

Axial piston units

A10FZO, A10VZO and A10FZG, A10VZG

Series 10

for variable-speed drives

RE 91485

Edition: 10.2016

Replaces: 06.2011



- For variable-speed operation with synchronous and asynchronous motors
- Sizes 3 to 180
- Nominal pressure/maximum pressure see technical data
- Open and closed circuits

Features

- Variable and fixed pumps with axial piston rotary group in swashplate design for hydrostatic drives in open and closed circuits.
- Suitable for start/stop operation
- Suitable for long pressure holding operation
- Proven A10 rotary group technology
- Through drive option
- High efficiency
- For use in one-, two- and four-quadrant operation

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Function and layout of variable-speed drives

Rexroth has further developed the proven axial piston units from the A10 product family for use in energy-efficient variable-speed drives and optimized the interplay between the electric motor and the pump. The especially robust units are employed for small to medium sizes and satisfy individual requirements with their numerous combination options.

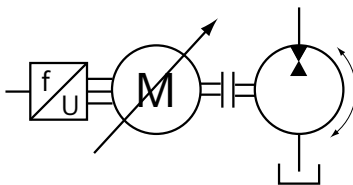
Variable-speed pump drives featuring Rexroth technology reduce energy consumption in industrial applications, while also reducing noise emissions. At the same time, the familiar performance is retained or even improved. The extensive spectrum of different variable-speed pump drives from Rexroth includes ready-to-use solutions that are finely scalable in both function and power. The energy-efficient hydraulic drive can be realized with internal gear pumps, fixed or variable axial piston units. Equipped with a suitable controller, exactly the required flow and pressure are provided which are needed at the machine.

The proven axial piston units have been developed further for use in speed-controlled drives.

These are approved for start/stop operation and designed for a changing direction of rotation. Even at the lowest speeds, between 0 and 200 rpm, they provide a constant pressure and are characterized by very high efficiency in pressure holding operation. Efficiency is achieved optimized by either a fixed or variable displacement, depending on the requirements of the cycle. The A10 units can be used as pumps and as motors in one-, two- or four-quadrant operation.

For the implementation of variable-speed drives, the new axial piston units offer numerous options for combination. The axial piston fixed displacement units A10FZO and A10FZG cover the sizes 3 to 63 cm³. The axial piston variable displacement units are available in the sizes 3 to 180 cm³ (A10VZO) and 3 to 63 cm³ (A10VZG). Equipped with a torque controller and 2-point control, they allow for a smaller dimensioning of the electric drive. The numerous combination options allow a wide range of different customized system requirements to be satisfied.

A10FZO



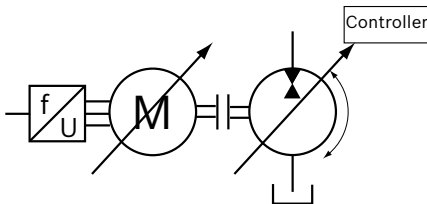
Axial piston fixed displacement units in open circuit with changing direction of rotation and unchanging pressure side (depends on the principal direction of rotation of the pump).

one- or two-quadrant operation

For type codes, see page 6

For technical data, see page 10 and 11

A10VZO



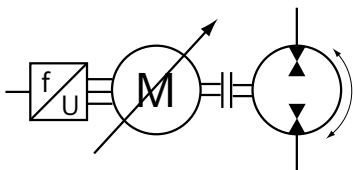
Axial piston variable displacement units in open circuit with changing direction of rotation and unchanging pressure side (depends on the principal direction of rotation of the pump).

one- or two-quadrant operation

For type codes, see page 24 and 25

For technical data, see page 31

A10FZG



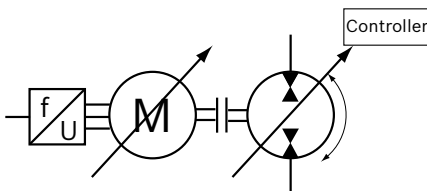
Axial piston fixed displacement unit in closed circuit with changing direction of rotation and two pressure sides.

One-, two- and four-quadrant operation

For type codes, see page 62

For technical data, see page 66 and 67

A10VZG



Axial piston variable displacement unit in closed circuit with changing direction of rotation and two pressure sides.

One-, two- and four-quadrant operation

For type codes, see page 78

For technical data, see page 82

Hydraulic fluids

The fixed displacement units A10FZO and A10FZG and variable displacement units A10VZO and VZG are designed for operation with HLP mineral oil according to DIN 51524. Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons

Notes on selection of hydraulic fluid

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see selection diagram).

Note

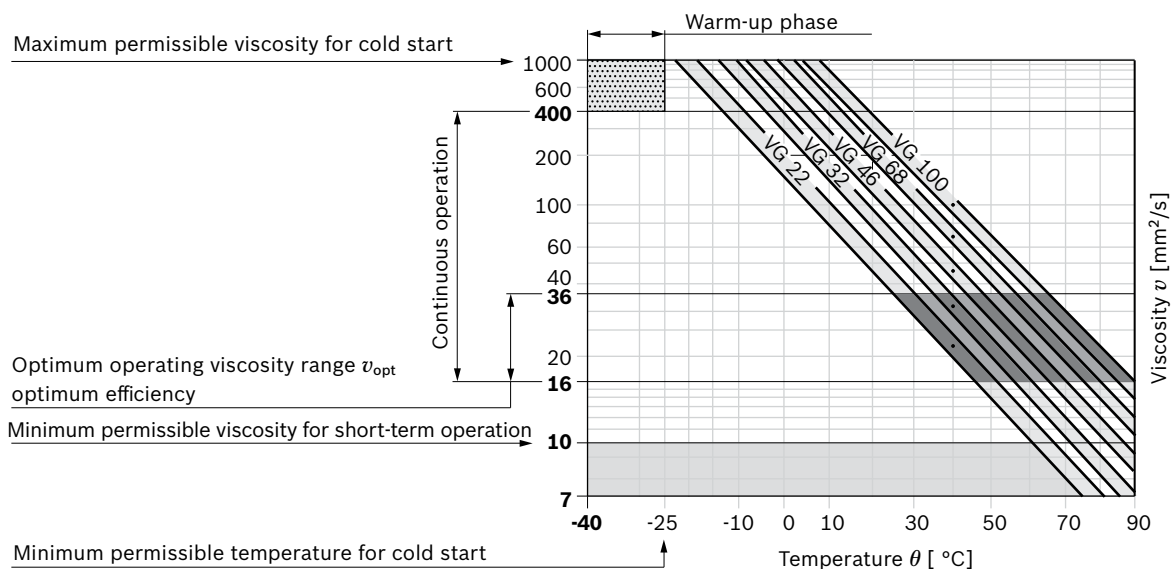
At no point of the component may the temperature be higher than 90 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, please contact the responsible member of staff at Bosch Rexroth.

Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	$\nu_{\text{max}} \leq 1000 \text{ mm}^2/\text{s}$	$\theta_{\text{St}} \geq -25 \text{ °C}$	$t \leq 3 \text{ min}$, without load ($p \leq 30 \text{ bar}$), $n \leq 1000 \text{ rpm}$
	Permissible temperature difference	$\Delta T \leq 13 \text{ K}$	between axial piston unit and hydraulic fluid
Warm-up phase	$\nu < 1000 \text{ to } 400 \text{ mm}^2/\text{s}$	$\theta = \leq -25 \text{ °C}$	Note the detailed information on operation with low temperatures, see data sheet 90300-03-B.
Continuous operation	$\nu = 400 \text{ to } 16 \text{ mm}^2/\text{s}$		This corresponds, for example on the VG 46, to a temperature range of +5 °C to +70 °C (see selection diagram page 3)
		$\theta = -25 \text{ °C to } +85 \text{ °C}$	measured at port L Observe the permissible temperature range of the shaft seal ($\Delta T = \text{approx. } 5 \text{ K}$ between the bearing/shaft seal and port L)
	$\nu_{\text{opt}} = 36 \text{ to } 16 \text{ mm}^2/\text{s}$		Range of optimum operating viscosity and efficiency
Short-term operation	$\nu_{\text{min}} 10 \text{ to } 16 \text{ mm}^2/\text{s}$		$t < 3 \text{ min}$, $p < 0.3 \cdot p_{\text{nom}}$

▼ Selection diagram



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.

Axial piston fixed displacement unit A10FZO



- ▶ For variable-speed operation with synchronous and asynchronous motors
- ▶ Sizes 3 to 63
- ▶ Nominal pressure/maximum pressure 315/350 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 A10FZO units can be used as pumps in one- and two-quadrant operation.

Type code A10FZO

01	02	03	04	05	06	07	08	09	10	11
A10F	Z	O		/	10	-	V	C	02	

Axial piston unit

01	Swashplate design, fixed, nominal pressure 315 bar, maximum pressure 350 bar	A10F
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Application area

02	Variable-speed drives	Z
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Operating mode

03	Pump, open circuit	O
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Size (NG) Geometric displacement, see table of values on page 10 and 11

04		010	018	028	045	063
	Other available intermediate sizes	003, 006, 008	012, 014, 016	021, 022, 023, 025, 026, 027	032, 035, 037, 039, 040, 042	051, 058

Series

05	Series 1, index 0	10
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Direction of rotation

06	Viewed on drive shaft ¹⁾	clockwise	R
		counter-clockwise	L

Sealing material

07	FKM (fluoroelastomer)	V
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Drive shaft

08	Splined shaft	Standard shaft	●	-	-	-	-	S
	ANSI B92.1a	similar to shaft "S" however for higher torque	-	●	●	●	●	R

Mounting flange

09	ISO 3019-1 (SAE)	C
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Working port

10	SAE flange ports A and B , opposite sides, metric fastening thread	02
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Through drive (for mounting options, see page 100)

11	Flange ISO 3019-1	Hub for splined shaft ²⁾		010	018	028	045	063	
	Diameter	Mounting ³⁾	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
		⌀, ∞	1 1/4 in 14T 12/24DP	-	-	-	-	●	K06

● = Available ○ = On request - = Not available

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) Changing direction of rotation permissible with the same pressure side for pressure reduction
- 2) According to ANSI B92.1a
- 3) Mounting holes pattern viewed on through drive with control at top

Preferred program A10FZO

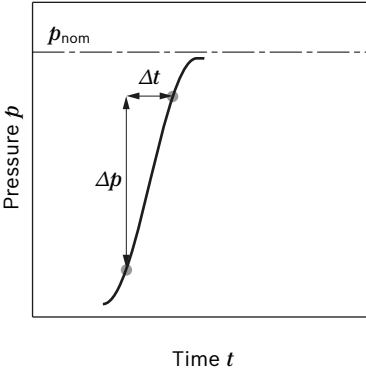
Overview of common configurations

Type	Material number
A A10FZO003/10R-VSC02N00	R902546689
A A10FZO006/10R-VSC02N00	R902544386
A A10FZO008/10R-VSC02N00	R902518485
A A10FZO010/10R-VSC02N00	R902518486
A A10FZO012/10R-VRC02N00	R902551828
A A10FZO014/10R-VRC02N00	R902544053
A A10FZO016/10R-VRC02N00	R902544054
A A10FZO018/10R-VRC02N00	R902544056
A A10FZO021/10R-VRC02N00	R902550355
A A10FZO022/10R-VRC02N00	R902557864
A A10FZO023/10R-VRC02N00	R902557865
A A10FZO025/10R-VRC02N00	R902557866
A A10FZO026/10R-VRC02N00	R902557867
A A10FZO027/10R-VRC02N00	R902557868
A A10FZO028/10R-VRC02N00	R902534669
A A10FZO032/10R-VRC02N00	R902557869
A A10FZO035/10R-VRC02N00	R902557870
A A10FZO037/10R-VRC02N00	R902557871
A A10FZO039/10R-VRC02N00	R902557872
A A10FZO040/10R-VRC02N00	R902557873
A A10FZO042/10R-VRC02N00	R902557875
A A10FZO045/10R-VRC02N00	R902548015
A A10FZO051/10R-VRC02N00	R902557876
A A10FZO058/10R-VRC02N00	R902557877
A A10FZO063/10R-VRC02N00	R902550737

Working pressure range A10FZO

Pressure at working port (see table)			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	2.0 ms		
Total operating period	300 h		
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 (see table)			
Minimum pressure p_{min}	Standard	0.8 bar absolute	Minimum pressure at suction port (see table) which is required in order 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_{max}		10 bar absolute	
Case pressure at port L			
Maximum pressure $p_{L\ max}$	2 bar absolute ²⁾		Maximum 0.5 bar higher than inlet pressure at suction port (see table), but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

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



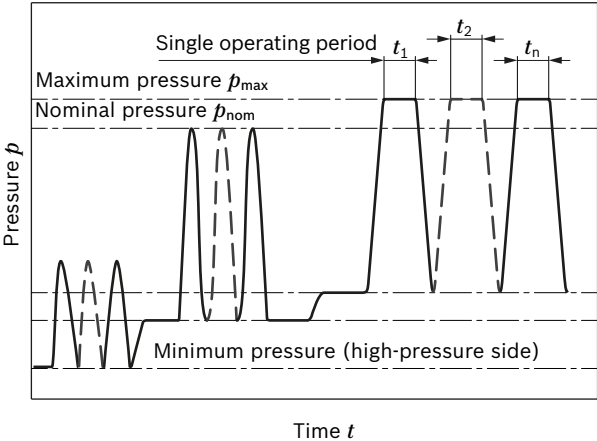
Notice

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

Denomination working port for direction of rotation.....

