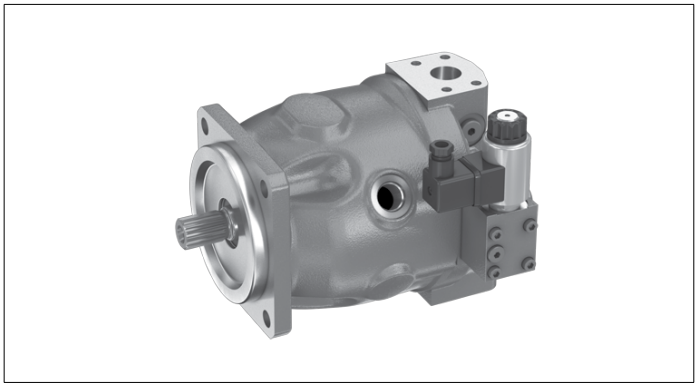
Axial piston variable displacement unit A10VZO



- For variable-speed operation with synchronous and asynchronous motors
- Size 10
  Nominal pressure/maximum pressure 250/315 bar
- Size 18 to 45
  Nominal pressure/maximum pressure 315/350 bar
  Size 71 to 180
  Nominal pressure/maximum pressure 280/350 bar
- Open circuit

Features

- For use in one- and two-quadrant operation
- Suitable for start/stop operation
- Suitable for long pressure holding operation
- Proven A10 rotary group technology
- Through drive option

Product description

The proven axial piston units from the A10 product family have now been further developed for use in speed-controlled drives. They are approved for start/stop operation and designed for a changing direction of rotation. Even at the lowest speed between 0 and 200 rpm, they provide a constant pressure and offer extremely high efficiency in pressure holding operation. The A10VZO units can be used as pumps in one- and two-quadrant operation.

Type code A10VZO

01	02	03	04	05		06	07		08	09	10	11	12	13
A10V	**Z**	**O**			**/**	**10**		**–**	**V**		**C**		**N00**	

Axial piston unit

01	Swashplate design, variable	**A10V**

Application area

02	Variable-speed drives	**Z**

Operating mode

03	Pump, open circuit	**O**

Size (NG)

04	Geometric displacement, see table of values on page 31	**010**	**018**	**028**	**045**	**071**	**100**	**140**	**180**	
	Other available intermediate sizes	003, 006, 008								

Control device

05	Two-point control	electrical	U = 12 V	●	●	●	●	○	○	○	○	**EZ300**[1]
			U = 24 V	●	●	●	●	○	○	○	○	**EZ400**[1]
		hydraulic		●	●	●	●	○	○	○	○	**DG000**[1]
	Pressure controller	hydraulic		●	●	●	●	○	○	○	○	**DR000**
		remote controlled hydraulically		●	●	●	●	○	○	○	○	**DRG00**
	Torque controller		Size 018 to 180									
	Beginning of control		up to 50 bar	–	●	●	●	○	○	○	○	**LA5D0**
			51 to 90 bar	–	●	●	●	○	○	○	○	**LA6D0**
			91 to 160 bar	–	●	●	●	○	○	○	○	**LA7D0**
			161 to 240 bar	–	●	●	●	○	○	○	○	**LA8D0**
			over 240 bar	–	●	●	●	○	○	○	○	**LA9D0**

Series

06	Series 1, index 0	**10**

Direction of rotation[2]

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

Sealing material

08	FKM (fluoroelastomer)	**V**

Drive shaft

09	Splined shaft	Standard shaft	●	–	–	–	–	○	○	○	**S**
	ANSI B92.1a	similar to shaft “S” however for higher torque	–	●	●	●	○	–	–	–	**R**

Mounting flange

10	ISO 3019-1 (SAE)	2-hole	●	●	●	–	–	–	–	–	**C**
		4-hole	–	–	–	●	○	○	○	○	**D**

Notice

- ▶ Note the project planning notes on page 105.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.

1) Please specify mechanical flow control $V_{g\,max}$ and $V_{g\,min}$ in the order text.

2) Changing direction of rotation permissible with the same pressure side for decompression

01	02	03	04	05		06	07		08	09	10	11	12	13
A10V	**Z**	**O**			**/**	**10**		**–**	**V**		**C**		**N00**	

Working port[3)]

		003 to 010	018	028	045	071	100	140	180	
11	SAE flange ports at top and bottom, on opposite sides, metric fastening thread with universal through drive	–	–	–	–	○	○	○	○	**22U**[5)]
	SAE flange ports at top and bottom, on opposite sides, metric fastening thread	–	●	●	●	○	○	○	–	**12**[3)5)]
	DIN 3852 threaded ports at rear, not for through drive	●	–	–	–	–	–	–	–	**14**
	DIN 3852 threaded ports on opposite side, only for through drive	●	–	–	–	–	–	–	–	**07**

Through drive (for dimensions and mounting options, see page 95)

					003 to 010	018	028	045	071	100	140	180	
12	With through-drive shaft, without hub, without intermediate flange; fastening thread metric, with universal through drive, only port plate 22U				–	–	–	–	○	○	○	○	**00**[4)5)]
	Without through drive, only port plates 12 and 14				●	●	●	●	○	○	○	○	**N00**
	Port plate 12 and 07												
	Flange ISO 3019-1			Hub for splined shaft[6)]									
	Diameter	Mounting[7)]		Diameter									
	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**
	Port plate 22U												
	Flange ISO 3019-1			Hub for splined shaft[6)]									
	Diameter			Diameter									
	82-2 (A)	⚷, ☍, ⚯	5/8 in	9T 16/32DP	–	–	–	–	○	○	○	○	**01**
		⚷, ☍, ⚯	3/4 in	11T 16/32DP	–	–	–	–	○	○	○	○	**52**
	101-2 (B)	⚷, ☍, ⚯	7/8 in	13T 16/32DP	–	–	–	–	○	○	○	○	**68**
		⚷, ☍, ⚯	1 in	15T 16/32DP	–	–	–	–	○	○	○	○	**04**
			1 1/4 in	14T 12/24DP	–	–	–	–	○	○	○	○	**06**
	127-4 (C)	⚷	1 in	15T 16/32DP	–	–	–	–	○	○	○	○	**E2**
		⚷	1 1/4 in	14T 12/24DP	–	–	–	–	○	○	○	○	**15**
	152-4 (D)	⚷	1 1/2 in	17T 12/24DP	–	–	–	–	–	○	○	○	**96**
		⚷	1 3/4 in	13T 8/16DP	–	–	–	–	–	–	○	○	**17**

Connector for solenoids

13	without, with hydraulic controllers	**0**
	HIRSCHMANN connector – without suppressor diode	**H**

● = Available ○ = On request – = Not available

3) A stepless mechanical flow control is only standard on version 12 N00 in sizes 018 to 140
$V_{g\,max}$: Setting range $V_{g\,max}$ to 50% $V_{g\,max}$ stepless
$V_{g\,min}$: Please specify setting range $V_{g\,min}$ to 40% $V_{g\,max}$ stepless, settings to be specified in plain text.
$V_{g\,max}$ and $V_{g\,min}$ limitations on through drives with port plates 12K.. and 22U.. can only be carried out via fixed set values, this should also be specified in plain text.

4) See data sheet 95581 universal through drive

5) When ordering sizes 071 to 180 with port plate 22, please order the relevant through drive “U”
Example: A10VZO045DR000/10R-VSD22U01
When ordering sizes 018 to 045 with port plate 12, please order the relevant through drive **with** “K”
Example: A10VZO018DR000/10R-VSD12K01

6) Splined shaft according to ANSI B92.1a (splined shafts according to SAE J744)

7) Mounting holes pattern viewed on through drive with control at top

Preferred program A10VZO

Overview of common configurations

Type	Material number
A10VZO003EZ400/10R-VSC14N00H	R902557878
A10VZO003DR000/10R-VSC14N000	R902557885
A10VZO006EZ400/10R-VSC14N00H	R902557879
A10VZO006DR000/10R-VSC14N000	R902557886
A10VZO008EZ400/10R-VSC14N00H	R902557880
A10VZO008DR000/10R-VSC14N000	R902557887
A10VZO010EZ400/10R-VSC14N00H	R902544384
A10VZO010DR000/10R-VSC14N000	R902557888
A10VZO018EZ400/10R-VRC12N00H	R902544060
A10VZO018DR000/10R-VRC12N000	R902557889
A10VZO028EZ400/10R-VRC12N00H	R902547871
A10VZO028DR000/10R-VRC12N000	R902557890
A10VZO045DR000/10R-VRD12N000	R902557891
A10VZO045EZ400/10R-VRD12N00H	R902548677
A10VZO071EZ400/10R-VRD12N00H	R902557881
A10VZO071DR000/10R-VRD12N000	R902557892
A10VZO100EZ400/10R-VSD12N00H	R902557882
A10VZO100DR000/10R-VSD12N000	R902557893
A10VZO140EZ400/10R-VSD12N00H	R902557883
A10VZO140DR000/10R-VSD12N000	R902557894
A10VZO180EZ400/10R-VSD22U00H	R902557884
A10VZO180DR000/10R-VSD22U000	R902557895

Please specify settings $V_{g\ min}$ and $V_{g\ max}$ in plain text.

Setting ranges stop $V_{g\ min}$ / $V_{g\ max}$

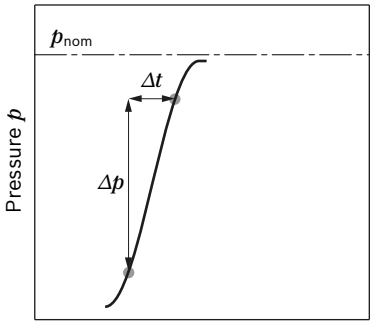
Size	$V_{g\ min}$	$V_{g\ max}$
3	0 to 3 cm^3; 0.9 cm^3/U	3 cm^3
6	0 to 4 cm^3; 0.9 cm^3/U	6 cm^3
8	0 to 4 cm^3; 0.9 cm^3/U	8 cm^3
10	0 to 4 cm^3; 0.9 cm^3/U	10 cm^3
18	0 to 8 cm^3; 1.1 cm^3/U	9 to 18 cm^3; 1.1 cm^3/U
28	0 to 12 cm^3; 1.6 cm^3/U	14 to 28 cm^3; 1.6 cm^3/U
45	0 to 18 cm^3; 3.2 cm^3/U	25 to 45 cm^3; 3.2 cm^3/U
71	0 to 28 cm^3; 4.7 cm^3/U	45 to 71 cm^3; 4.7 cm^3/U
100	0 to 40 cm^3; 6.2 cm^3/U	50 to 100 cm^3; 6.2 cm^3/U
140	0 to 56 cm^3; 7.1 cm^3/U	70 to 140 cm^3; 7.1 cm^3/U
180	–	–

Only fixed stop possible with size 18 to 140 for port plates with through drive.

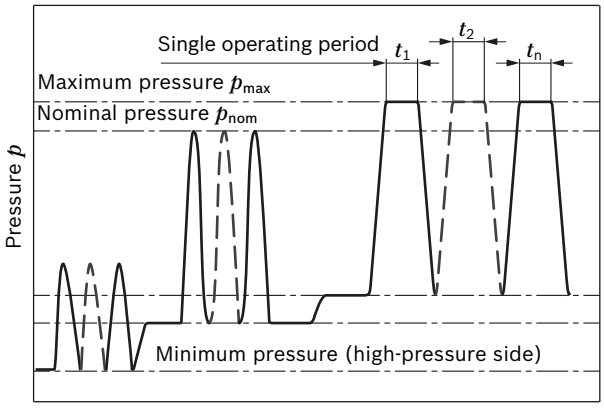
Working pressure range A10VZO – size 3 to 10

Pressure at working port B		Definition
Nominal pressure p_{nom}	250 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	315 bar	The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	2.0 ms	
Total operating period	300 h	
Minimum pressure $p_{B\ abs}$ (high-pressure side)	10 bar	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	16000 bar/s	Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure $p_{A\ min}$ **Standard**	0.8 bar absolute	Minimum pressure at suction port **S** (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{S\ max}$	10 bar absolute	
Leakage pressure at port L, L_1		
Maximum pressure $p_{L\ max}$	2 bar absolute[2)]	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

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



▼ **Pressure definition**



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

Notice

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

Flow direction

Direction of rotation, viewed on drive shaft	Direction of rotation	Flow
Type code "**R**"	Clockwise	**S** to **B**
	Counterclockwise[1)]	**B** to **S**
Type code "**L**"[3)]	Counterclockwise	**S** to **B**
	Clockwise[1)]	**B** to **S**

1) Only permissible in decompression operation, a pressure side switch is not permitted.
2) Higher values on request
3) Position **S** and **B** with counter-clockwise rotation, observe installation drawing

Working pressure range A10VZO – size 18 to 45

Pressure at working port B			Definition
Nominal pressure p_{nom}		315 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}		350 bar	The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period		2.5 ms	
Total operating period		300 h	
Minimum pressure $p_{B\ abs}$ (high-pressure side)		10 bar[1)]	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$		16000 bar/s	Maximum permissible 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 absolute	Minimum pressure at suction port **S** (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{S\ max}$		10 bar absolute	
Case pressure at port L, L_1			
Maximum pressure $p_{L\ max}$		2 bar absolute[2)]	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

For details of the rate of pressure change and pressure definition, please refer to page 27

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

Flow direction

Direction of rotation, viewed on drive shaft	Direction of rotation	Flow
Type code "**R**"	Clockwise	**S** to **B**
	Counterclockwise[3)]	**B** to **S**
Type code "**L**"	Counterclockwise	**S** to **B**
	Clockwise[3)]	**B** to **S**

1) Please contact us about lower pressures.
2) Higher values on request
3) Only permissible in decompression operation, a pressure side switch is not permitted.

