2.29)	16 (0.63) deep
	72	255	8.7	58.2	M10 × 1.5;
		(10.04)	(0.34)	(2.29)	16 (0.63) deep
	85	302	12.5	67.2	M10 × 1.5;
		(11.89)	(0.49)	(2.65)	20 (0.79) deep
	100	302	11.7	36.0	M10 × 1.5;
		(11.89)	(0.46)	(1.42)	20 (0.79) deep

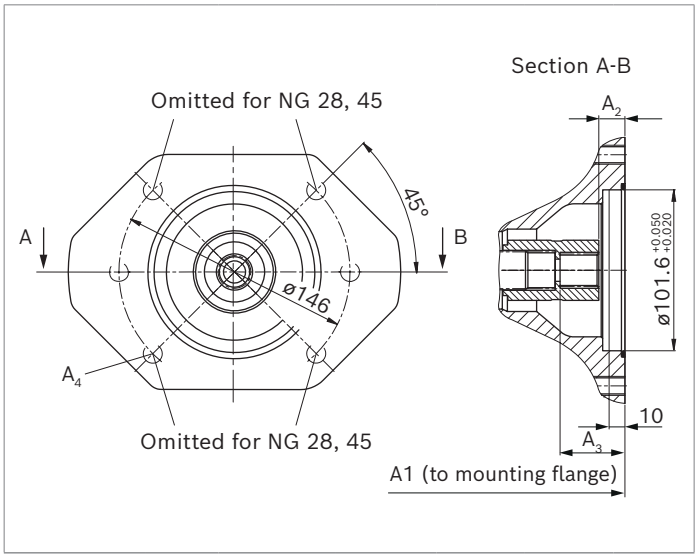
K52 (SAE J744 19-4 (A-B))	NG	A1	A2[4]	A3[4]	A4[3][5]
	18	182	18.3	39.3	M10 × 1.5;
		(7.17)	(0.71)	(1.54)	14.5 (0.57) deep
	28	204	18.4	39.4	M10 × 1.5;
		(8.03)	(0.72)	(1.55)	16 (0.63) deep
	45	229	18.4	38.8	M10 × 1.5;
		(9.02)	(0.72)	(1.53)	16 (0.63) deep
	60/	255	18.4	38.8	M10 × 1.5;
	63	(10.04)	(0.72)	(1.53)	16 (0.63) deep
	72	255	18.4	38.8	M10 × 1.5;
		(10.04)	(0.72)	(1.53)	16 (0.63) deep
	85	302	21.5	42.5	M10 × 1.5;
		(11.89)	(0.85)	(1.67)	20 (0.79) deep
	100	302	21.5	42.5	M10 × 1.5;
		(11.89)	(0.85)	(1.67)	20 (0.79) deep

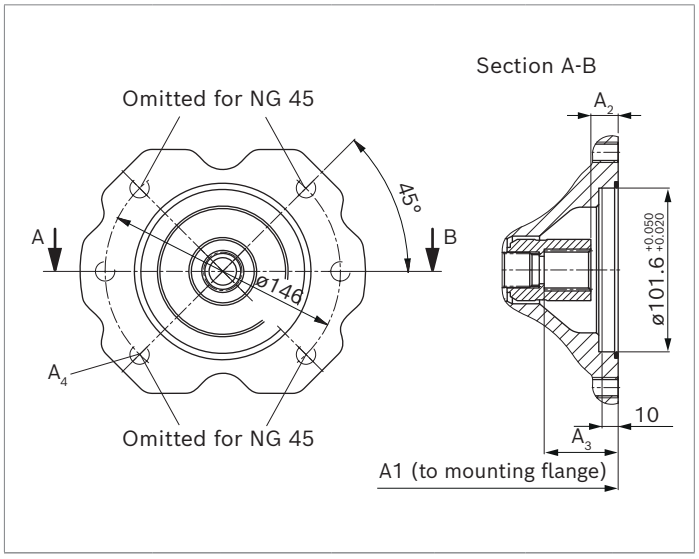
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) Minimum dimensions
5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability across sizes							Code
Diameter	Mounting[2]	Diameter		18	28	45	60/63	72	85	100	
101-2 (B)	☍, ☌	7/8 in	13T 16/32DP	–	●	●	●	●	●	●	K68
		1 in	15T 16/32DP	–	–	●	●	●	●	●	K04