Direction of rotation, viewed on drive shaft	Suction port	Working port
Type code “R”	A	B
Type code “L”	B	A

▼ Pressure definition



Flow direction

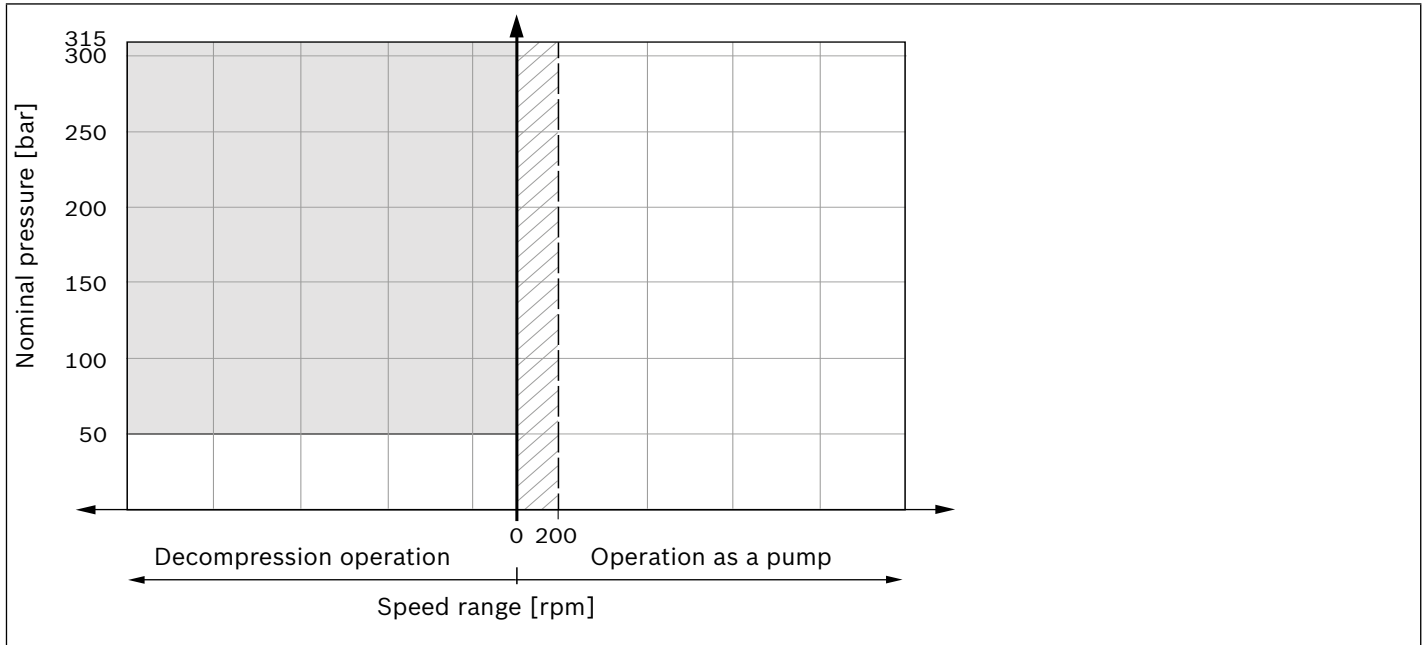
Direction of rotation, viewed on drive shaft	Direction of rotation	Flow
Type code “R”	Clockwise	A to B
	Counterclockwise ¹⁾	B to A
Type code “L”	Counterclockwise	B to A
	Clockwise ¹⁾	A to B

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

1) Only permissible in decompression operation, a pressure side switch is not permitted

2) Higher values on request

A10FZO: Permissible operating data and operating ranges at $V_{g \max}$



Operating range

- ☐ Operation without restriction
- ☒ Permissible with single operating period $t \leq 3$ min;
maximum cycle share 80%.
For longer time periods $t > 3$ min, please use A10VZO.
- ☐ Operation as a motor possible with restrictions, please contact us.
Permissible for short-term decompression operation $t \leq 200$ ms

Technical data A10FZO size 3 to 63

Superordinate size		NG	10				18				28			
Available intermediate sizes		NG	3	6	8	10	12	14	16	18	21	22	23	25
Displacement, geometric, per revolution		$V_{g \max}$ cm ³	3	6	8.1	10.6	12	14	16	18	21	22	23	25
Rotational speed at $V_{g \max}$ maximum ¹⁾														
Suction speed operation as a pump ¹⁾		n_{nom} rpm			3600				3300				3000	
Max. speed decompression operation ²⁾		n_{nom} rpm			3600				3300				3000	
Flow	at n_{nom} and $V_{g \max}$	q_v l/min	10.8	21.6	29	38.2	39.6	46.2	52.8	59.4	63	66	69	75
Power pump operation	at n_{nom} , $V_{g \max}$ and $\Delta p = 315$ bar	P kW	5.6	11.3	15.3	20	21	24.2	27.7	31.2	33	34	36.3	39
Torque	at $V_{g \max}$ and $\Delta p = 315$ bar	T Nm	15	30	40.5	53	60.2	70.2	80.2	90.3	105	110	116	125
	at $V_{g \max}$ and $\Delta p = 100$ bar	T Nm	5	9.5	12.7	16.8	19.1	22.3	25.5	28.7	33.4	35	36.6	40
Rotary stiffness of drive shaft	S	c Nm/rad			9200				–				–	
	R	c Nm/rad			–				14800				26300	
Moment of inertia for rotary group		J_{TW} kgm ²			0.0006				0.0009				0.0017	
Maximum angular acceleration ²⁾³⁾		α rad/s ²			14000				12600				11200	
Case volume		V l			0.11				0.19				0.6	
Weight (approx.)		m kg			9				10				15.5	

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

1) The values are applicable:
 – At absolute pressure $p_{abs} = 1$ bar at suction port
 – For the optimal viscosity range of $\nu_{opt} = 36$ to 16 mm²/s
 – For hydraulic fluid based on mineral oils

2) Higher values on request

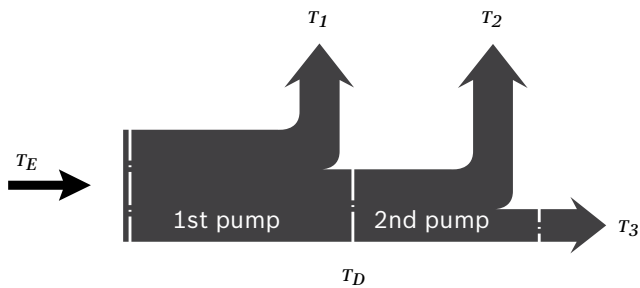
3) The limit value is only valid for a single pump, multiple pump version available on request. The load capacity of the connecting parts must be considered.