Working pressure range A10VZO – size 71 to 180

Pressure at working port B		Definition
Nominal pressure p_{nom}	280 bar[2)]	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar	The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	2.5 ms	
Total operating period	300 h	
Minimum pressure $p_{B\ abs}$ (high-pressure side)	10 bar	Minimum pressure on the high-pressure side (**B**) which is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	16000 bar/s	Maximum permissible 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 absolute	Minimum pressure at suction port **S** (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Maximum pressure $p_{S\ max}$	10 bar absolute	
Case pressure at port L, L_1		
Maximum pressure $p_{L\ max}$	2 bar absolute[2)]	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

For details of the rate of pressure change and pressure definition, please refer to page 27

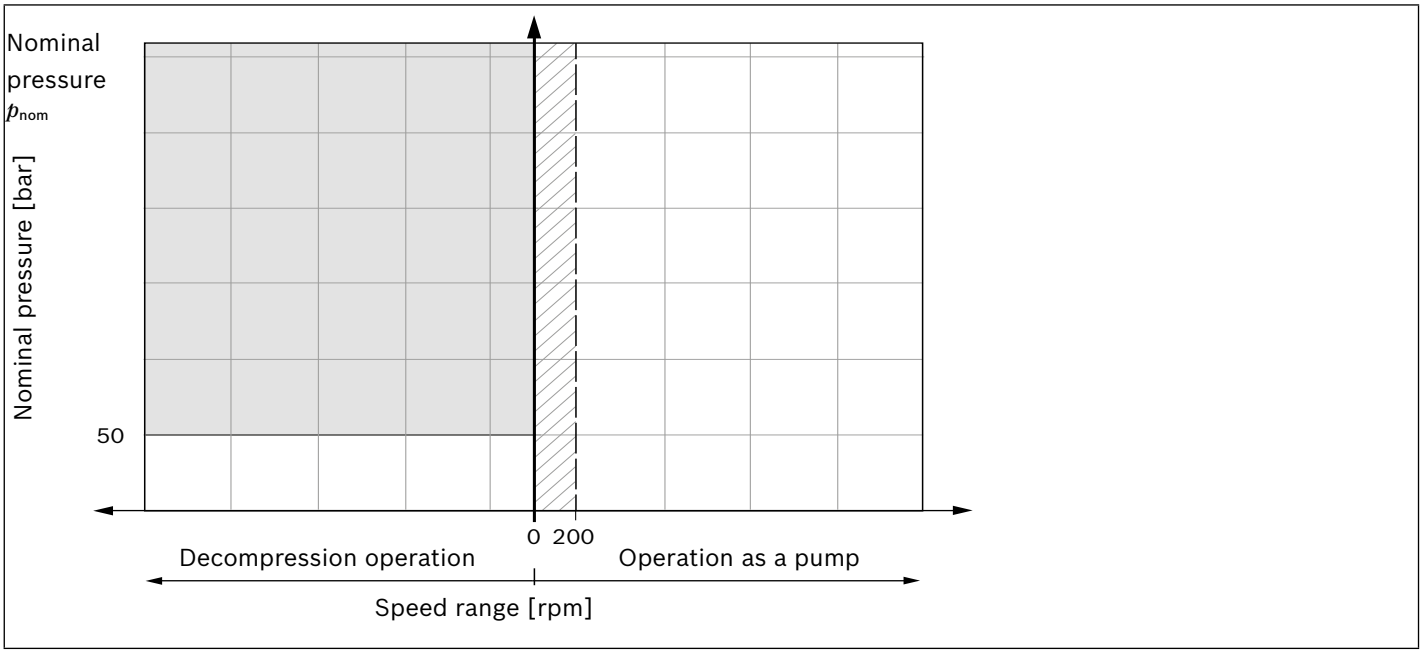
Notice
Working pressure range valid when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

Flow direction

Direction of rotation, viewed on drive shaft	Direction of rotation	Flow
Type code "**R**"	Clockwise	**S** to **B**
	Counterclockwise[1)]	**B** to **S**
Type code "**L**"	Counterclockwise	**S** to **B**
	Clockwise[1)]	**B** to **S**

1) Only permissible in decompression operation, a pressure side switch is not permitted.
2) Higher values on request

A10VZO sizes 003 to 045: Permissible operating data and operating ranges



Operating range	
	Operation without restriction
	With V_g <40%, no time restriction With $V_{g\,max}$ single operating period t<3 min, maximum cycle share 80%
	Operation as a motor possible with restrictions, please contact us. With V_g <40%, no time restriction With $V_{g\,max}$ permissible for short-term decompression operation t ≤ 200 ms

Technical data A10VZO size 3 to 45

Size		NG		3	6	8	10	18	28	45
Displacement, geometric, per revolution		$V_{g\,max}$	cm^3	3.5	6	8	10.5	18	28	45
Rotational speed maximum[1]	at $V_{g\,max}$									
Suction speed operation as a pump[1]		n_{nom}	rpm	3600	3600	3600	3600	3300	3000	3000
Max. speed decompression operation[2]		n_{nom}	rpm	3600	3600	3600	3600	3300	3000	3000
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	12.6	21.6	28.8	38	59	84	135
Power Operation as a pump at n_{nom}, $V_{g\,max}$	and Δp = 250 bar	P	kW	5	10	15	16	–	–	–
	and Δp = 315 bar	P	kW	–	–	–	–	34	39	44
Torque	at $V_{g\,max}$ and Δp = 250 bar	T	Nm	14	24	32	42	–	–	–
	at $V_{g\,max}$ and Δp = 315 bar	T	Nm	–	–	–	–	90	140	225
	at $V_{g\,max}$ and Δp = 100 bar	T	Nm	6	9	13	17	29	45	72
Rotary stiffness of drive shaft	S	c	Nm/rad	8100	8100	8100	8100	–	–	–
	R	c	Nm/rad	–	–	–	–	14800	26300	41000
Moment of inertia for rotary group		J_{TW}	kgm^2	0.0006	0.0006	0.0006	0.0006	0.00093	0.0017	0.0033
Maximum angular acceleration[2][3]		α	rad/s^2	14000	14000	14000	14000	12600	11200	9500
Case volume		V	l	0.2	0.2	0.2	0.2	0.25	0.3	1.0
Weight **without** through drive (14N00, 12N00 approx.)		m	kg	8	8	8	8	12	15	27
Weight **without** through drive (22U00 approx.)		m	kg	–	–	–	–	–	–	–
Weight **with** through drive (07K.., 12K..approx.)		m	kg	10.5	10.5	10.5	10.5	14	18	28
Weight **with** through drive (22U..approx.)		m	kg	–	–	–	–	–	–	–

Determining the characteristics

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

Key

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

Notice

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

For further information on speed increase, see page 33

1) The values are applicable:
   – At absolute pressure p_{abs} = 1 bar at suction port **S**
   – For the optimal viscosity range of v_{opt} = 36 to 16 mm^2/s
   – For hydraulic fluid based on mineral oils
2) Higher values on request
3) The limit value is only valid for a single pump, multiple pump version available on request. The load capacity of the connecting parts must be considered.

Technical data A10VZO size 71 to 180

Size		NG		71	100	140	180
Displacement, geometric, per revolution		$V_{g\,max}$	cm^3	71.1	100	140	180
Rotational speed maximum[1)]	at $V_{g\,max}$						
Suction speed operation as a pump[1)]		n_{nom}	rpm	2550	2300	2200	1800
Max. speed decompression operation[2)]		n_{nom}	rpm	On request			
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	181	230	308	324
Power pump operation at n_{nom}, $V_{g\,max}$	and Δp = 280 bar	P	kW	84	107	143	151
Torque	at $V_{g\,max}$ and Δp = 280 bar	T	Nm	317	445	623	801
	at $V_{g\,max}$ and Δp = 100 bar	T	Nm	113	159	223	286
Rotary stiffness of drive shaft	S	c	Nm/rad	–	121142	169537	171107
	R	c	Nm/rad	76545	–	–	–
Moment of inertia for rotary group		J_{TW}	kgm^2	0.0087	0.0185	0.0276	0.033
Maximum angular acceleration[2)3)]		α	rad/s^2	7500	6200	5000	4000
Case volume		V	l	1.6	2.2	3.0	2.7
Weight **without** through drive (12N00, 42N00 approx.)		m	kg	36.5	55	70	–
Weight **without** through drive (22U00 approx.)		m	kg	47	69	73	78
Weight **with** through drive (12K..approx.)		m	kg	–	–	–	–
Weight **with** through drive (22U..approx.)		m	kg	47	69	73	78

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

Key

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

Notice

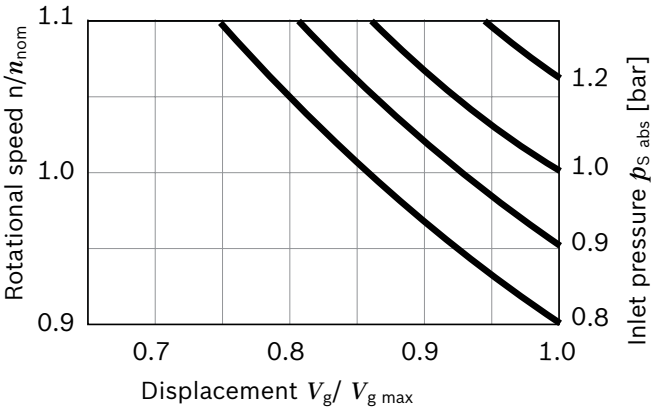
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommends testing the load by means of experiment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

For further information on speed increase, see page 33

1) The values are applicable:
   – At absolute pressure p_{abs} = 1 bar at suction port **S**
   – For the optimal viscosity range of v_{opt} = 36 to 16 mm^2/s
   – For hydraulic fluid based on mineral oils
2) Higher values on request
3) The limit value is only valid for a single pump, multiple pump version available on request. The load capacity of the connecting parts must be considered.
4) With port plates 7 or 14

Minimum permissible inlet pressure at suction port S with speed increase

In order to avoid damage to the pump (cavitation), a minimum inlet pressure must be guaranteed at suction port **S**.
The minimum inlet pressure level depends on the rotational speed and the displacement of the variable pump.

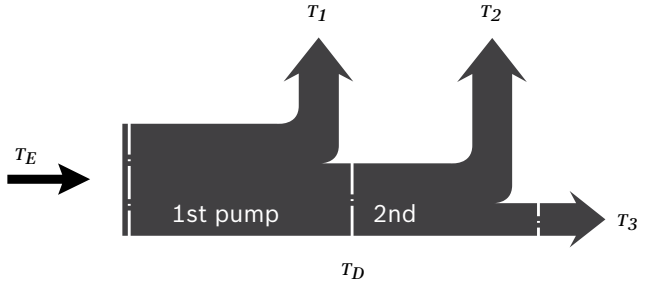


During continuous operation in overspeed over n_{nom}, a reduction in operational service life is to be expected due to cavitation erosion.

Permissible input and through-drive torques

Size				003 to 10	18	28	45	71	100	140	180
Input torque											
at drive shaft, maximum[2]	S	$T_{E\,max}$	Nm	126	–	–	–	–	1104	1620	1620
		Ø	in	3/4	–	–	–	–	1 1/2	1 3/4	1 3/4
	R	$T_{E\,max}$	Nm	–	160	250	400	650	–	–	–
		Ø	in	–	3/4	7/8	1	1 1/4	–	–	–
Maximum through-drive torque											
	S	$T_{D\,max}$	Nm	41	–	–	–	–	778	1266	1266
	R	$T_{D\,max}$	Nm	–	92	127	229	480	–	–	–

▼ **Distribution of torques**



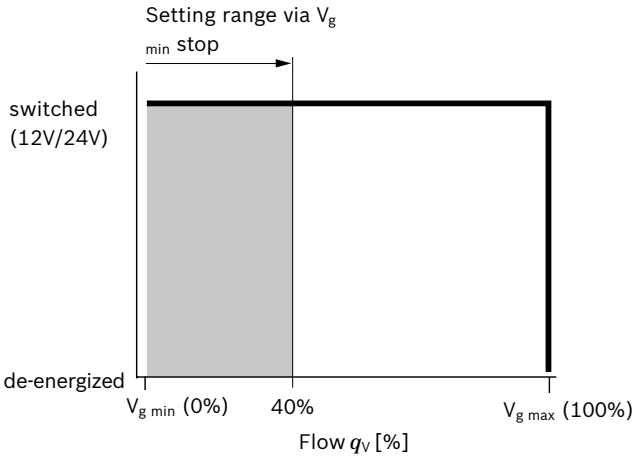
Torque at 1st pump	T_1		
Torque at 2nd pump	T_2		
Torque at 3rd pump	T_3		
Input torque	T_E	=	$T_1 + T_2 + T_3$
	T_E	<	$T_{E\,max}$
Through-drive torque	T_D	=	$T_2 + T_3$
	T_D	<	$T_{D\,max}$

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

EZ300/EZ400 – Two-point control, electric

The variable displacement unit is set to minimum swivel angle by actuating switching solenoid. The control pressure is taken internally from the high-pressure side. A minimum system pressure depending on the operating data is required for the pump to be adjusted (please contact us). The axial piston unit can only be switched between $V_{g\,max}$ and $V_{g\,min}$.
Please specify the pre-setting in plain text.