● = Available ○ = On request – = Not available

▼ **101-2**





K68 (SAE J744 22-4 (B))	NG	A1	A2[4]	A3[4]	A4[3]
	28	204	17.4	42.4	M12 × 1.75;
		(8.03)	(0.68)	(1.67)	18 (0.71) deep
	45	229	17.4	41.8	M12 × 1.75;
		(9.02)	(0.68)	(1.65)	18 (0.71) deep
	60/63	255	17.4	41.8	M12 × 1.75;
		(10.04)	(0.68)	(1.65)	18 (0.71) deep
		267.5[6]			
		(10.53)[6]			
	72	255	17.4	41.8	M12 × 1.75;
		(10.04)	(0.68)	(1.65)	18 (0.71) deep
	85	302	20.5	44.8	M12 × 1.75;
		(11.89)	(0.81)	(1.76)	20 (0.79) deep
	100	302	20.5	44.8	M12 × 1.75;
		(11.89)	(0.81)	(1.76)	20 (0.79) deep

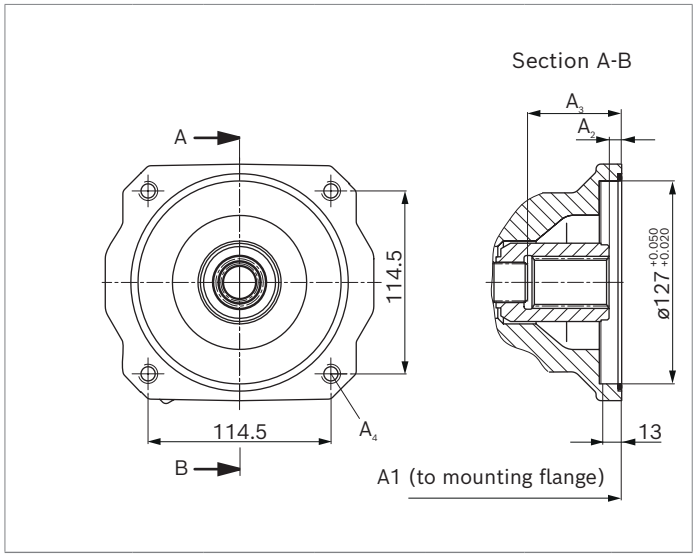
K04 (SAE J744 25-4 (B-B))	NG	A1	A2[4]	A3[4]	A4[3][5]
	45	229	17.9	47.4	M12 × 1.75;
		(9.02)	(0.70)	(1.87)	18 (0.71) deep
	60/63	255	17.9	46.8	M12 × 1.75;
		(10.04)	(0.70)	(1.84)	18 (0.71) deep
		267.5[6]			
		(10.53)[6]			
	72	255	17.9	46.8	M12 × 1.75;
		(10.04)	(0.70)	(1.84)	18 (0.71) deep
	85	302	20.7	49.5	M12 × 1.75;
		(11.89)	(0.81)	(1.95)	20 (0.79) deep
	100	302	20.7	49.5	M12 × 1.75;
		(11.89)	(0.81)	(1.95)	20 (0.79) deep

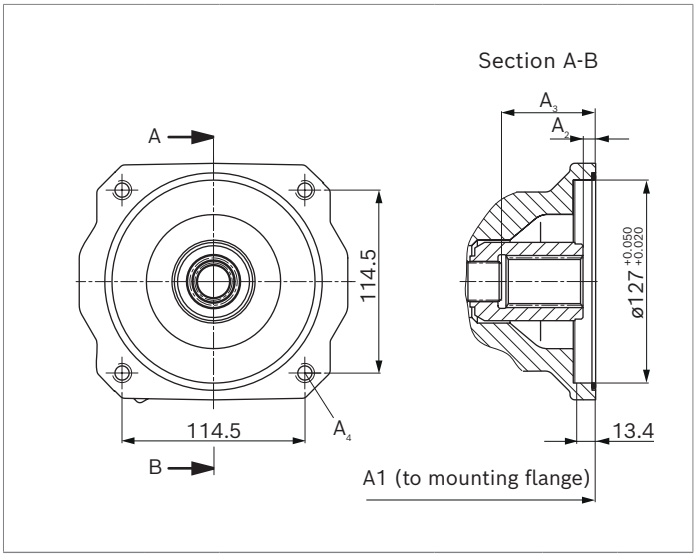
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) Minimum dimensions
5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1
6) With connection plate 32(82)