			45							63		
26	27	28	32	35	37	39	40	42	45	51	58	63
26	27	28	32	35	37	39	40	42	45	51	58	63
3000			3000							2600		
3000			3000							2600		
78	81	84	96	105	111	117	120	126	135	133	151	164
41	42	44	50	55	58.3	61	63	66	71	70	79	86
130.4	135	140.4	160	175	185.6	195	200	210	225.7	256	291	316
41.4	43	44.6	51	56	59	62	64	67	71.6	81	92	100
–			–							–		
26300			41000							69400		
0.0017			0.003							0.0056		
11200			9500							8000		
0.6			0.7							0.8		
15.5			21							26		

Permissible input and through-drive torques

Size			3	6	8	10	12	14	16	18	21	23	26	28	37	45	58	63
Torque at $V_{g\max}$ and $\Delta p = 315 \text{ bar}^{1)}$	$T_{\max}$	Nm	15	30	41	53	60	70	80	90	105	116	130	140	186	226	291	316
Maximum input torque at drive shaft ²⁾	S	$T_{E\max}$	Nm	126	126	126	126	–	–	–	–	–	–	–	–	–	–	–
		$\emptyset$	in	3/4	3/4	3/4	3/4	–	–	–	–	–	–	–	–	–	–	–
	R	$T_{E\max}$	Nm	–	–	–	–	160	160	160	160	250	250	250	250	400	400	650
		$\emptyset$	in	–	–	–	–	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	1	1	1 1/4
Maximum through-drive torque	S	$T_{D\max}$	Nm	41	41	41	41	–	–	–	–	–	–	–	–	–	–	–
	R	$T_{D\max}$	Nm	–	–	–	–	92	92	92	92	127	127	127	127	292	292	480

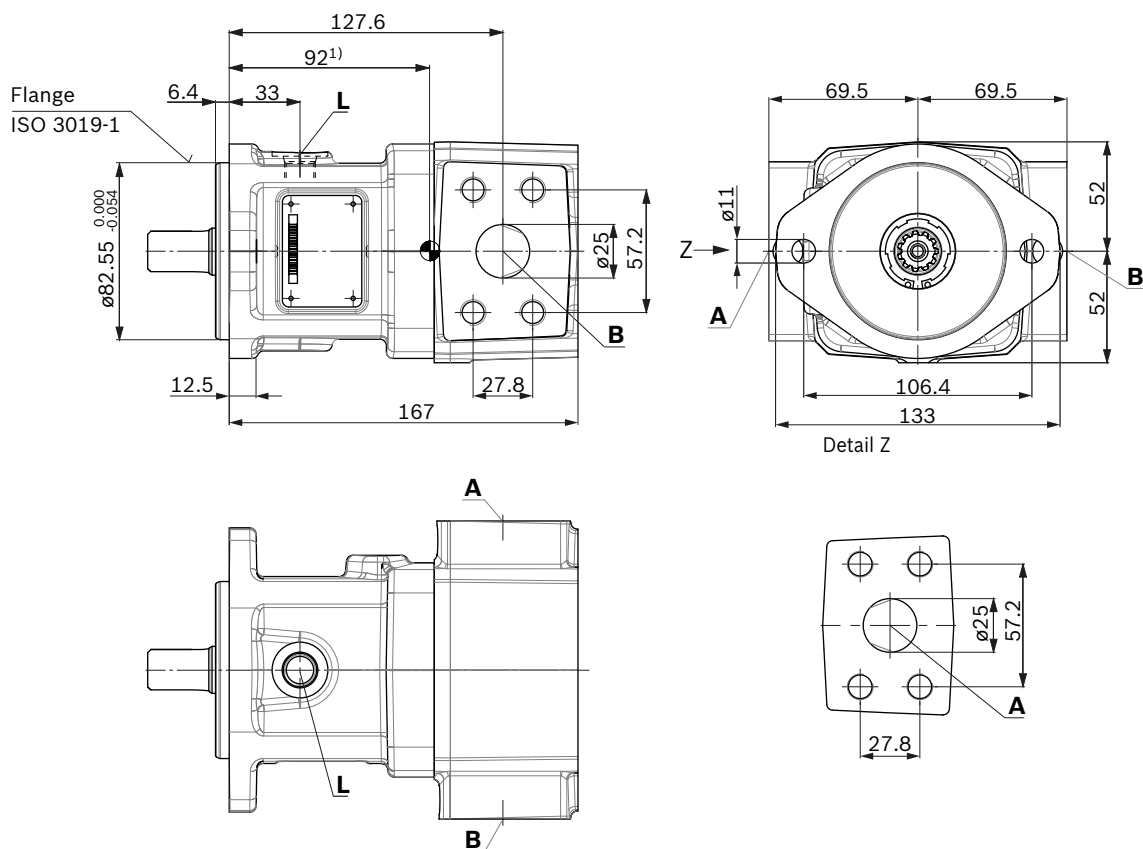
▼ Distribution of torques



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	$T_D = T_2 + T_3$
	$T_D < T_{D\max}$

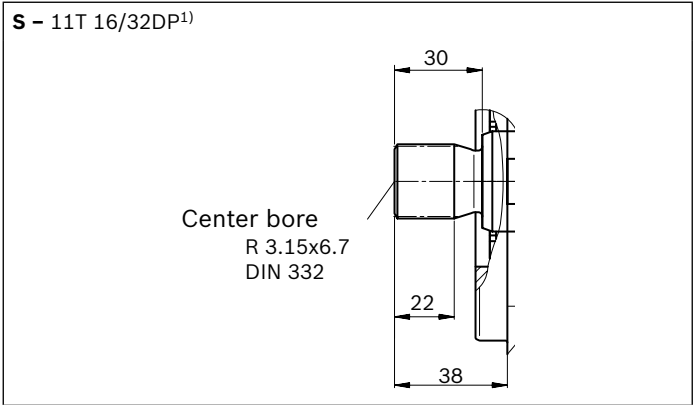
¹⁾ Efficiency not considered

²⁾ For drive shafts with no radial force

Dimensions A10FZO sizes 3 to 10**Clockwise and counterclockwise rotation (flow direction see table page 8)**