▼ **Characteristic curve EZx00**

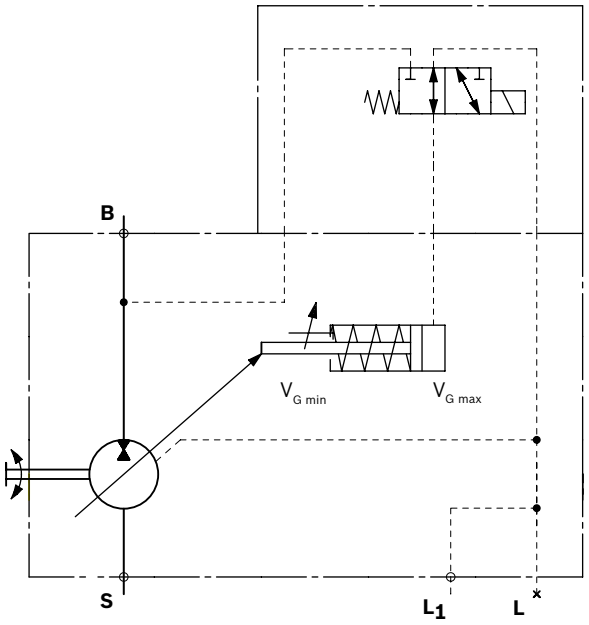


De-energized ≙ $V_{g\,max}$
Current switch on ≙ $V_{g\,min}$

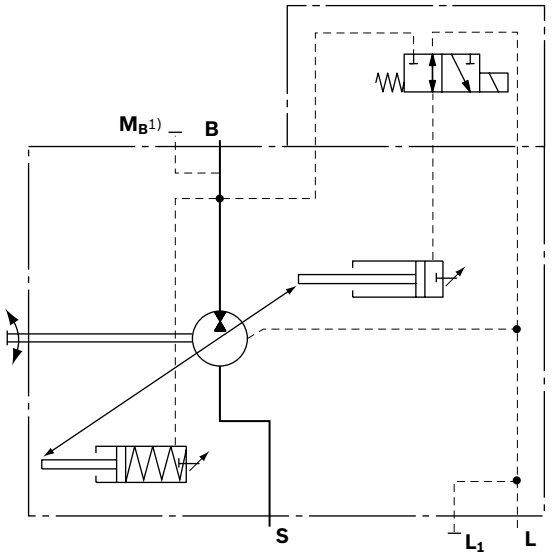
Technical data, solenoid	EZ300	EZ400
Voltage	12 V (±15%)	24 V (±15%)
Position $V_{g\,max}$	de-energized	de-energized
Position $V_{g\,min}$	Current switched on	Current switched on
Nominal current at 20 °C	1.5 A	0.8 A
Duty cycle	100%	100%
Type of protection: see connector version page 102		

Ambient temperature range -20 °C to +60 °C.
If these temperatures cannot be complied with, please contact us

▼ **Circuit diagram A10VZO...EZ3/4 sizes 3 to 10**



▼ **Circuit diagram A10VZO...EZ3/4 sizes 18 to 180**



1) Only port plate 22

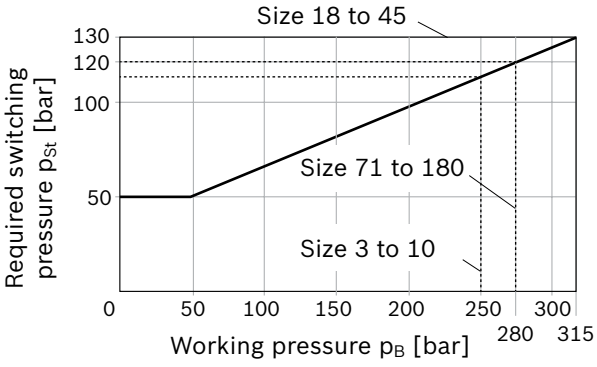
DG000 – Two-point control, hydraulic

The variable pump can be set to a minimum swivel angle by connecting an external switching pressure to port **X.** This will supply control fluid directly to the stroking piston; a minimum pressure of $p_{st} \geq 50$ bar is required.
The variable pump can only be switched between $V_{g\,min}$ and $V_{g\,max.}$ Please specify the pre-setting in plain text.
Please note, that the required switching pressure at port **X** is directly dependent on the actual working pressure p_B at port **B.** (See switching pressure characteristic curve).

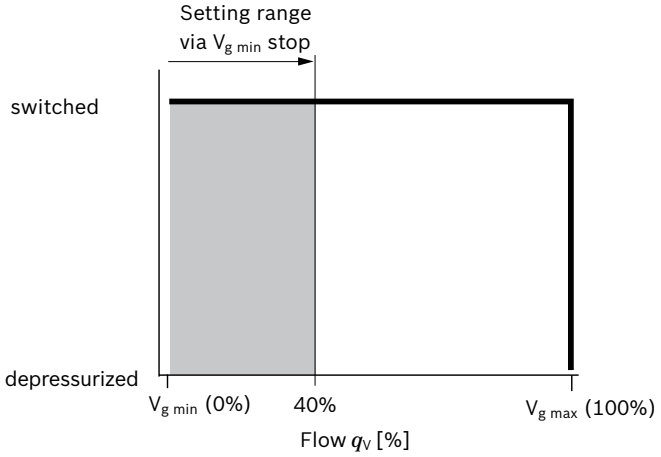
The maximum permissible switching pressure corresponds to the nominal pressure of the pump.

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

▼ **Switching pressure characteristic curve**

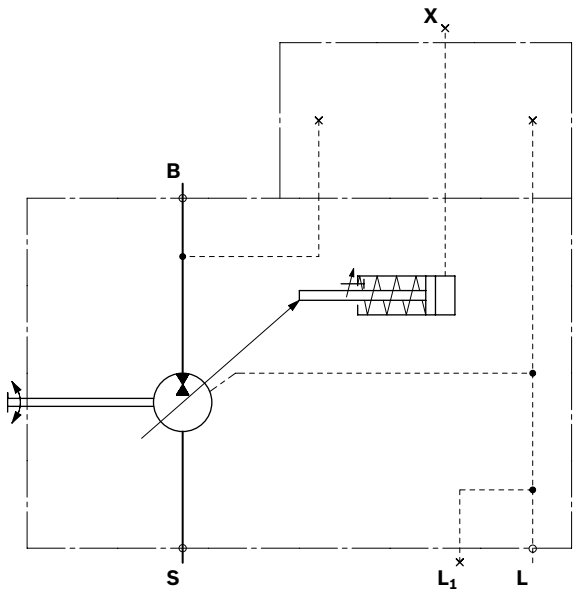


▼ **Characteristic curve DG000**

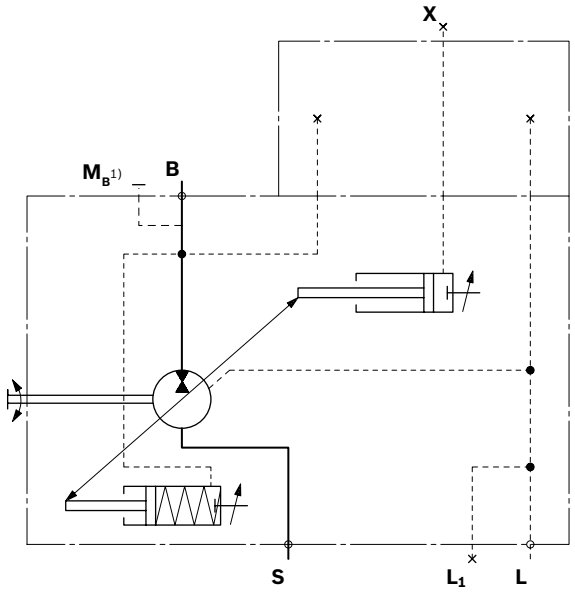


Depressurized ≙ $V_{g\,max}$
Pressure switch on ≙ $V_{g\,min}$

▼ **Circuit diagram DG000; A10VZO sizes 3 to 10**



▼ **Circuit diagram DG000; A10VZ0 sizes 18 to 180**



1) Only port plate 22

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 control valve, the pump will regulate to a smaller displacement to reduce the control differential.

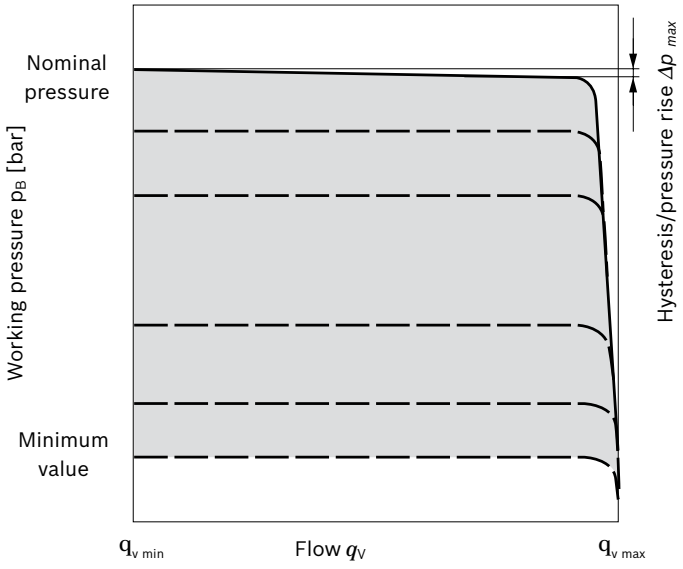
- Initial position in depressurized state: $V_{g\,max}$.
- Setting range[1] for pressure control, see characteristic curve DR and table.

Notice

- The described function is only available in the selected direction of rotation (type code R/L). Please contact us regarding switching the direction of rotation

-

▼ **Characteristic curve DR**



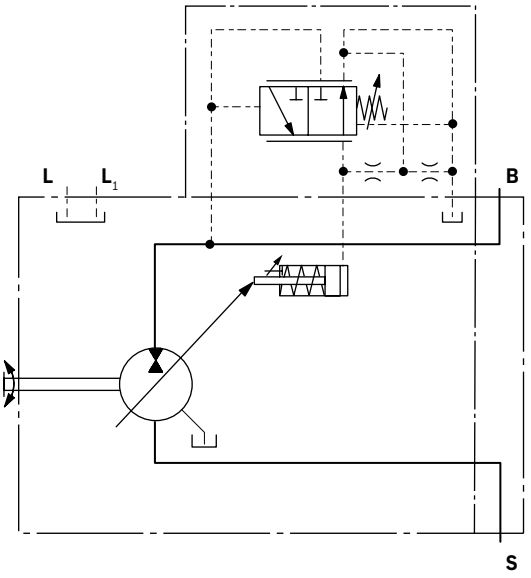
Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C.

Setting range pressure controller

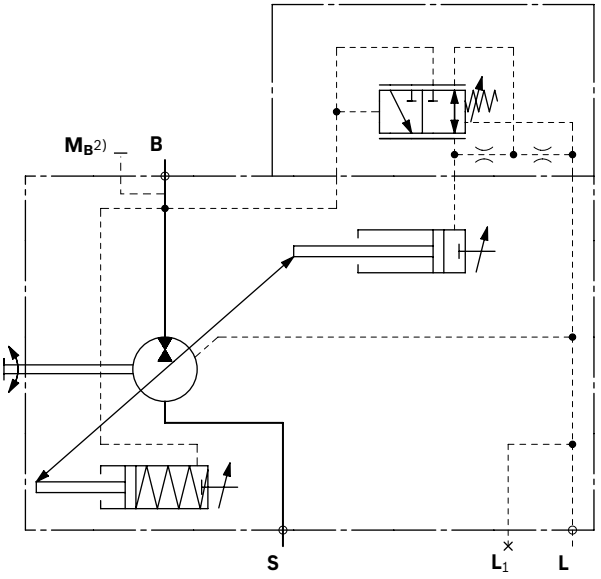
NG	10	18 to 45	71 to 180
Nominal pressure/ maximum value	250	315	280[3]
Minimum value	20	60	60

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Only port plate 22
3) Higher value on request

▼ **Circuit diagram DR nominal size 3 to 10**



▼ **Circuit diagram DR nominal size 18 to 180**



Controller data DR

NG		10	18	28	45	71	100	140	180
Pressure increase	Δp [bar]	4	4	4	6	8	10	12	12
Hysteresis and repeatability	Δp [bar]	maximum 3							
Pilot fluid consumption	[l/min]	maximum approx. 3							

DRG – Pressure controller, remote controlled

For the remote controlled pressure controller, the LS pressure limitation is performed using a separately arranged pressure relief valve. Therefore any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 36.
A pressure relief valve is externally piped 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 Δp (standard setting), the quantity of control fluid at the port is **X** approx. 1.5 l/min. If a different setting (range 10 to 22 bar) is required, please state in plain text.
As a separate pressure relief valve (**1**) we recommend:

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

The max. length of piping should not exceed 2 m.

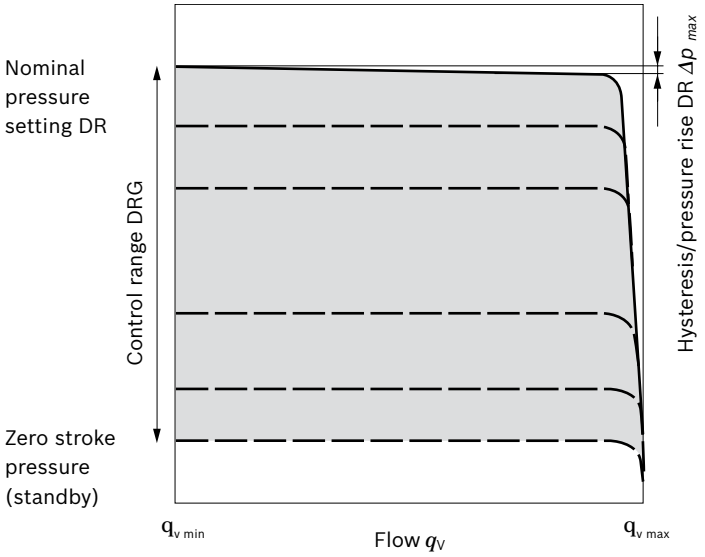
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range for differential pressure 10 to 22 bar standard is 20 bar.

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

Notice

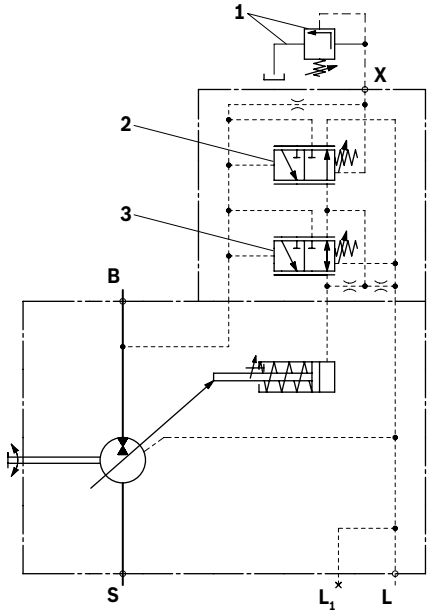
- The described function is only available in the selected direction of rotation (type code R/L). Please contact us regarding switching the direction of rotation

▼ **Characteristic curve DRG**



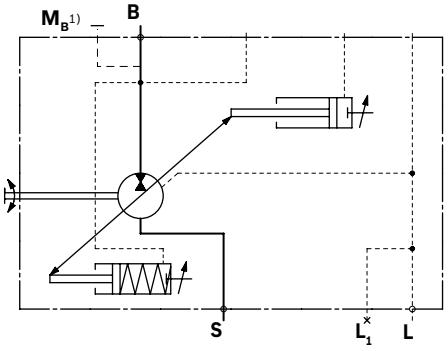
Characteristic curve valid at n_1 = 1500 rpm and θ_{fluid} = 50 °C.