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]		Availability across sizes							Code
Diameter	Mounting[2]	Diameter		18	28	45	60/63	72	85	100	
127-4 (C)	⌘	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	●	K15
		1 1/2 in	17T 12/24DP	–	–	–	–	–	●	●	K16

● = Available ○ = On request – = Not available

▼ **127-4**





K15 (SAE J744 32-4 (C))	NG	A1	A2[4]	A3[4]	A4[3][5]
	60/63	255 (10.04)	17.9 (0.70)	55.9 (0.20)	M12 × 1.75; 16 (0.63) deep
	72	255 (10.04)	17.9 (0.70)	55.9 (0.20)	M12 × 1.75; 16 (0.63) deep
	85	301.5 (11.87)	22 (0.87)	60 (2.36)	M12 × 1.75; through
	100	301.5 (11.87)	22 (0.87)	60 (2.36)	M12 × 1.75; through

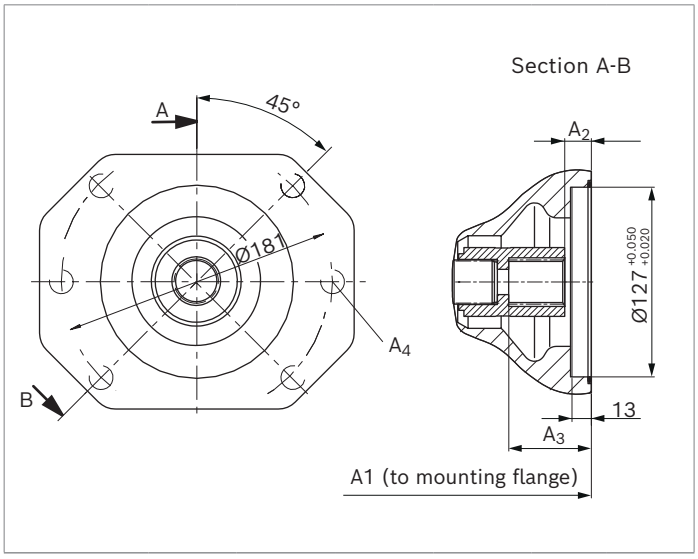
K16 (SAE J744 32-4 (C))	NG	A1	A2[4]	A3[4]	A4[3][5]
	85	301.5 (11.87)	12.8 (0.50)	67.2 (2.65)	M12 × 1.75; through
	100	301.5 (11.87)	12.8 (0.50)	67.2 (2.65)	M12 × 1.75; through

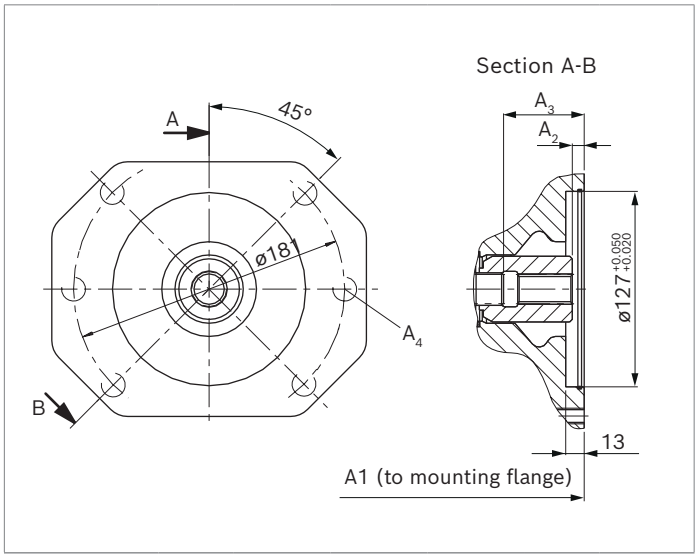
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) Minimum dimensions
5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Flange ISO 3019-1 (SAE)		Hub for splined shaft[1]	Availability across sizes							Code
Diameter	**Mounting[2]**	**Diameter**	**18**	**28**	**45**	**60/63**	**72**	**85**	**100**	
127-2 (B)	⚬⚬, ⚬⚬	1 1/4 in 14T 12/24DP	–	–	–	–	–	●	●	K07
		1 1/2 in 17T 12/24DP	–	–	–	–	–	●	●	K24