1) Center of gravity

▼ **Splined shaft 3/4 in (SAE J744)**



Connection table **A10FZO**

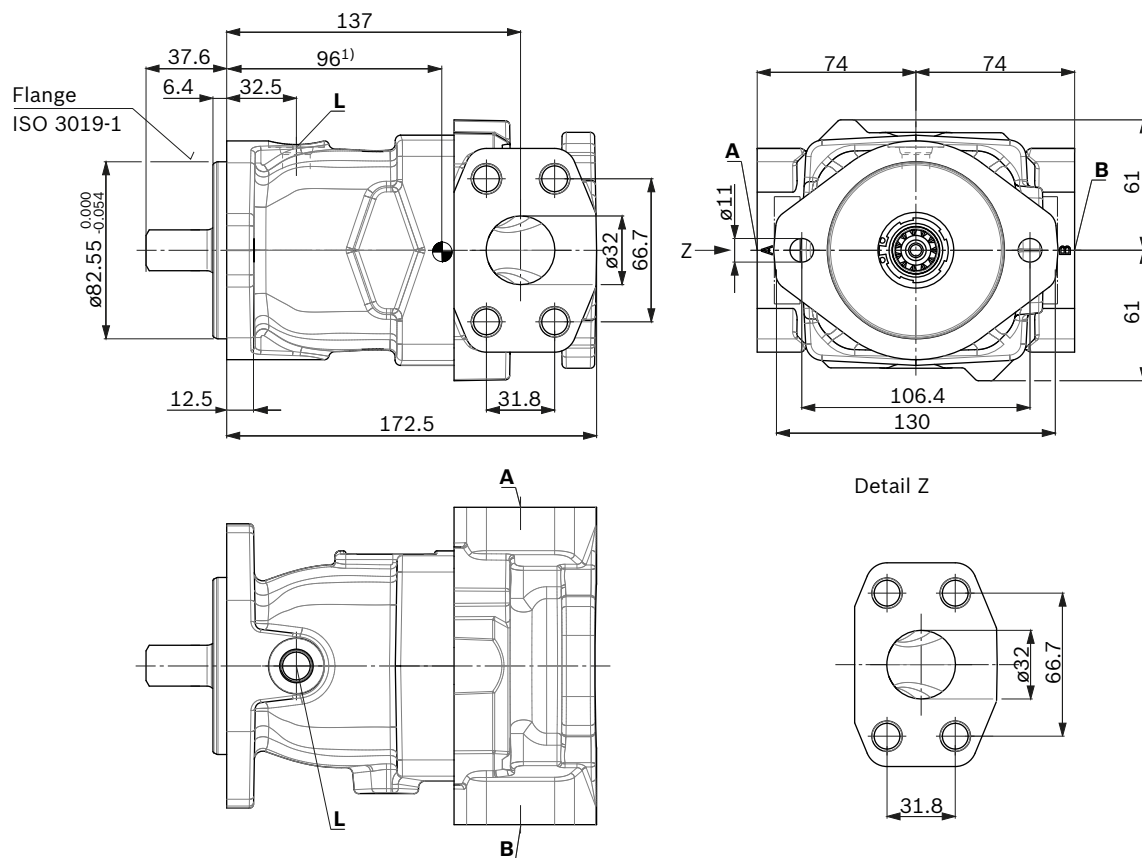
Ports	Standard	Size ²⁾	$p_{\max \text{ abs}}$ [bar] ³⁾	State ⁶⁾
Working port (high-pressure series)	SAE J518 ⁴⁾	1 in	350	O
Fastening thread	DIN 13	M12 × 1.75; 17 deep		
Suction port (high-pressure series)	SAE J518 ⁴⁾	1 in	10	O
Fastening thread	DIN 13	M12 × 1.75; 17 deep		
L Drain port	DIN 11926 ⁵⁾	9/16-18UNF-2B; 12.5 deep	2	O

Denomination working port for direction of rotation.....

Direction of rotation, viewed on drive shaft	Suction port	Working port
Type code “ R ”	A	B
Type code “ L ”	B	A

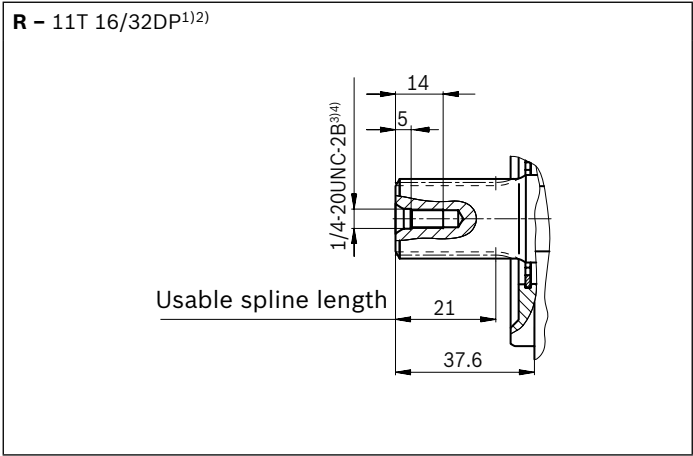
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Metric fastening thread is a deviation from standard.
5) The countersink can be deeper than as specified in the standard.
6) O = Must be connected (plugged on delivery)

Dimensions A10FZO sizes 12 to 18**Clockwise and counterclockwise rotation (flow direction see table page 8)**

1) Center of gravity

▼ Splined shaft 3/4 in SAE J744



Connection table **A10FZO**

Ports	Standard	Size ⁴⁾	$p_{\text{max abs}}$ [bar] ⁵⁾	State ⁸⁾
Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	350	O
Fastening thread	DIN 13	M14 × 2; 19 deep		
Suction port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	10	O
Fastening thread	DIN 13	M14 × 2; 19 deep		
L Drain port	DIN 11926 ⁷⁾	9/16-18UNF-2B; 12.5 deep	2	O

Denomination working port for direction of rotation.....

Direction of rotation, viewed on drive shaft	Suction port	Working port
Type code “ R ”	A	B
Type code “ L ”	B	A

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

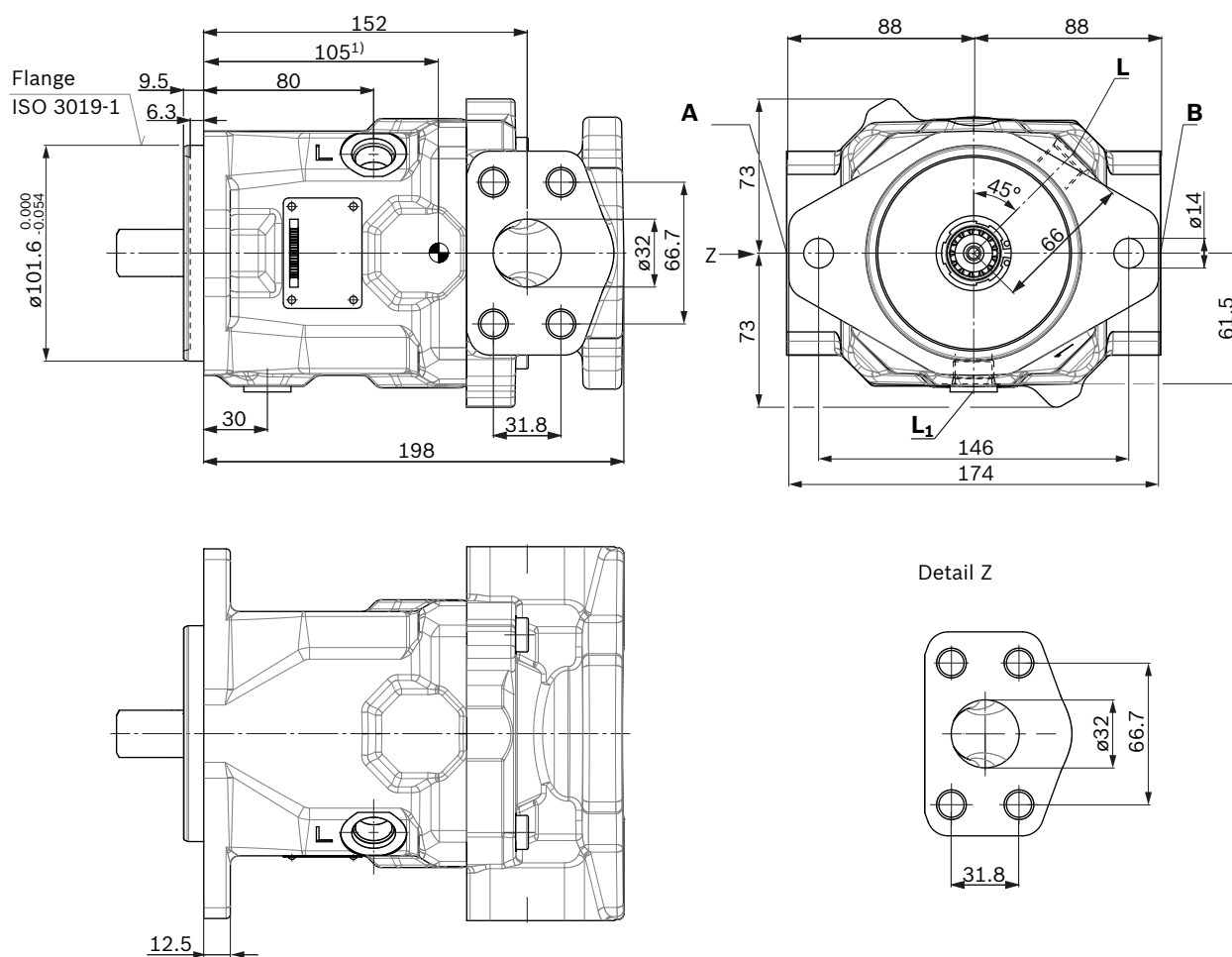
4) For notes on tightening torques, see the instruction manual.