▼ **Circuit diagram DRG A10VZO sizes 3 to 10**



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**)

▼ **Circuit diagram base unit A10VZO sizes 18 to 180; valve setup, see sizes 3 to 10**



Controller data DR**G**

NG		10	18	28	45	71	100	140	180
Hysteresis and repeatability	Δp [bar]	maximum 3							
Pilot fluid consumption DR and DRG	[l/min]	maximum approx. 4.5							

1) Only port plate 22

LA.D – Pressure and torque controller

Pressure controller equipped like DR, see page 36.
In order to achieve a constant drive torque, the swivel angle of the axial piston pump is varied depending on the working pressure so that the drive torque remains constant.
When ordering please state the torque characteristics to be set at the factory in plain text, e.g. 50 Nm.

Notice

- The described function is only available in the selected direction of rotation (type code R/L). Please contact us regarding switching the direction of rotation

Controller data

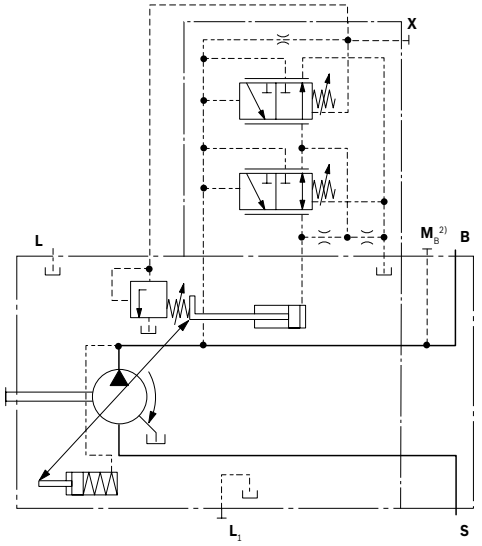
For technical data of pressure controller DR see page 36.
Pilot fluid consumption max. approx. 5.5 l/min

Reference values	Torque T [Nm] for size							
Beginning of control	18	28	45	71	100	140	180	Order code
up to 50 bar	up to 17.0	up to 26.0	up to 42.0	up to 67.0	up to 94.0	up to 132.0	up to 170.0	**LA5**[1)]
50 to 90	17.1 × 30.0	26.1 × 47.0	42.1 × 76.0	67.1 × 121.0	94.1 × 169.0	132.1 × 237.0	170.1 × 305.0	**LA6**
91 to 160	30.1 × 54.0	47.1 × 84.0	76.1 × 134.0	121.1 × 213.0	169.1 × 299.0	237.1 × 418.0	305.1 × 537.0	**LA7**
161 to 240	54.1 × 81.0	84.1 × 126.0	134.1 × 202.0	213.1 × 319.0	299.1 × 449.0	418.1 × 629.0	537.1 × 809.0	**LA8**
over 240	over 81.1	over 126.1	over 202.1	over 319.1	over 449.1	over 629.1	over 809.1	**LA9**

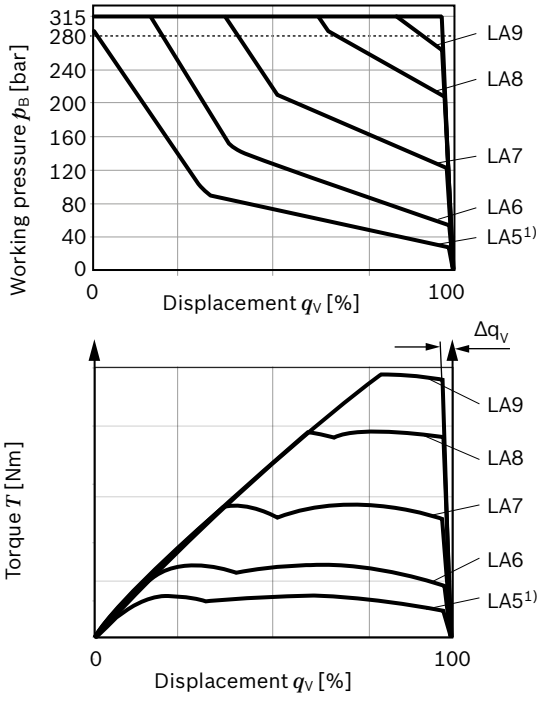
Conversion of the torque values in power [kW]

$P = \frac{T}{6.4}$ [kW] (at 1500 rpm) or $P = \frac{2 \times T \times n}{60000}$ [kW] (For rotational speeds see page 31 onwards)

▼ **Circuit diagram LA.D**



▼ **Characteristic curve LA.D**

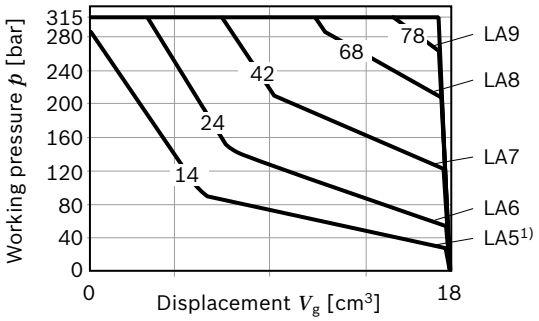


1) Please contact us.
2) Only with port plate 22

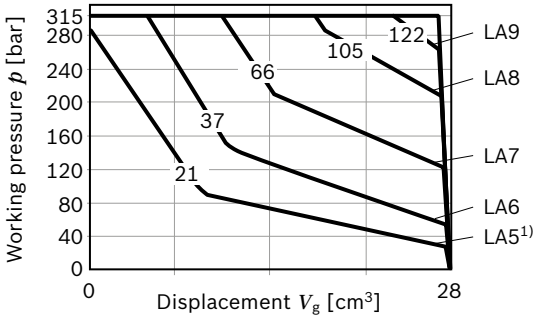
LA.D – Pressure and torque controller, characteristic curve

Torque characteristic curve in Nm

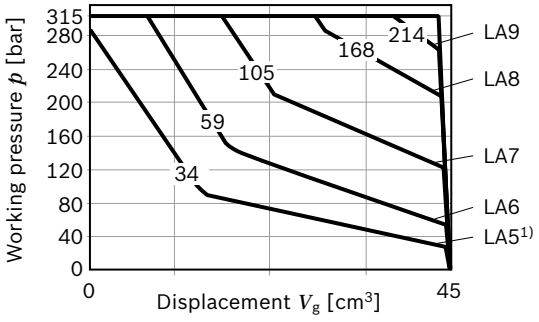
Size 18



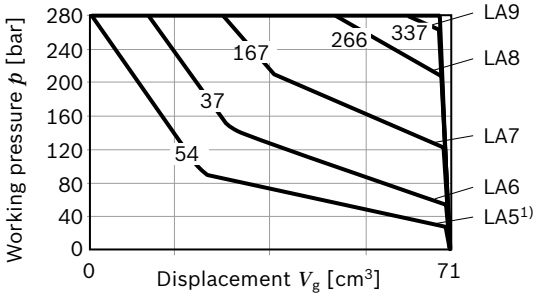
Size 28



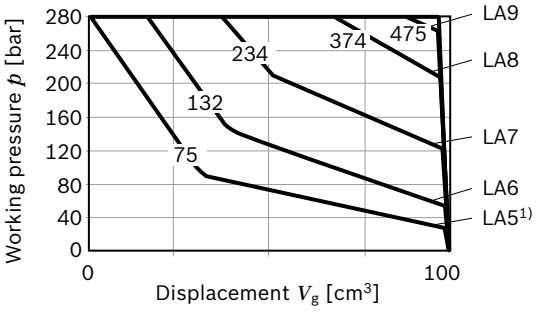
Size 45



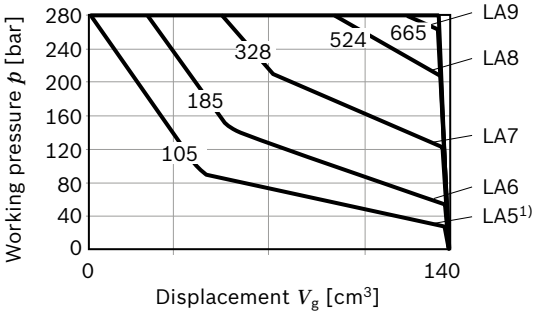
Size 71



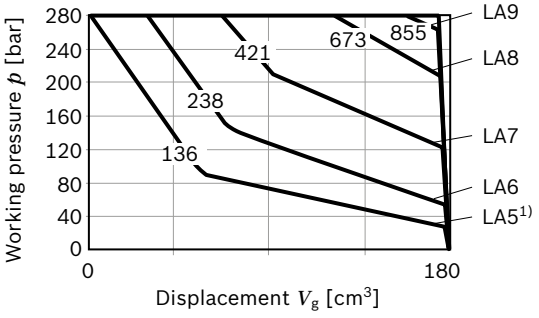
Size 100



Size 140



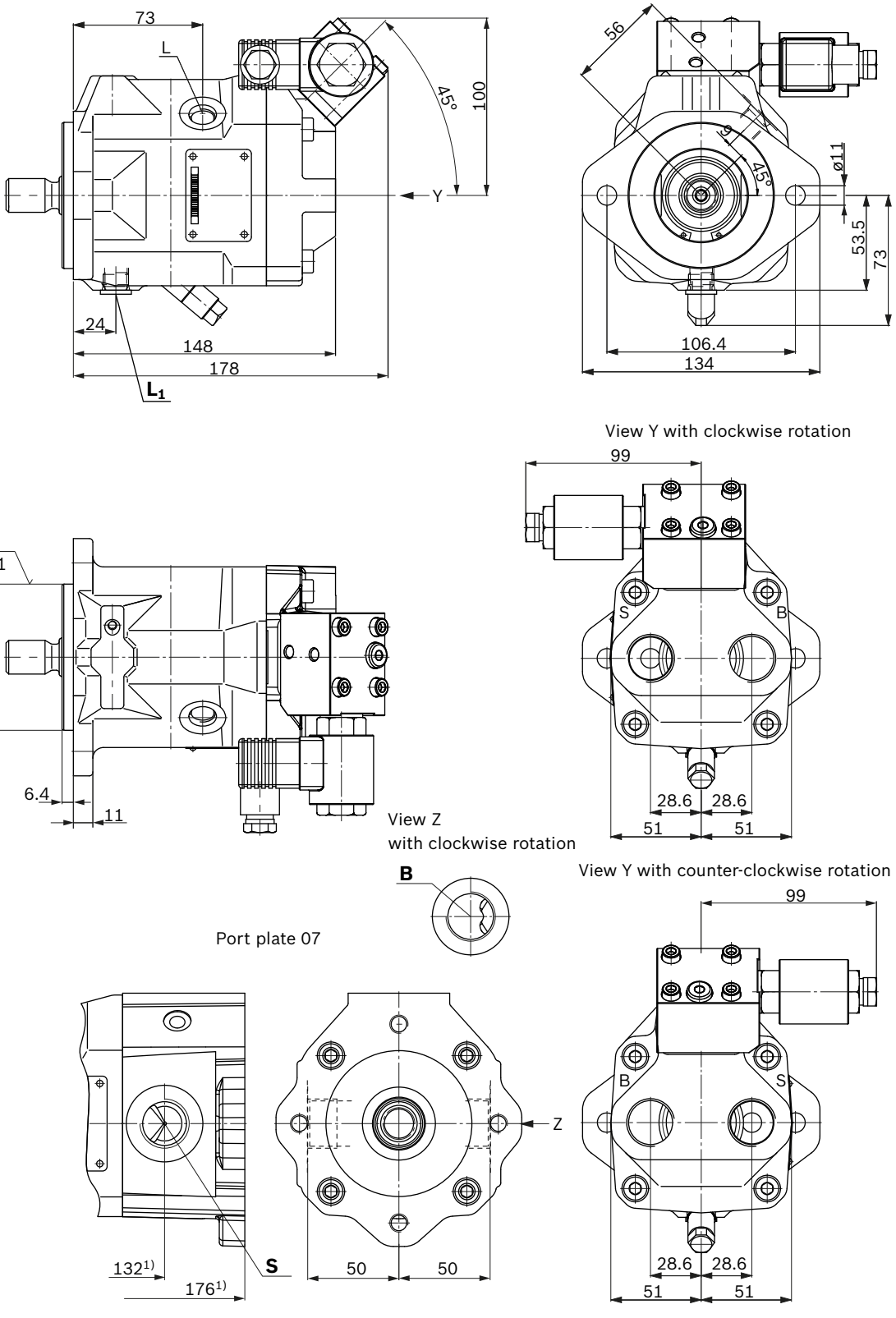
Size 180



1) Please contact us.