● = Available ○ = On request – = Not available

▼ **127-2**





K07 (SAE J744 32-4 (C))	**NG**	**A1**	**A2**[4]	**A3**[4]	**A4**[3][5]
	85	301.5	22	60	M16×2;
		(11.87)	(0.87)	(2.36)	24 (0.94) deep
	100	301.5	22	60	M16×2;
		(11.87)	(0.87)	(2.36)	24 (0.94) deep

K24 (SAE J744 38-4 (C-C))	**NG**	**A1**	**A2**[4]	**A3**[4]	**A4**[3][5]
	85	302	12.8	67.2	M16×2;
		(11.89)	(0.50)	(2.65)	24 (0.94) deep
	100	302	12.8	67.2	M16×2;
		(11.89)	(0.50)	(2.65)	24 (0.94) 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) Minimum dimensions
5) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

Overview of mounting options

Through drive			Mounting options – 2nd pump				
Flange ISO 3019-1	**Hub for splined shaft**	**Code**	**A10VO/5x NG (shaft)**	**A10VO/60 NG (shaft)**	**A10VSO/31 NG (shaft)**	**A1VO/10 NG (shaft)**	**External gear pump**
82-2 (A)	5/8 in	K01	10 (U), 18 (U)	–	18 (U)	18, 28 (S2)	AZPF
	3/4 in	K52	10 (S), 18 (S, R)	–	18 (S, R)	18, 28 (S3)	
101-2 (B)	7/8 in	K68	28 (S, R) 45 (U, W)[1)]	45 (S4)	28 (S, R) 45 (U, W)	35 (S4)	AZPN/AZPG
	1 in	K04	45 (S, R) 60, 63 (U, W)[2)] 72 (U, W)[2)]	45 (S5)	45 (S, R)	35 (S5)	–
127-4 (C)	1 1/4 in	K15	60, 63 (S, R) 72 (S, R)	–	–	–	–
	1 1/2 in	K16	85 (S), 100 (S)	–	–	–	–
127-2 (C)	1 1/4 in	K07	85 (U), 100 (U)	–	71 (S, R)	–	PGH5
	1 1/2 in	K24	85 (S), 100 (S)	–	–	–	–

1) Not for NG28 with K68
2) Not for NG45 with K04

Combination pumps A10VO + A10VO

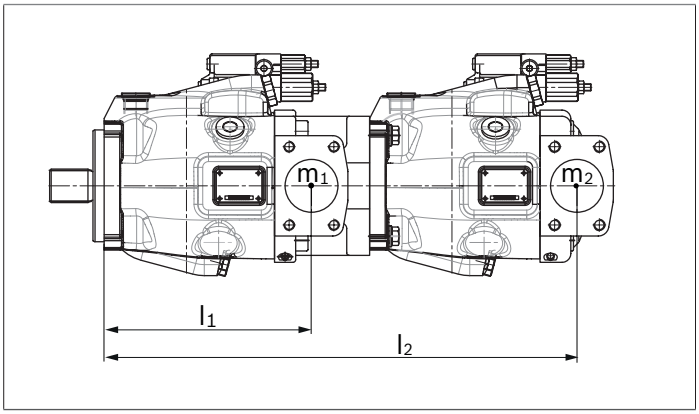
By using combination pumps, the user can also gain access to independent circuits without the need for splitter gearboxes.
When ordering combination pumps the type designations for the 1st and 2nd pump must be joined by a "**+**" and are combined into one part number. Each single pump should be ordered according to type code.