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.

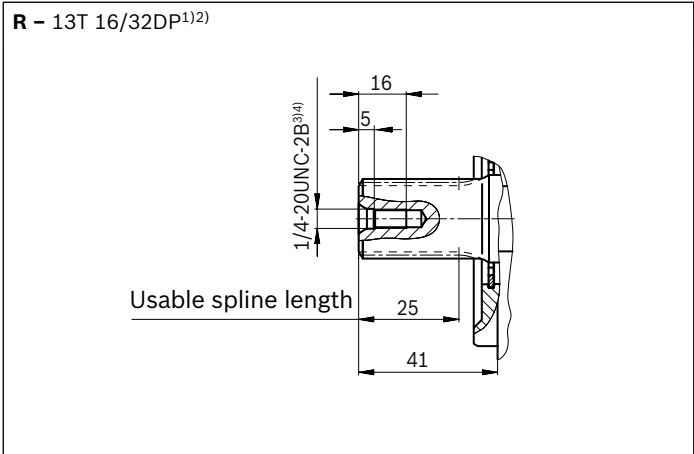
7) The countersink can be deeper than as specified in the standard.

8) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

Dimensions A10FZO sizes 21 to 28**Clockwise and counterclockwise rotation (flow direction see table page 8)**

1) Center of gravity

▼ **Splined shaft 7/8 in SAE J744**



Connection table **A10FZO**

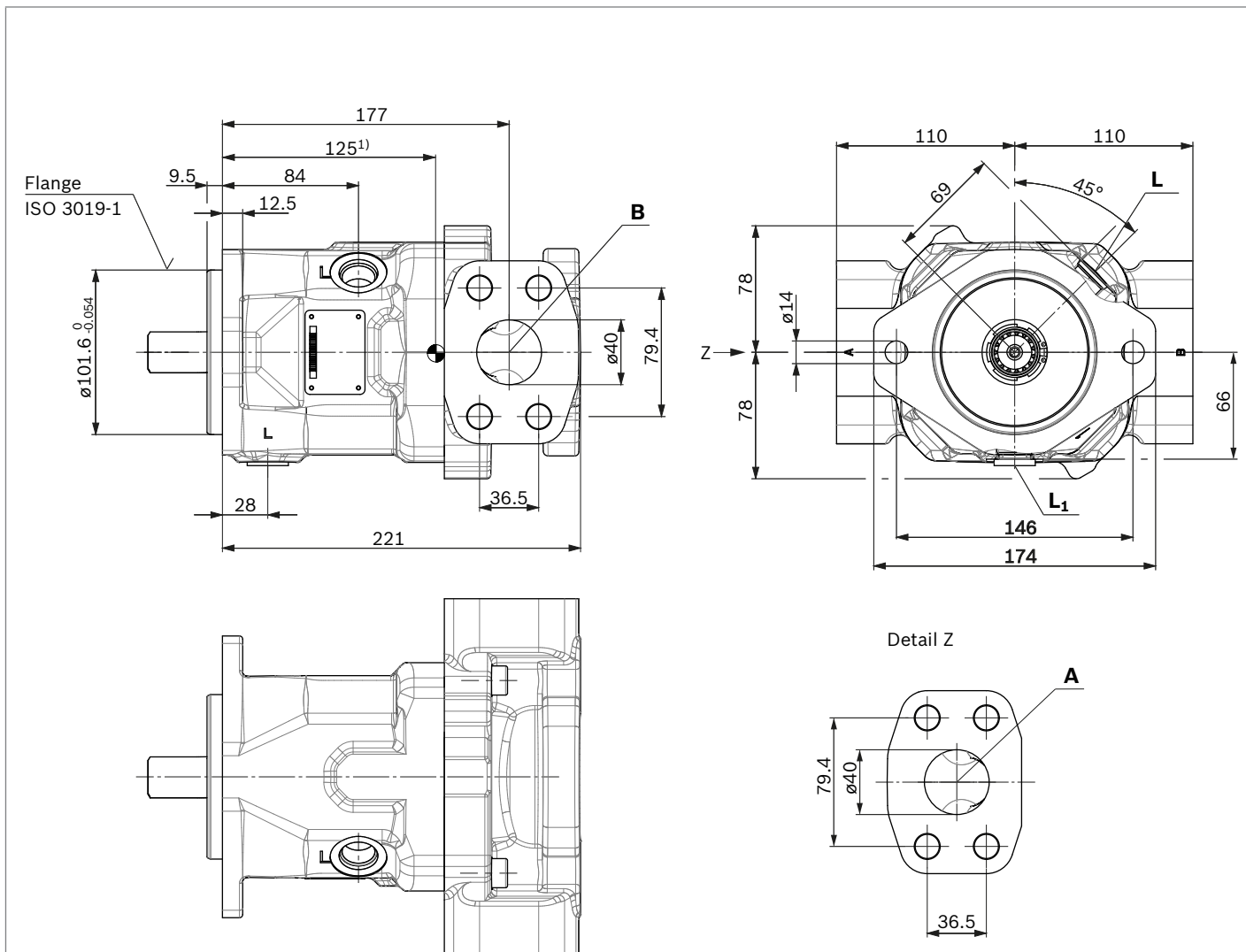
Ports	Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾
Working port (high-pressure series) Fastening thread	SAE J518 ⁶⁾ DIN 13	1 1/4 in M14 × 2; 19 deep	350	O
Suction port (high-pressure series) Fastening thread	SAE J518 ⁶⁾ DIN 13	1 1/4 in M14 × 2; 19 deep	10	O
L Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	O ⁸⁾
L₁ Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	X ⁸⁾

Denomination working port for direction of rotation.....