Dimensions A10VZO sizes 3 to 10

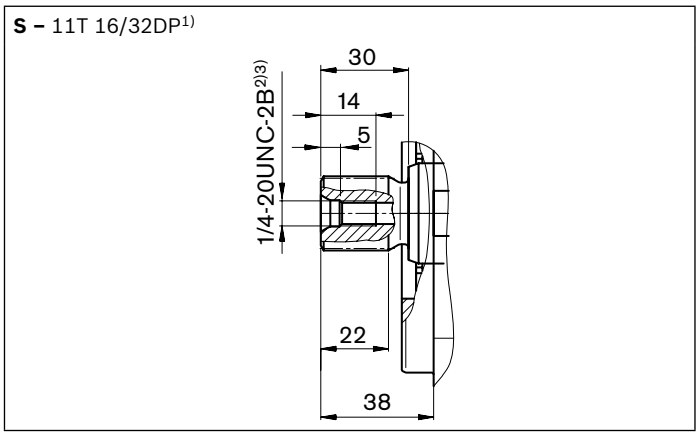
EZ3/4 – Two-point control electric, port plate 14 and 07, clockwise rotation



1) To flange surface

▼ **Splined shaft 3/4 in SAE J744**

S – 11T 16/32DP[1)]

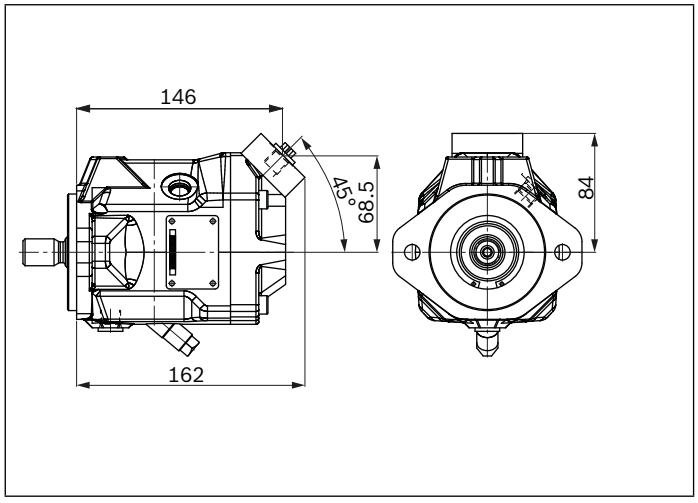


Connection table **A10VZO**

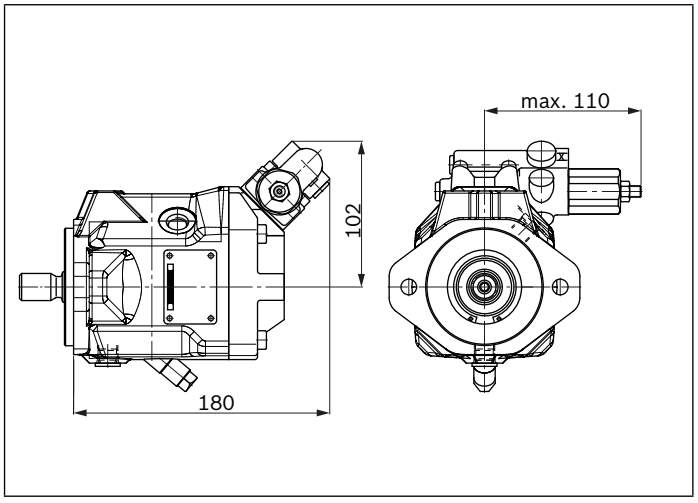
Ports		**Standard**	**Size**[4)]	$p_{max\ abs}$ **[bar]**[5)]	**State**[9)]
B	Working port (standard pressure series)	DIN 3852	M27 × 2; 16 deep	315	O
S	Suction port (standard pressure series)	DIN 3852	M27 × 2; 16 deep	5	O
L	Drain port	ISO 11926[7)]	9/16-18UNF-2B; 10 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	9/16-18UNF-2B; 10 deep	2	X[8)]
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 11.5 deep	315	O
X	Pilot pressure port with DG	DIN ISO 228	G 1/4	315	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.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

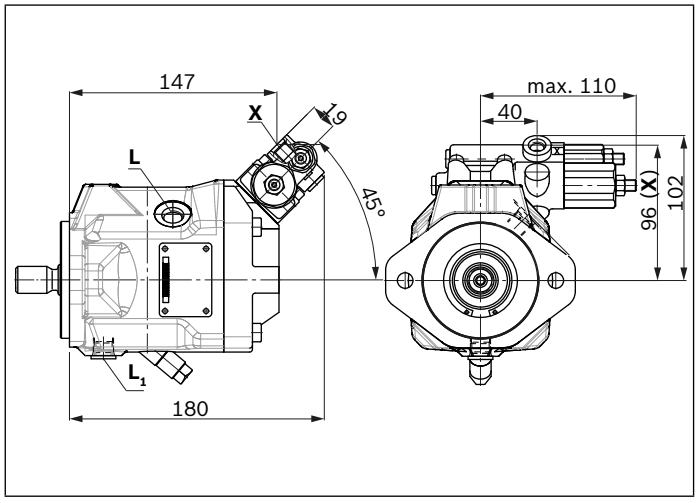
▼ **DG – Two-point control, direct operated, hydraulic**



▼ **DR – Pressure controller, hydraulic**



▼ **DRG – Pressure controller, remote controlled, hydraulic**

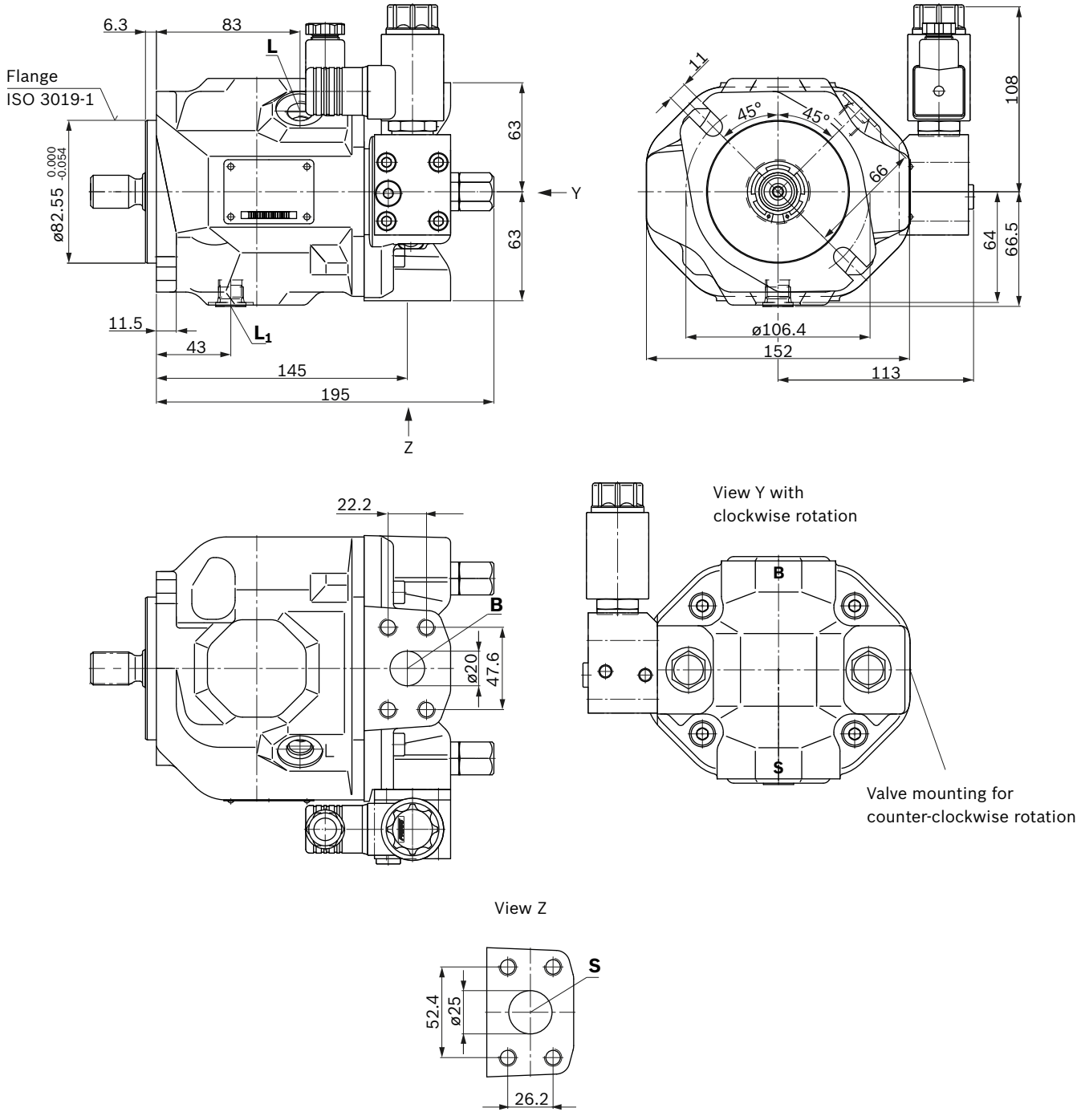


Notice

Valve mounting for counter-clockwise rotation see overall dimensions on page 40.

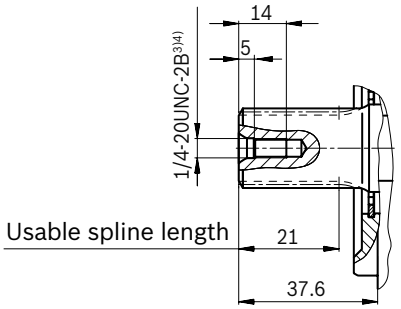
Dimensions A10 VZO size 18

EZ3/4 – Two-point control electric, port plate 12, clockwise rotation



▼ **Splined shaft 3/4 in SAE J744**

R – 11T 16/32DP[1)2)]

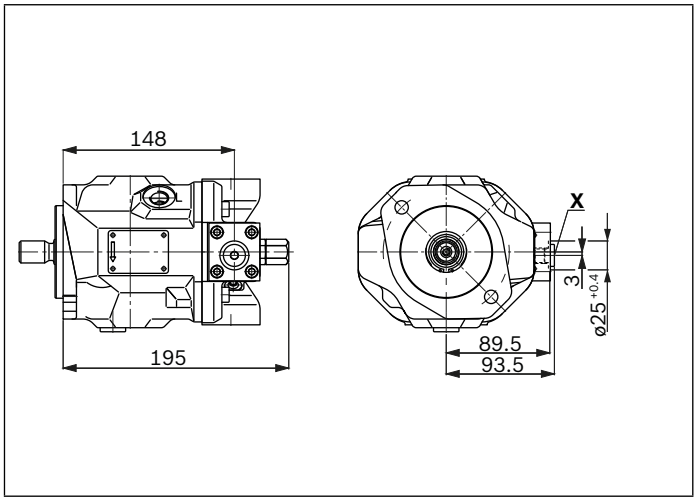


Connection table **A10VZO**

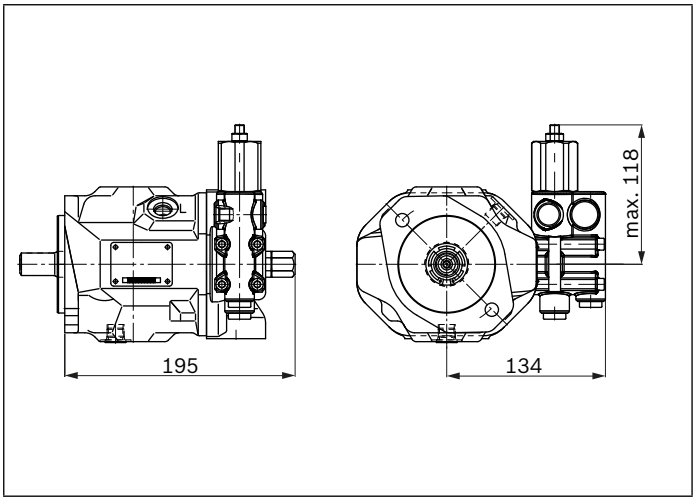
Ports		Standard	Size[4)]	$p_{max\ abs}$ [bar][5)]	State[9)]
B	Working port (standard pressure series) Fastening thread	SAE J518[6)] DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
S	Suction port (standard pressure series)	SAE J518[6)] DIN 13	1 in M10 × 1.5; 17 deep	10	O
L	Drain port	ISO 11926[7)]	9/16-18UNF-2B; 10 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	9/16-18UNF-2B; 10 deep	2	X[8)]
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 11.5 deep	350	O
X	Pilot pressure port (DG only)	DIN ISO 228[7)]	G1/4; 12 deep	350	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.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

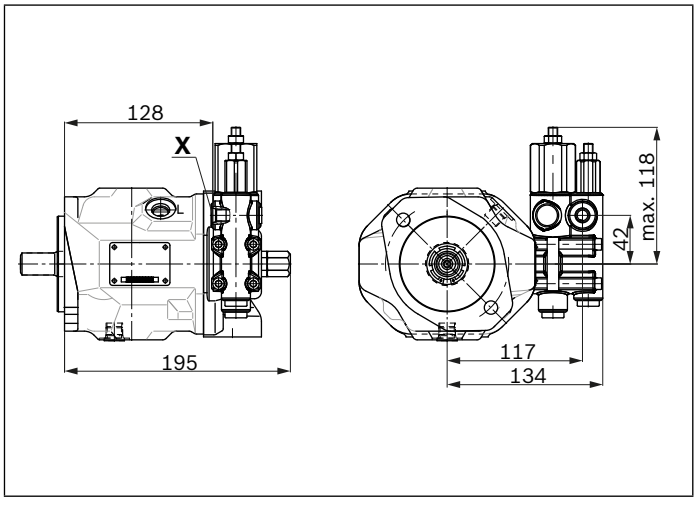
▼ **DG – Two-point control, direct operated, hydraulic**



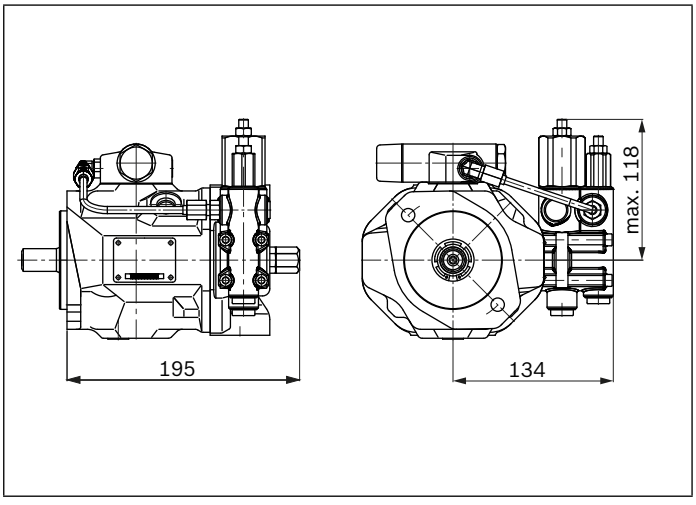
▼ **DR – Pressure controller, hydraulic**