Notice

- The combination pump type code is shown in shortened form in the order confirmation.
- Each through-drive is plugged with a **non-pressure-resistant** cover. This means the units must be sealed with a pressure-resistant cover before commissioning.

Order example:
A10VO85DRS/53R-VSC12K04+
A10VO45DRG/53R-VSC11N00
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).

Notice
Through drives with installed hub are supplied with a spacer.
The spacer must be removed before installation of the 2nd pump and before commissioning. For further information, see the operating instructions 92703-01-B



m_1, m_2, m_3	Weight of pump	[kg (lbs)]
l_1, l_2, l_3	Distance from center of gravity	[mm (inch)]
$M_m = (m_1 \times l_1 + m_2 \times l_2 + m_3 \times l_3) \times \frac{1}{102\ (12)}$		[Nm (lb-ft)]

Permissible moments of inertia

NG				10	18	28	45	60/63	72	85	100
static	M_m	Nm	–	500	890	900	1370	1370	3080	3080	
		lb-ft	–	369	656	664	101	101	2270	2270	
dynamic at 10 g (98.1 m/s^2)	M_m	Nm	–	50	89	90	137	137	308	308	
		lb-ft	–	37	65	66	101	101	227	227	
Weight **without** through-drive plate (e.g. 2nd pump)	m	kg	8	11.5	15	18	22	22	36	36	
		lb-ft	18	25	33	40	49	49	79	79	
Weight **with** through-drive plate	m	kg	–	13	18	24	28	28	45	45	
		lb-ft	–	29	40	53	62	62	99	99	
Center of gravity distance **without** through drive	l_1	mm	–	78	85	96	105	105	122	122	
		inch	–	3.07	3.35	3.78	4.13	4.13	4.80	4.80	
Center of gravity distance **with** through drive	l_1	mm	–	87	99	115	127	127	150	150	
		inch	–	3.43	3.90	4.53	5.00	5.00	5.90	5.90	

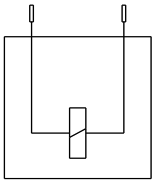
Connector for solenoids

DEUTSCH DT04-2P

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

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

▼ **Switching symbol**



▼ **Mating connector DEUTSCH DT06-2S-EP04**

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

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).

Notice

- If necessary, you can change the position of the connector by turning the solenoid body. The procedure is defined in the operating instructions 92703-01-B.
- Only the dead weight (<1 N (0.22 lbf)) of the connection cable with a length of 150 mm (5.91 inch) may act on the plug-in connection and the solenoid coil with coil nut. Other forces and vibrations are not permissible. This can be realized e.g. by fixing the cable to the same vibration system.

Swivel angle sensor

Description

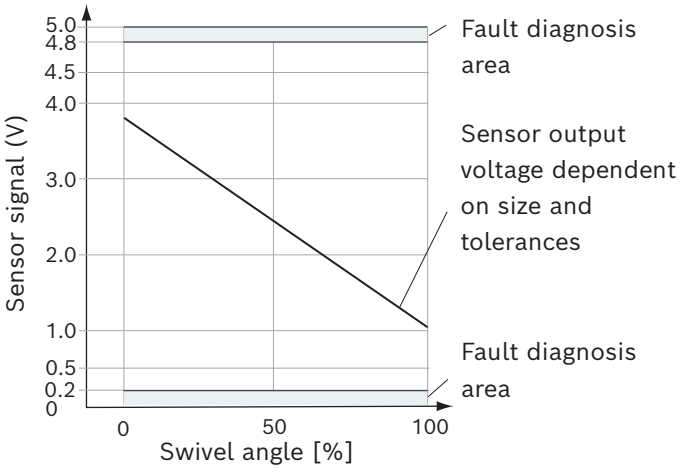
The swivel angle sensor PAL is used for contactless detection of the swivel angle of axial piston units using a Hall effect-based sensor IC. The measured position is converted into electric signals by the redundant swivel angle sensor.