Direction of rotation, viewed on drive shaft	Suction port	Working port
Type code “ R ”	A	B
Type code “ L ”	B	A

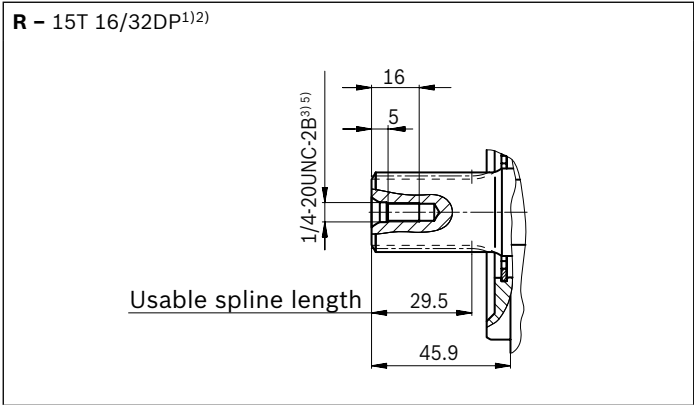
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the 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 L₁ 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 A10 FZO, sizes 37 to 45**Clockwise and counterclockwise rotation (flow direction see table page 8)**

1) Center of gravity

▼ **Splined shaft 1 in SAE J744**



Connection table **A10FZO**

Ports	Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾
Working port (high-pressure series) Fastening thread	SAE J518 ⁶⁾ DIN 13	1 1/2 in M16 × 2; 21 deep	350	O
Suction port (high-pressure series) Fastening thread	SAE J518 ⁶⁾ DIN 13	1 1/2 in M16 × 2; 21 deep	10	O
L Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 deep	2	O ⁸⁾
L₁ Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 deep	2	X ⁸⁾

Denomination working port for direction of rotation.....

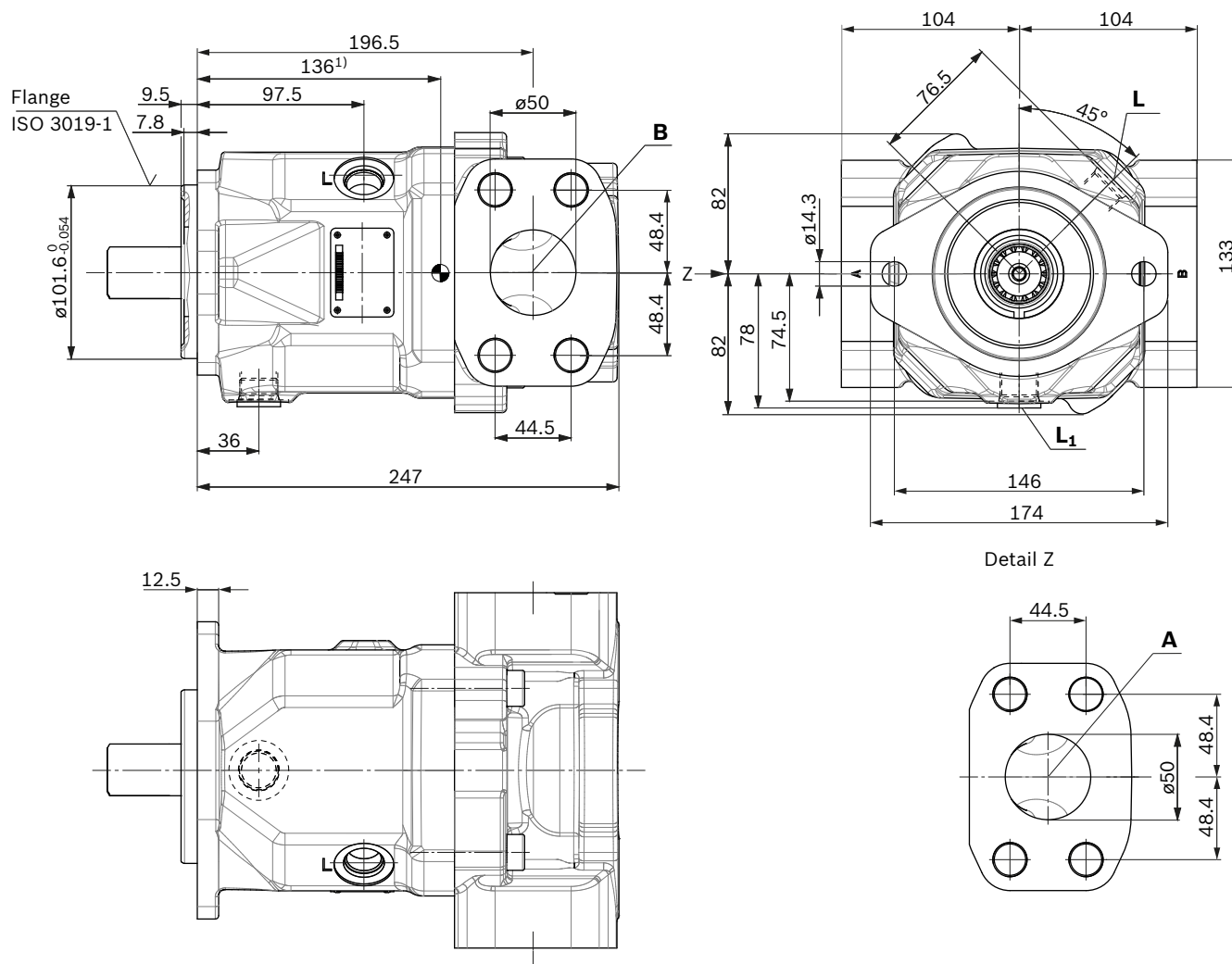
Direction of rotation, viewed on drive shaft	Working port	Suction port
Type code “ R ”	B	A
Type code “ L ”	A	B

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, L₁ or L₂ must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

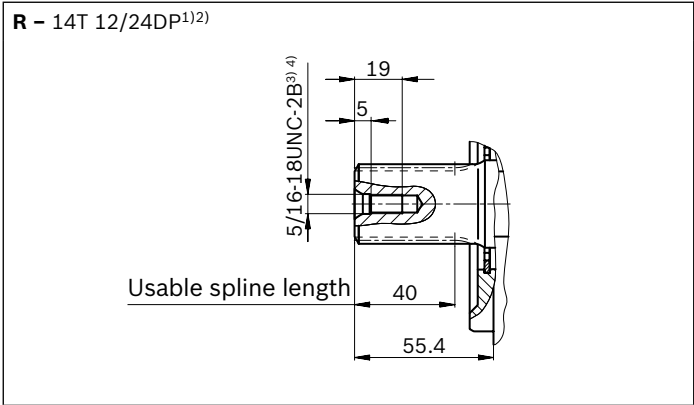
Dimensions A10 FZO size 51/58/63

Clockwise and counterclockwise rotation (flow direction see table page 8)