▼ **DRG – Pressure controller, remote controlled, hydraulic**



▼ **LAxD – Torque controller, hydraulic**

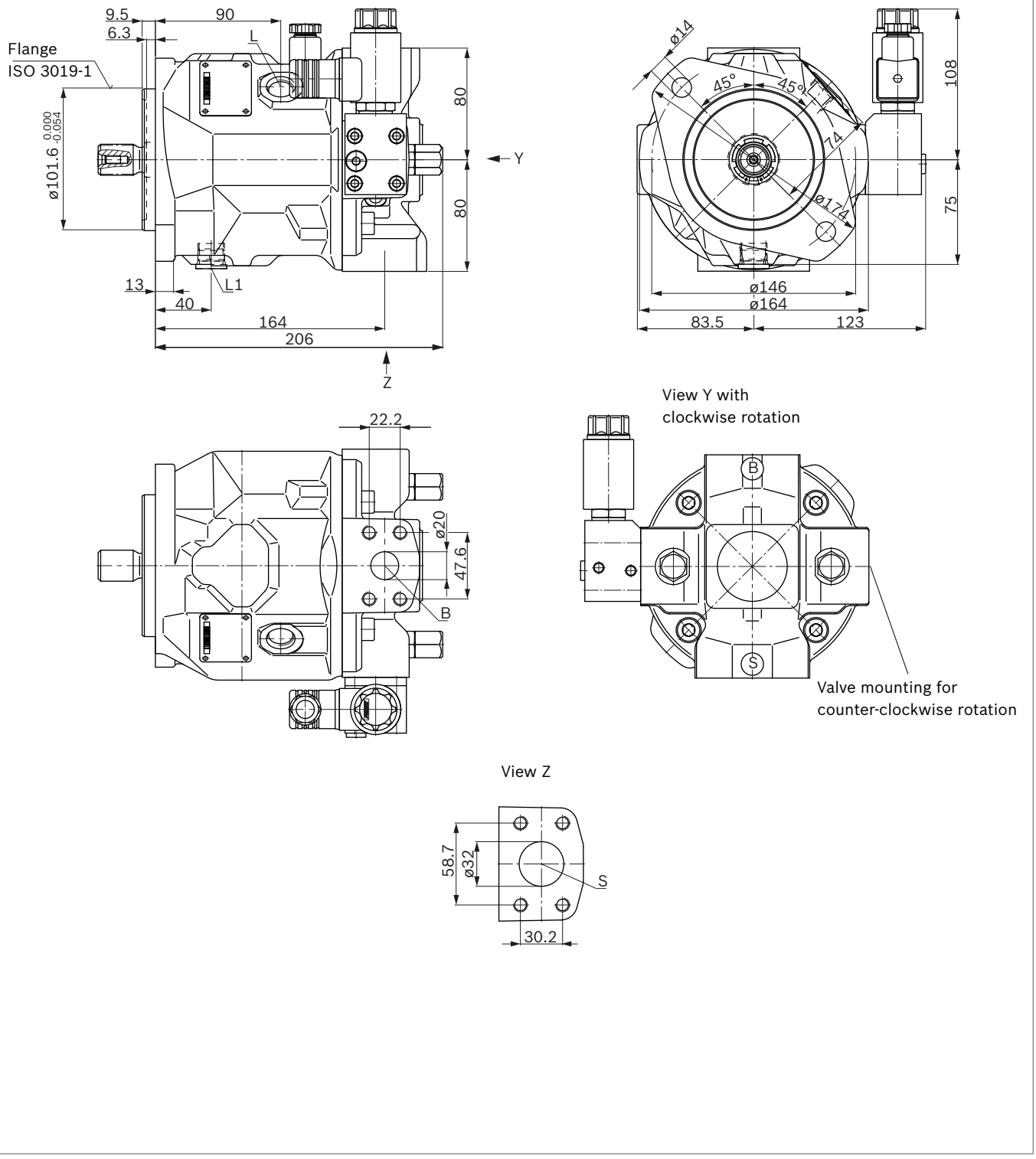


Notice

Valve mounting for counter-clockwise rotation see overall dimensions on page 43.

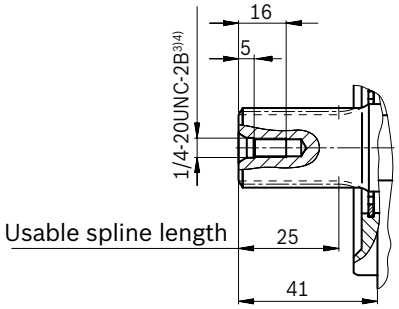
Dimensions A10VZO size 28

EZ3/4 – Two-point control electric, port plate 12, clockwise rotation



▼ **Splined shaft 7/8 in SAE J744**

R – 13T 16/32DP[1)2)]

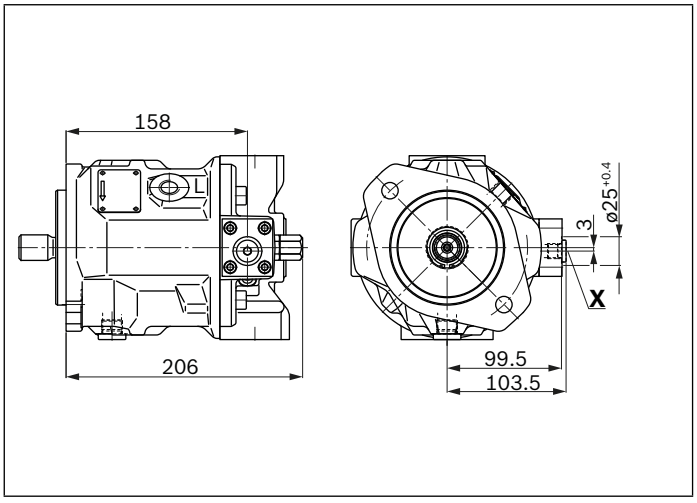


Connection table **A10VZO**

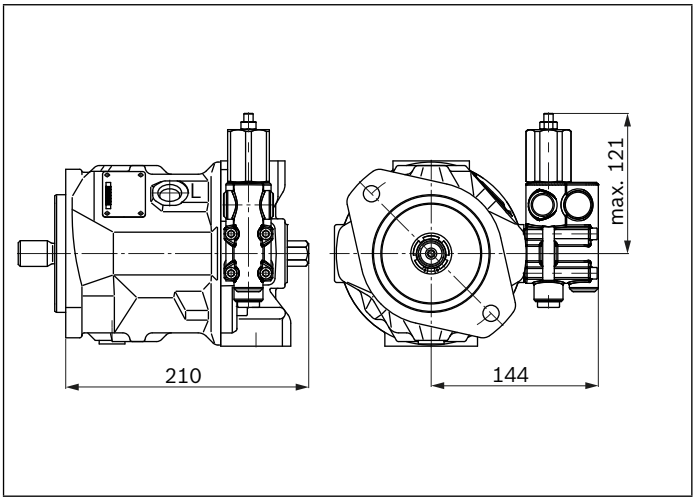
Ports		Standard	Size[4)]	$p_{max\ abs}$ [bar][5)]	State[9)]
B	Working port (standard pressure series) Fastening thread	SAE J518[6)] DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
S	Suction port (standard pressure series)	SAE J518[6)] DIN 13	1 1/4 in M10 × 1.5; 17 deep	10	O
L	Drain port	ISO 11926[7)]	3/4-16UNF-2B; 12 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	3/4-16UNF-2B; 12 deep	2	X[8)]
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 11.5 deep	350	O
X	Pilot pressure port (DG only)	DIN ISO 228[7)]	G1/4; 12 deep	350	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.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

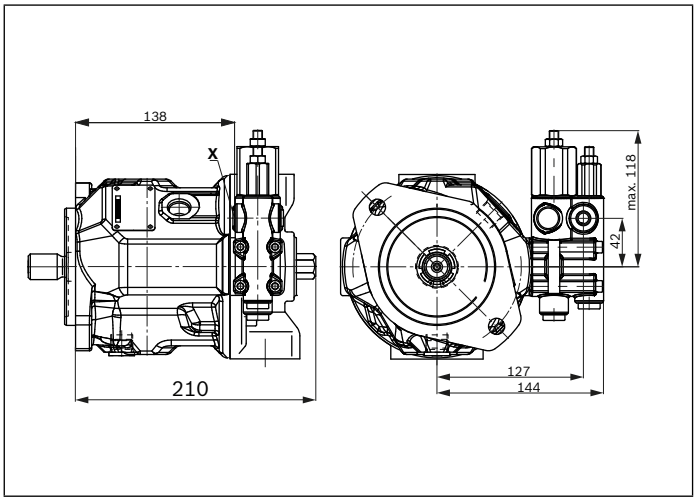
▼ **DG – Two-point control, direct operated, hydraulic**



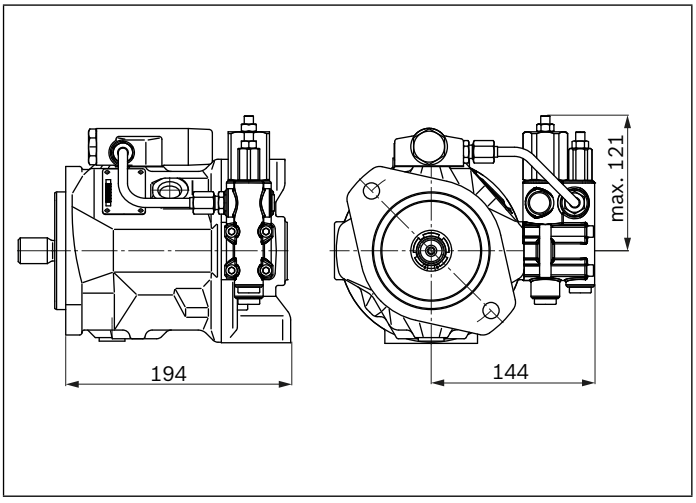
▼ **DR – Pressure controller, hydraulic**



▼ **DRG – Pressure controller, remote controlled, hydraulic**



▼ **LAxD – Torque controller, hydraulic**

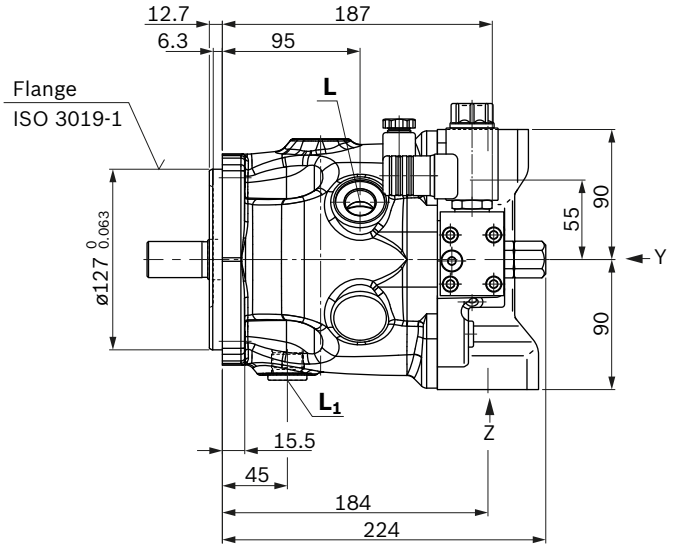


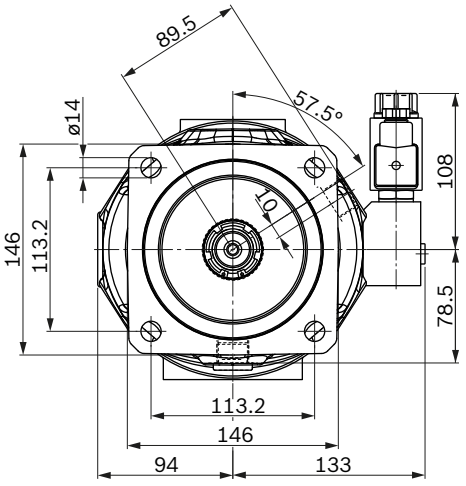
Notice

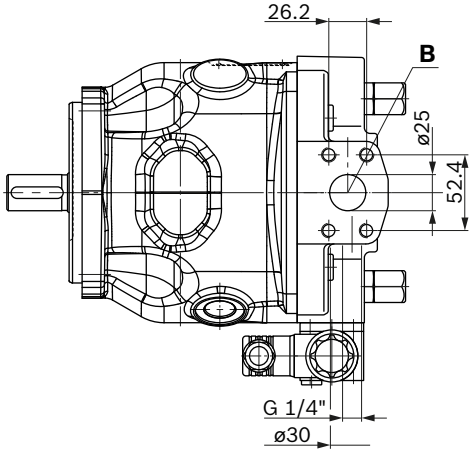
Valve mounting for counter-clockwise rotation see overall dimensions on page 46.