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

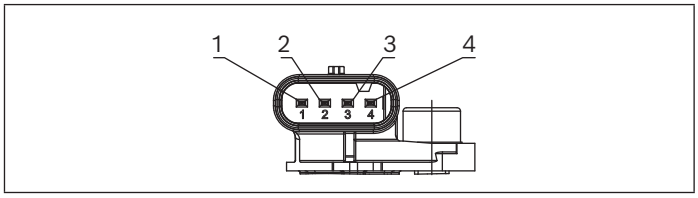
Features

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

▼ **Output characteristic at pin 4, code H**
Swivel angle sensor installation left
with view of the shaft, control valve top



Pin assignment



▼ **Pin assignment analog ratiometric/PWM** (order code H)
PAL 2 312A340 CM/10F
(for further information, see data sheet 95161)

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

▼ **Permissible PAL variants**

Output signal	Type	Code
Analog ratiometric/PWM	PAL 2 312A340 CM/10F	H
SENT/SENT	PAL 2 312A340 SM/10F	P

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

Notice

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

▼ **Pin assignment SENT/SENT** (order code P)
PAL 2 312A340 SM/10F
(for further information, see data sheet 95161)

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

Mating connector

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

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation.
This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is e.g. a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest positioned drain port (**L**, **L_1**, **L_2**).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid.
To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts).
Under all operating conditions, the 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 (31.5 inch). The minimum suction pressure at port **S** must not fall below 0.8 bar (12 psi) absolute during operation and during cold start.
When designing the reservoir, ensure that there is adequate distance between the suction line and the drain line. We recommend using a baffle (baffle plate) between suction line and drain line.
A baffle improves the air separation ability as it gives the hydraulic fluid more time for desorption. Apart from that, this prevents the heated return flow from being drawn directly back into the suction line. The suction port must be supplied with air-free, calmed and cooled hydraulic fluid.

Notice

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

Installation position

See the following examples **1** to **12**. Further installation positions are available upon request.
Recommended installation position: **1** and **3**

Key	
F	Filling / Air bleeding
S	Suction port
L; **L_1**; **L_2**	Drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm (7.87 inch))
h_{min}	Minimum required distance to reservoir bottom (100 mm (3.94 inch))
$h_{ES\ min}$	Minimum height required to prevent axial piston unit from draining (25 mm (0.98 inch))
$h_{S\ max}$	Maximum permissible suction height (800 mm (21.50 inch))

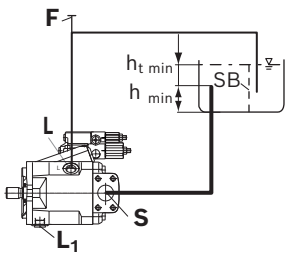
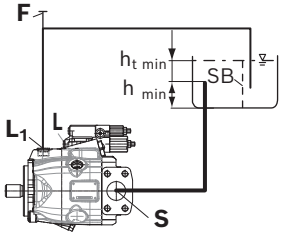
Notice

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

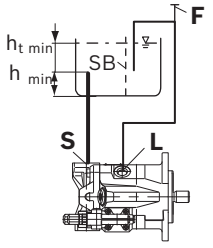
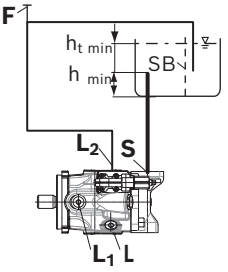
Below-reservoir installation (standard)

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

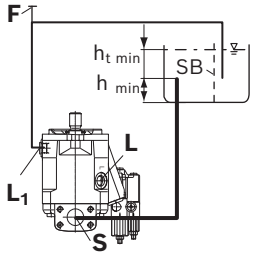
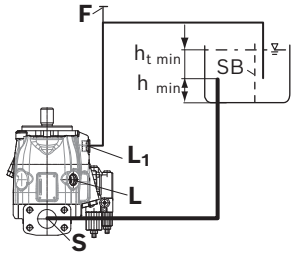
▼ **Installation position 1**

Air bleed	Filling	Air bleed	Filling
F	**L** (**F**)	**F**	**L_1** (**F**)
Series **52**		Series **53**	
			