Dimensions A10VZO size 45

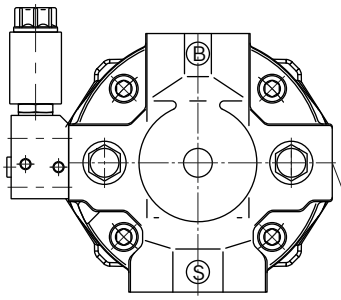
EZ3/4 – Two-point control electric, port plate 12, clockwise rotation





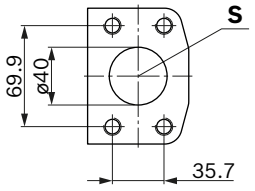


View Y with
clockwise rotation



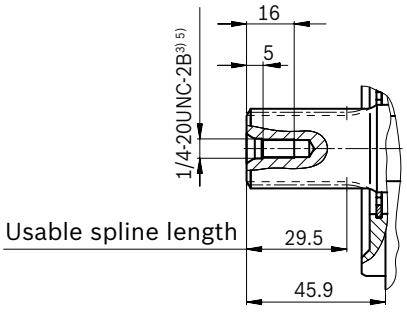
Valve mounting for counter-
clockwise rotation

View Z



▼ **Splined shaft 1 in SAE J744**

R – 15T 16/32DP[1)2)]

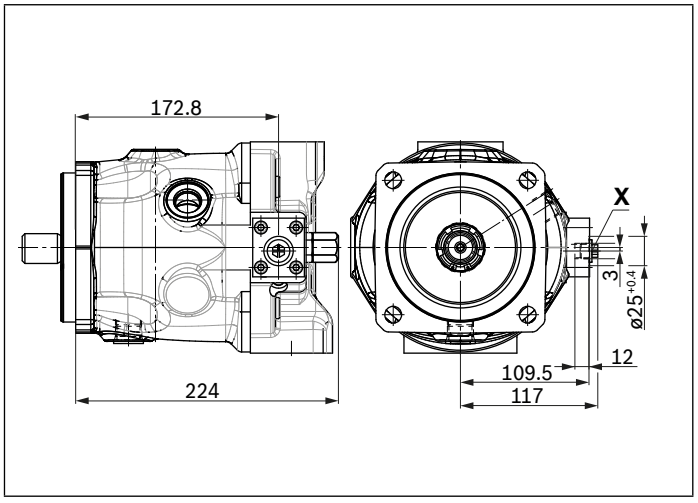


Connection table **A10VZO**

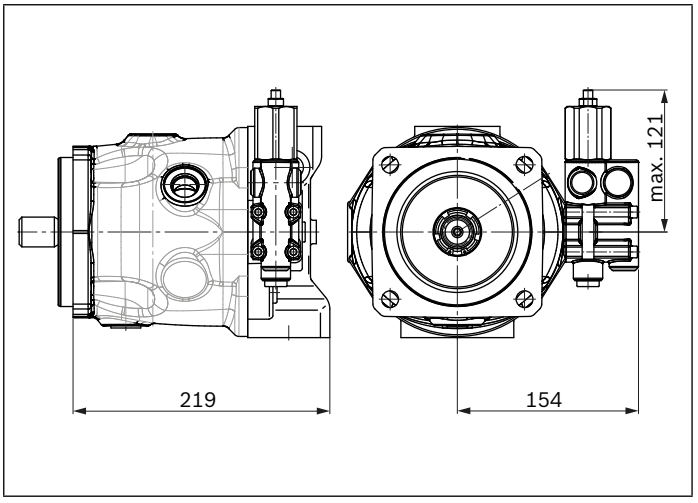
Ports		**Standard**	**Size**[4)]	$p_{max\ abs}$ **[bar]**[5)]	**State**[9)]
B	Working port (standard pressure series) Fastening thread	SAE J518[6)] DIN 13	1 in M10 × 1.5; 17 deep	350	O
S	Suction port (standard pressure series)	SAE J518[6)] DIN 13	1 1/2 in M12 × 1.75; 20 deep	10	O
L	Drain port	ISO 11926[7)]	7/8-14UNF-2B; 14 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	7/8-14UNF-2B; 14 deep	2	X[8)]
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 11.5 deep	350	O
X	Pilot pressure (only on DG)	DIN ISO 228[7)]	G1/4; 12 deep	350	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.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

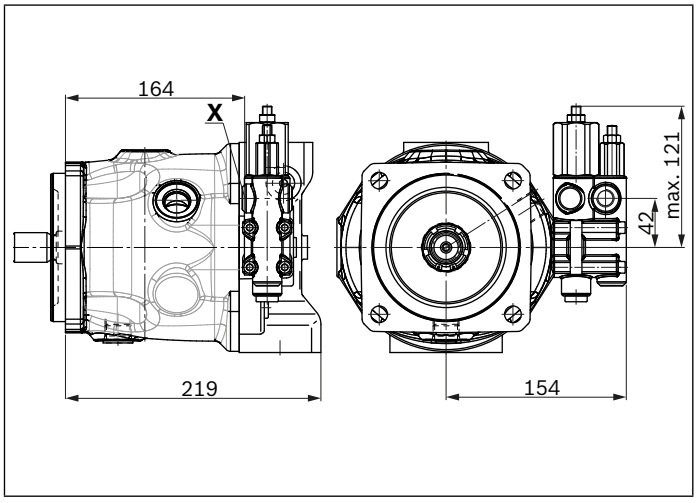
▼ **DG – Two-point control, direct operated, hydraulic**



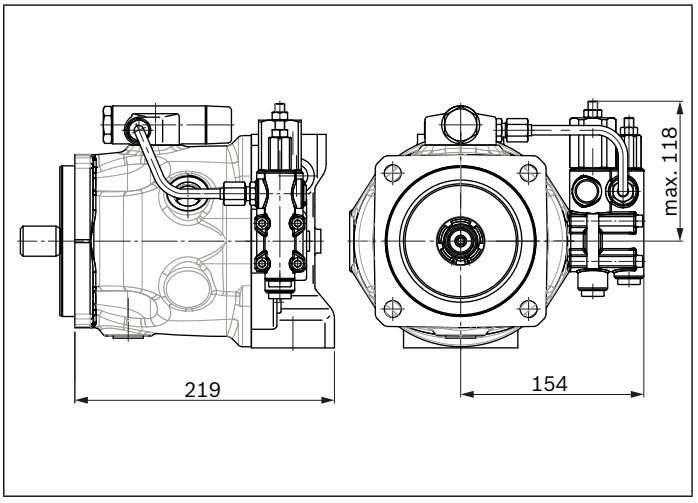
▼ **DR – Pressure controller, hydraulic**



▼ **DRG – Pressure controller, remote controlled, hydraulic**



▼ **LAxD – Torque controller, hydraulic**

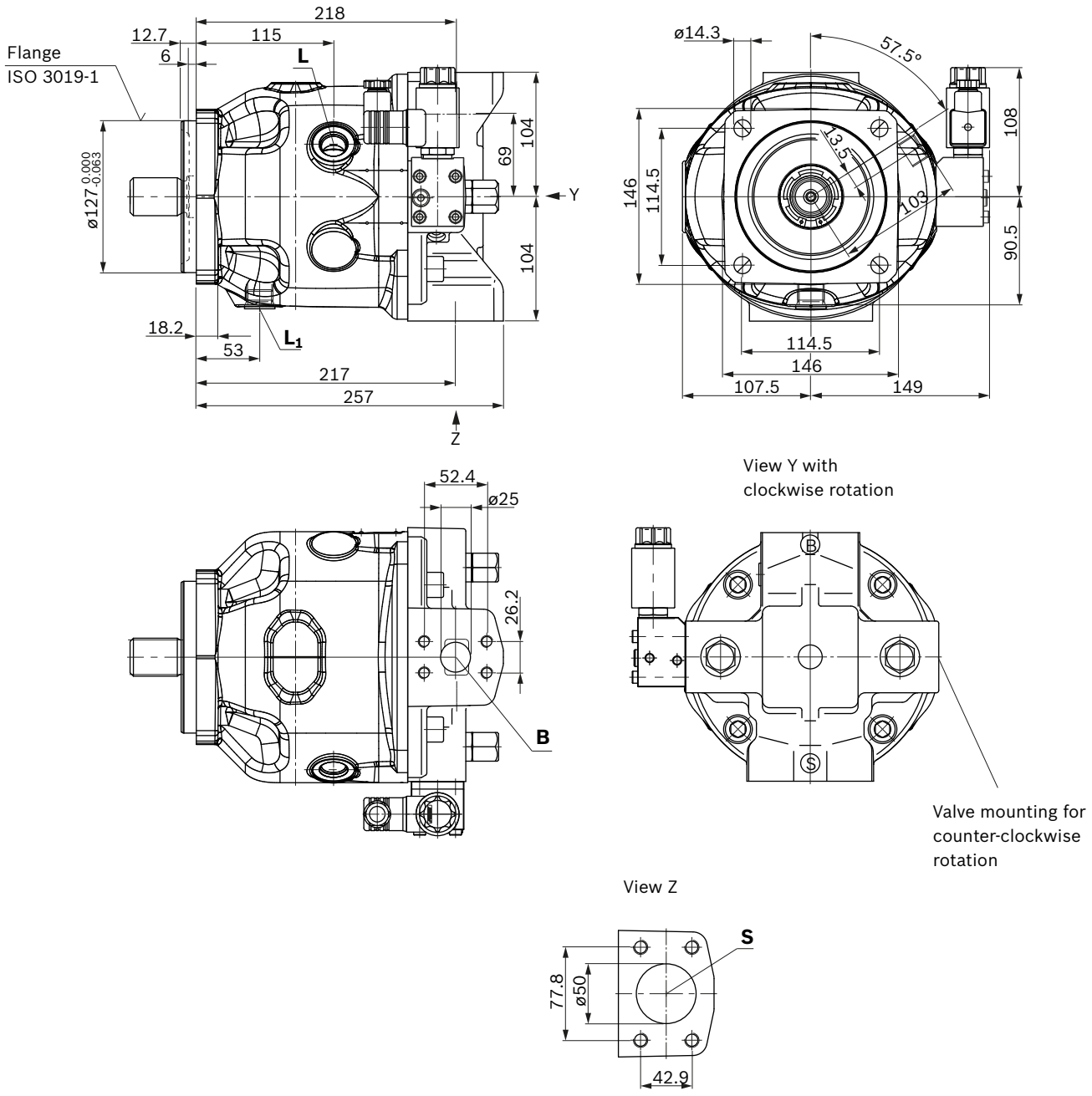


Notice

Valve mounting for counter-clockwise rotation see overall dimensions on page 49.

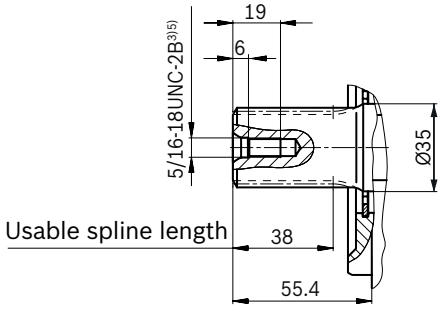
Dimensions A10VZO size 71

EZ3/4 – Two-point control electric, port plate 12, clockwise rotation



▼ **Splined shaft 1 1/4 in SAE J744**

R – 14T 12/24DP[1)2)]



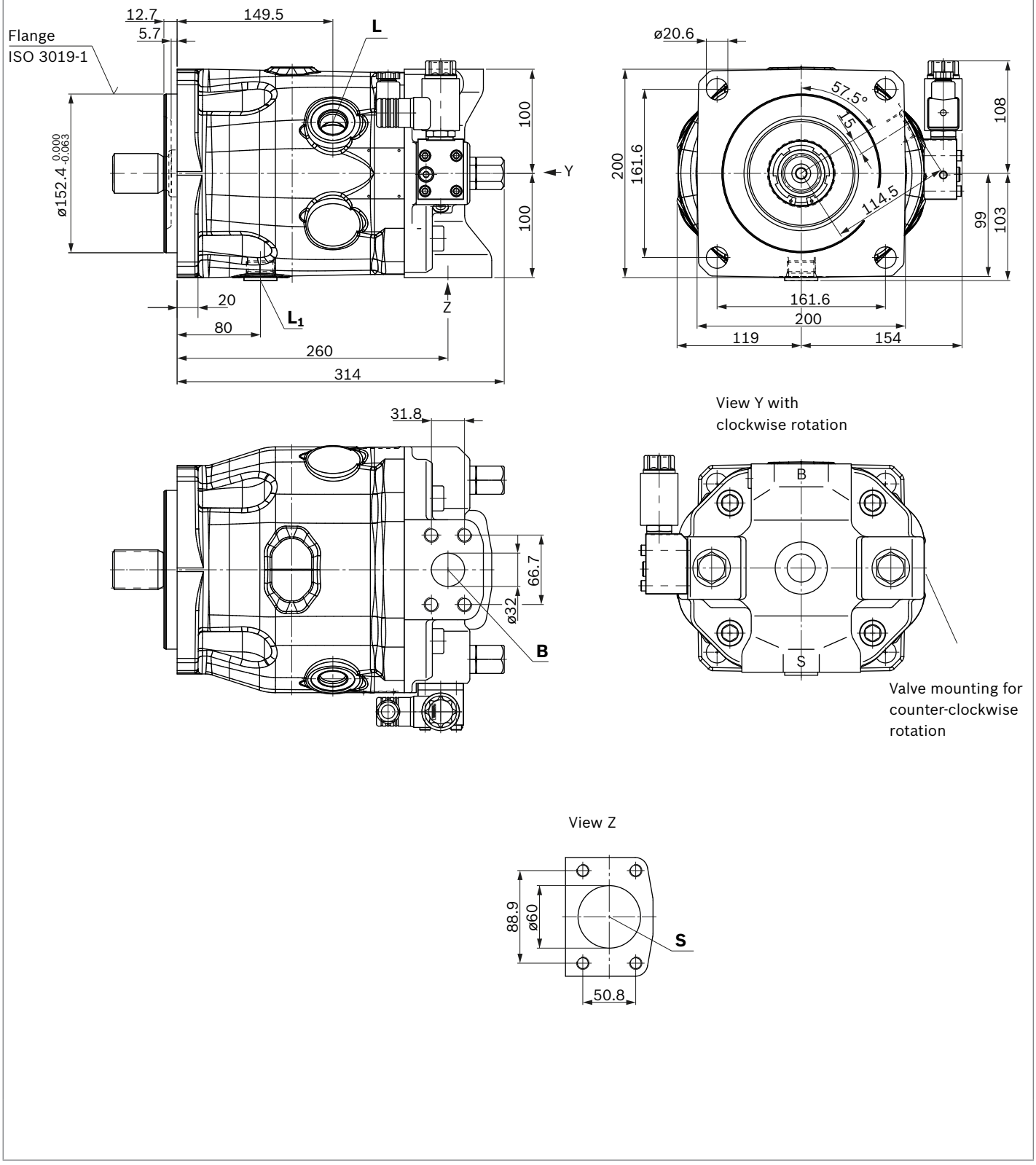
Connection table **A10VZO**

Ports		Standard	Size[4)]	$p_{max\ abs}$ [bar][5)]	State[9)]
B	Working port (standard pressure series) Fastening thread	SAE J518[6)] DIN 13	1 in M10 × 1.5; 17 deep	350	O
S	Suction port (standard pressure series)	SAE J518[6)] DIN 13	2 in M12 × 1.75; 20 deep	10	O
L	Drain port	ISO 11926[7)]	7/8-14UNF-2B; 14 deep	2	O[8)]
L_1	Drain port	ISO 11926[7)]	7/8-14UNF-2B; 14 deep	2	X[8)]

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.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
6) Metric fastening thread is a deviation from standard.
7) The countersink can be deeper than as specified in the standard.
8) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

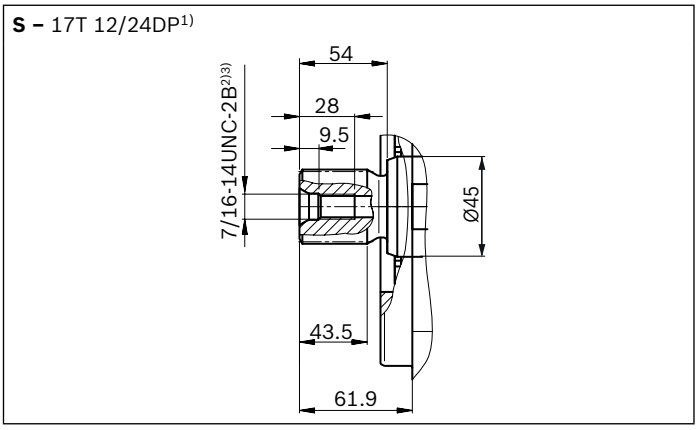
Dimensions A10VZO size 100

EZ3/4 – Two-point control electric, port plate 12, clockwise rotation



▼ **Splined shaft 1 1/2 in SAE J744**

S – 17T 12/24DP[1)]



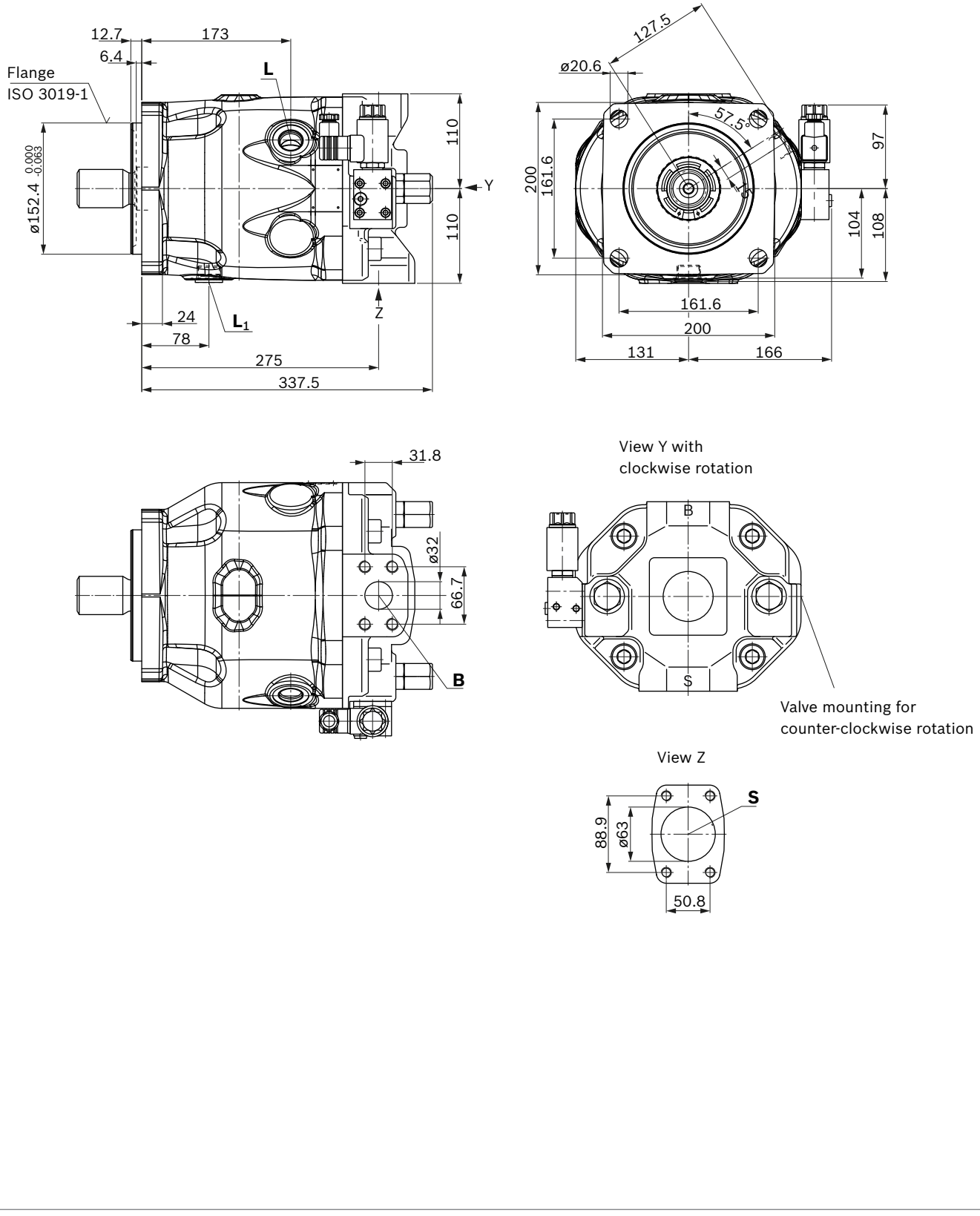
Connection table **A10VZO**

Ports		**Standard**	**Size**[3)]	$p_{max\ abs}$ **[bar]**[4)]	**State**[8)]
B	Working port (standard pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/4 in M14 × 2; 19 deep	350	O
S	Suction port (standard pressure series)	SAE J518[5)] DIN 13	2 1/2 in M12 × 1.75; 17 deep	10	O
L	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 16 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 16 deep	2	X[7)]

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) For notes on tightening torques, see the instruction manual.
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink can be deeper than as specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
8) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

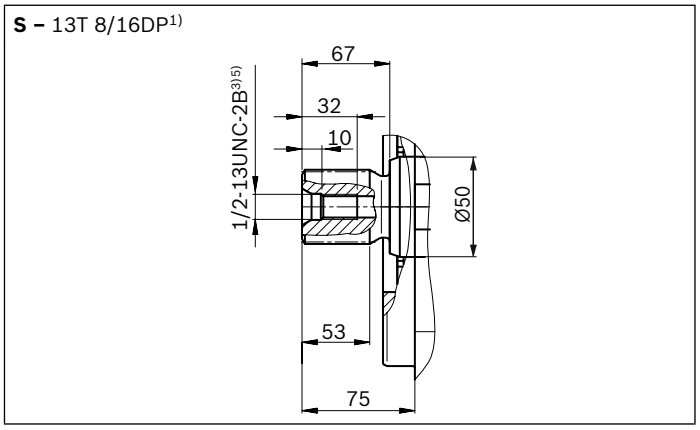
Dimensions A10VZO size 140

EZ3/4 – Two-point control electric, port plate 12, clockwise rotation



▼ **Splined shaft 1 3/4 in SAE J744**

S – 13T 8/16DP[1)]



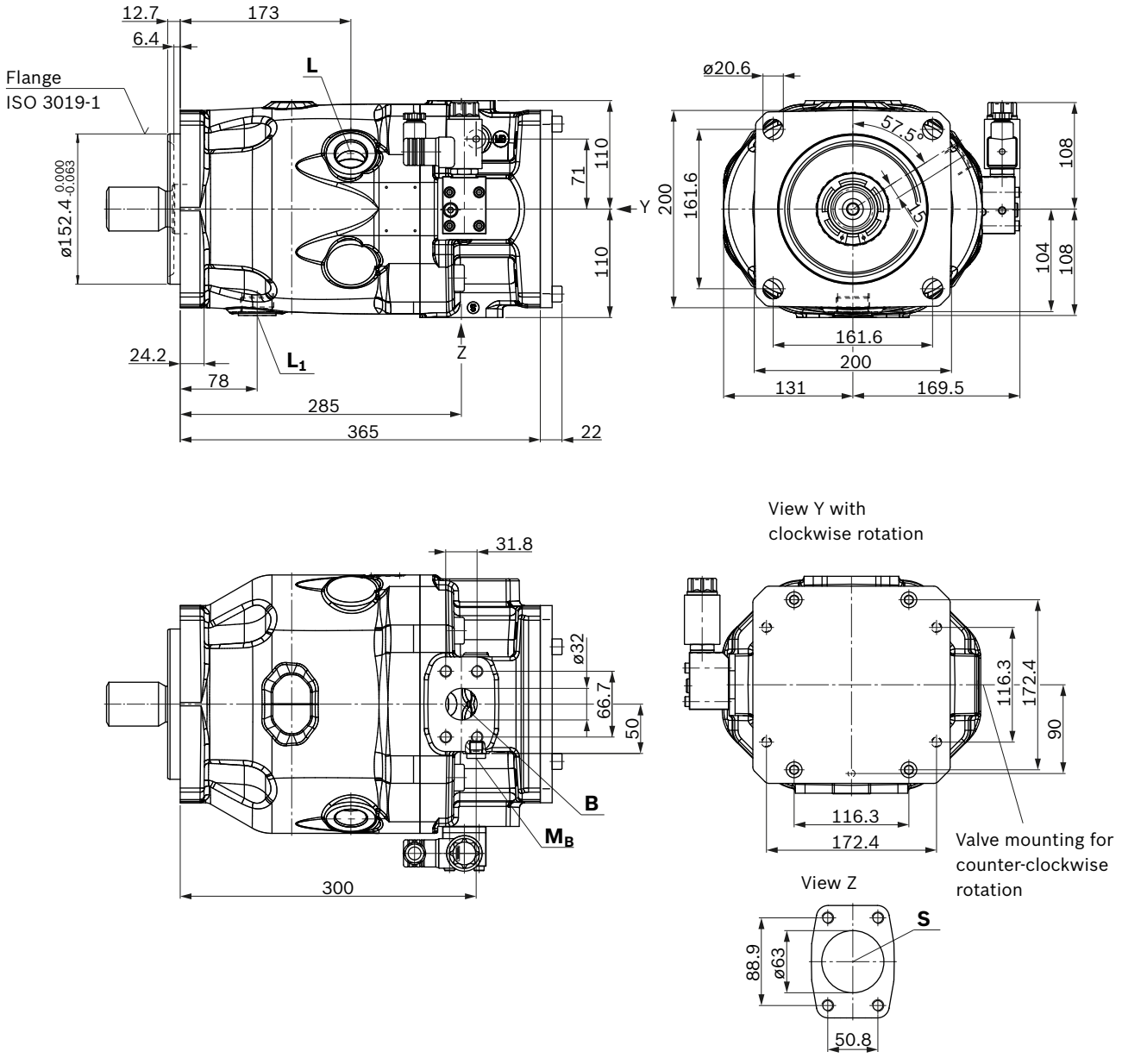
Connection table **A10VZO**

Ports		Standard	Size[3)]	$p_{max\ abs}$ [bar][4)]	State[8)]
B	Working port (high-pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/4 in M14 × 2; 19 deep	350	O
S	Suction port (high-pressure series)	SAE J518[5)] DIN 13	2 1/2 in M12 × 1.75; 17 deep	10	O
L	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 16 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	1 1/16-12UNF-2B; 16 deep	2	X[7)]

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) For notes on tightening torques, see the instruction manual.
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink can be deeper than as specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
8) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

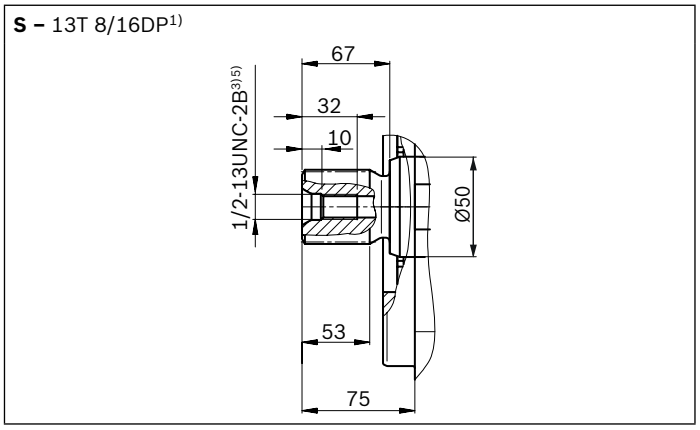
Dimensions A10VZO size 180

EZ3/4 – Two-point control electric, port plate 22U, clockwise rotation



▼ **Splined shaft 1 3/4 in SAE J744**

S – 13T 8/16DP[1)]



Connection table **A10VZO**

Ports		Standard	Size[3)]	$p_{max\ abs}$ [bar][4)]	State[8)]
B	Working port (high-pressure series) Fastening thread	SAE J518[5)] DIN 13	1 1/4 in M14 × 2; 19 deep	350	O
S	Suction port (high-pressure series)	SAE J518[5)] DIN 13	2 1/2 in M12 × 1.75; 17 deep	10	O
L	Drain port	ISO 11926[6)]	1 5/16-12UNF-2B; 15 deep	2	O[7)]
L_1	Drain port	ISO 11926[6)]	1 5/16-12UNF-2B; 15 deep	2	X[7)]
M_B	Measuring port, high pressure	DIN 3852-2[6)]	G 1/4 in; 12 deep	350	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For notes on tightening torques, see the instruction manual.
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Metric fastening thread is a deviation from standard.
6) The countersink can be deeper than as specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (also see installation instructions starting on page 103).
8) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)