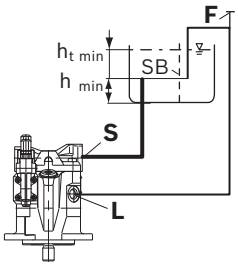
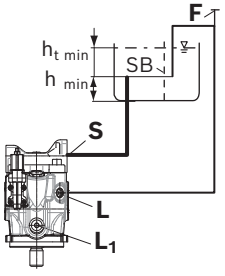
▼ **Installation position 4**

Air bleed	Filling	Air bleed	Filling
F	**L** (**F**)	**F**	**L_2** (**F**)
Series **52**		Series **53**	
			

▼ **Installation position 2**[1)]

Air bleed	Filling	Air bleed	Filling
F	**L_1** (**F**)	**F**	**L_1** (**F**)
Series **52**		Series **53**	
			

▼ **Installation position 3**[1)]

Air bleed	Filling	Air bleed	Filling
F	**L** (**F**)	**F**	**L** (**F**)
Series **52**		Series **53**	
			

For key, see page 84.

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

Above-reservoir installation

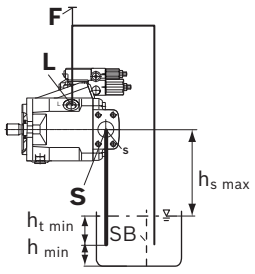
Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm (0.98 inch) is required in position 6. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm (31.50 inch).

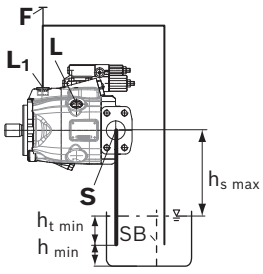
A check valve in the case drain line is only permissible in individual cases. Consult us for approval.

For key, see page 84.

▼ **Installation position 5**

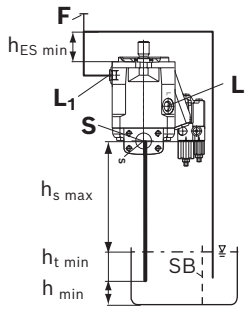
Air bleed	Filling	Air bleed	Filling
F	**L** (**F**)	**F**	**L**$_1$ (**F**)
Series **52**		Series **53**	

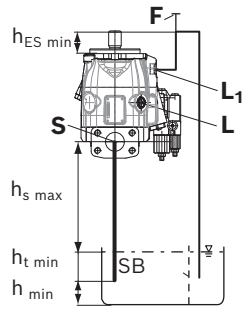




▼ **Installation position 6**[1)]

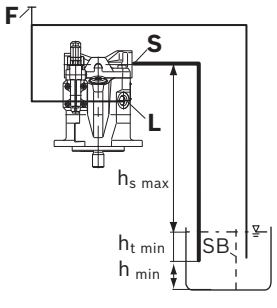
Air bleed	Filling	Air bleed	Filling
F	**L**$_1$ (**F**)	**F**	**L**$_1$ (**F**)
Series **52**		Series **53**	

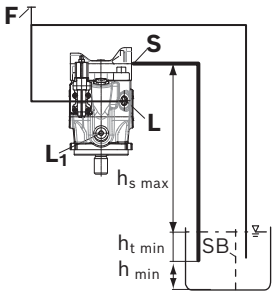




▼ **Installation position 7**[1)]

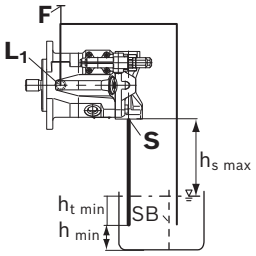
Air bleed	Filling	Air bleed	Filling
F	**L** (**F**)	**F**	**L** (F)
Series **52**		Series **53**	

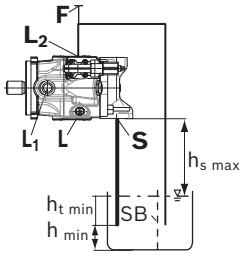




▼ **Installation position 8**

Air bleed	Filling	Air bleed	Filling
F	**L**$_1$ (**F**)	**F**	**L**$_2$ (**F**)
Series **52**		Series **53**	





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.

Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

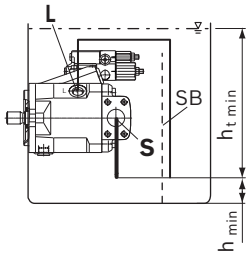
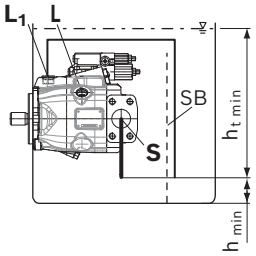
If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

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

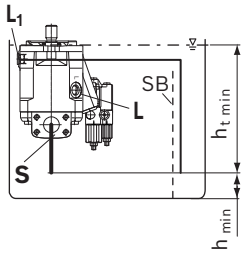
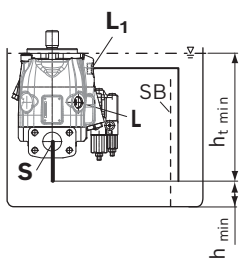
Notice

- Our advice is to fit a suction pipe to the suction port **S** and to fit a pipe to case drain port **L**, **L_1** or **L_2**. In this case, the other drain port must be plugged. The housing of the axial piston unit is to be filled via **L, L_1** or **L_2** (see installation position 9 to 12) before the pipework is fitted and the reservoir is filled with hydraulic fluid.

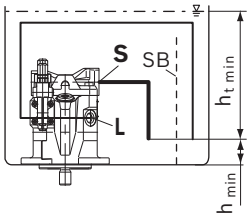
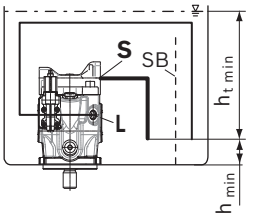
▼ **Installation position 9**

Air bleed	Filling	Air bleed	Filling
L	**L**	**L_1**	**L_1**
Series **52**		Series **53**	
			

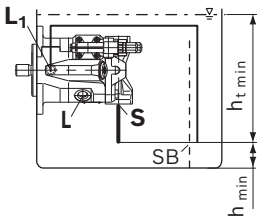
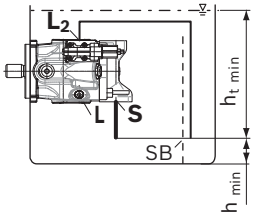
▼ **Installation position 10**[1)]

Air bleed	Filling	Air bleed	Filling
L_1	**L_1**	**L_1**	**L_1**
Series **52**		Series **53**	
			

▼ **Installation position 11**[1)]

Air bleed	Filling	Air bleed	Filling
L	**L**	**L**	**L**
Series **52**		Series **53**	
			

▼ **Installation position 12**

Air bleed	Filling	Air bleed	Filling
L_1	**L_1**	**L_2**	**L_2**
Series **52**		Series **53**	
			

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.

For key, see page 84.

Project planning notes

- The A10VO axial piston variable pump is intended to be used in an open circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding operating instructions completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift. The characteristic curve may also shift due to the dither frequency or control electronics.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the operating instructions.
- Not all configuration variants of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact at Bosch Rexroth if you require reliability parameters (e.g., $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct current signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct current signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. A pressure relief valve should therefore be provided in the hydraulic system. In this connection, observe the technical limits of the pressure relief valve.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The excitation frequency of the pump is 9 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the information regarding the tightening torques of port threads and other screw connections in the operating instructions.
- The ports and fastening threads are designed for the permissible pressures p_{max} of the respective ports, see the connection tables. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk.
  The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.

Related documentation

Product-specific documentation

Document type	Title	Document number
Data sheet	Hall effect swivel angle and linear position sensor PAL2/20	95161
	Application software eOC BODAS pump control	95345
	BODAS controller RC5-6 series 40	95207
	BODAS controller RC18-12 series 40, RC27-18 series 40	95208
	Load-sensing control block M4-12	64276
	Load-sensing control block M4-15	64283
	Flow sharing control block in mono block/sandwich plate design M7-22	64295
	Storage and preservation of axial piston units	90312
Operating instructions	Axial piston variable pump A10VO, A10VSO, A10VNO, A10VSNO series 52 and 53	92703-01-B

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Rating of hydraulic fluids used in Rexroth hydraulic components (pumps and motors)	90235
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245

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