1) Center of gravity

▼ **Splined shaft 1 1/4 in SAE J744**



Connection table **A10FZO**

Ports	Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾	
Working port (high-pressure series)	SAE J518 ⁶⁾	2 in	350	O	
Fastening thread	DIN 13	M20 × 2.5; 24 deep			
Suction port (high-pressure series)	SAE J518 ⁶⁾	2 in	10	O	
Fastening thread	DIN 13	M20 × 2.5; 24 deep			
L	Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 deep	2	O ⁸⁾
L₁	Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 deep	2	X ⁸⁾

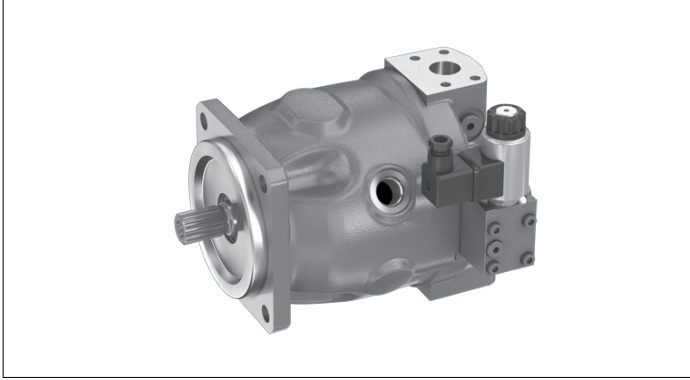
Denomination working port for direction of rotation.....

Direction of rotation, viewed on drive shaft	Working port	Suction port
Type code “ R ”	B	A
Type code “ L ”	A	B

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, L₁ or L₂ must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

Axial piston variable displacement unit A10VZO



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

- ▶ 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

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	●	●	●	●	○	○	○	○	EZ300¹⁾
			U = 24 V	●	●	●	●	○	○	○	○	EZ400¹⁾
		hydraulic		●	●	●	●	○	○	○	○	DG000¹⁾
	Pressure controller	hydraulic		●	●	●	●	○	○	○	○	DR000
		remote controlled hydraulically		●	●	●	●	○	○	○	○	DRG00
	Torque controller Beginning of control	Size 018 to 180										
			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
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Direction of rotation²⁾

07	Viewed on drive shaft	clockwise	R
		counter-clockwise	L

Sealing material

08	FKM (fluoroelastomer)	V
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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 port³⁾

		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	-	-	-	-	o	o	o	o	22U⁵⁾
	SAE flange ports at top and bottom, on opposite sides, metric fastening thread	-	•	•	•	o	o	o	-	12³⁾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	-	-	-	-	o	o	o	o	00⁴⁾⁵⁾
	Without through drive, only port plates 12 and 14	•	•	•	•	o	o	o	o	N00
Port plate 12 and 07										
Flange ISO 3019-1		Hub for splined shaft ⁶⁾								
Diameter	Mounting ⁷⁾	Diameter								
82-2 (A)	ø, ∞ 5/8 in	9T 16/32DP	•	•	•	•	-	-	-	K01
	ø, ∞ 3/4 in	11T 16/32DP	•	•	•	•	-	-	-	K52
101-2 (B)	ø, ∞ 7/8 in	13T 16/32DP	-	-	•	•	-	-	-	K68
	ø, ∞ 1 in	15T 16/32DP	-	-	-	•	-	-	-	K04
Port plate 22U										
Flange ISO 3019-1		Hub for splined shaft ⁶⁾								
Diameter		Diameter								
82-2 (A)	ø, ø, ∞ 5/8 in	9T 16/32DP	-	-	-	-	o	o	o	01
	ø, ø, ∞ 3/4 in	11T 16/32DP	-	-	-	-	o	o	o	52
101-2 (B)	ø, ø, ∞ 7/8 in	13T 16/32DP	-	-	-	-	o	o	o	68
	ø, ø, ∞ 1 in	15T 16/32DP	-	-	-	-	o	o	o	04
	1 1/4 in	14T 12/24DP	-	-	-	-	o	o	o	06
127-4 (C)	⊗ 1 in	15T 16/32DP	-	-	-	-	o	o	o	E2
	⊗ 1 1/4 in	14T 12/24DP	-	-	-	-	o	o	o	15
152-4 (D)	⊗ 1 1/2 in	17T 12/24DP	-	-	-	-	-	o	o	96
	⊗ 1 3/4 in	13T 8/16DP	-	-	-	-	-	-	o	17

Connector for solenoids

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

• = Available o = 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 $V_{g \min}$ / $V_{g \max}$

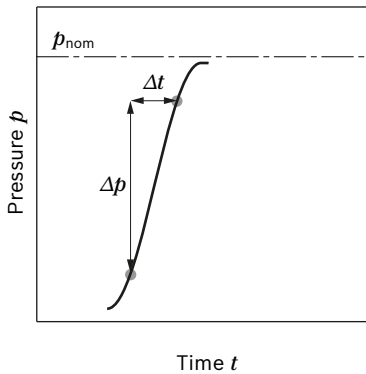
Size	$V_{g \min}$	$V_{g \max}$
3	0 to 3 cm³; 0.9 cm³/U	3 cm³
6	0 to 4 cm³; 0.9 cm³/U	6 cm³
8	0 to 4 cm³; 0.9 cm³/U	8 cm³
10	0 to 4 cm³; 0.9 cm³/U	10 cm³
18	0 to 8 cm³; 1.1 cm³/U	9 to 18 cm³; 1.1 cm³/U
28	0 to 12 cm³; 1.6 cm³/U	14 to 28 cm³; 1.6 cm³/U
45	0 to 18 cm³; 3.2 cm³/U	25 to 45 cm³; 3.2 cm³/U
71	0 to 28 cm³; 4.7 cm³/U	45 to 71 cm³; 4.7 cm³/U
100	0 to 40 cm³; 6.2 cm³/U	50 to 100 cm³; 6.2 cm³/U
140	0 to 56 cm³; 7.1 cm³/U	70 to 140 cm³; 7.1 cm³/U
180	–	–

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

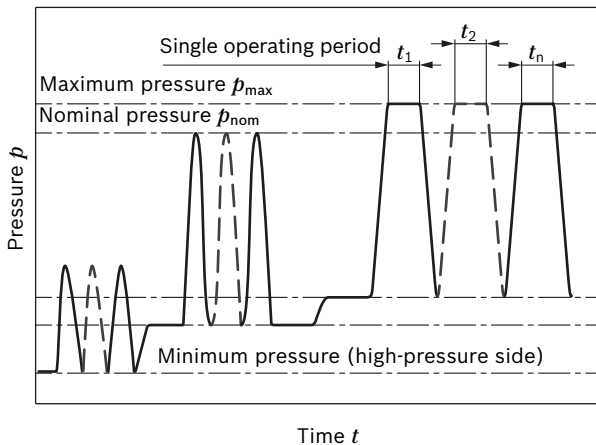
Working pressure range A10VZO – size 3 to 10

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 = $t_1 + t_2 + \dots + t_n$

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.

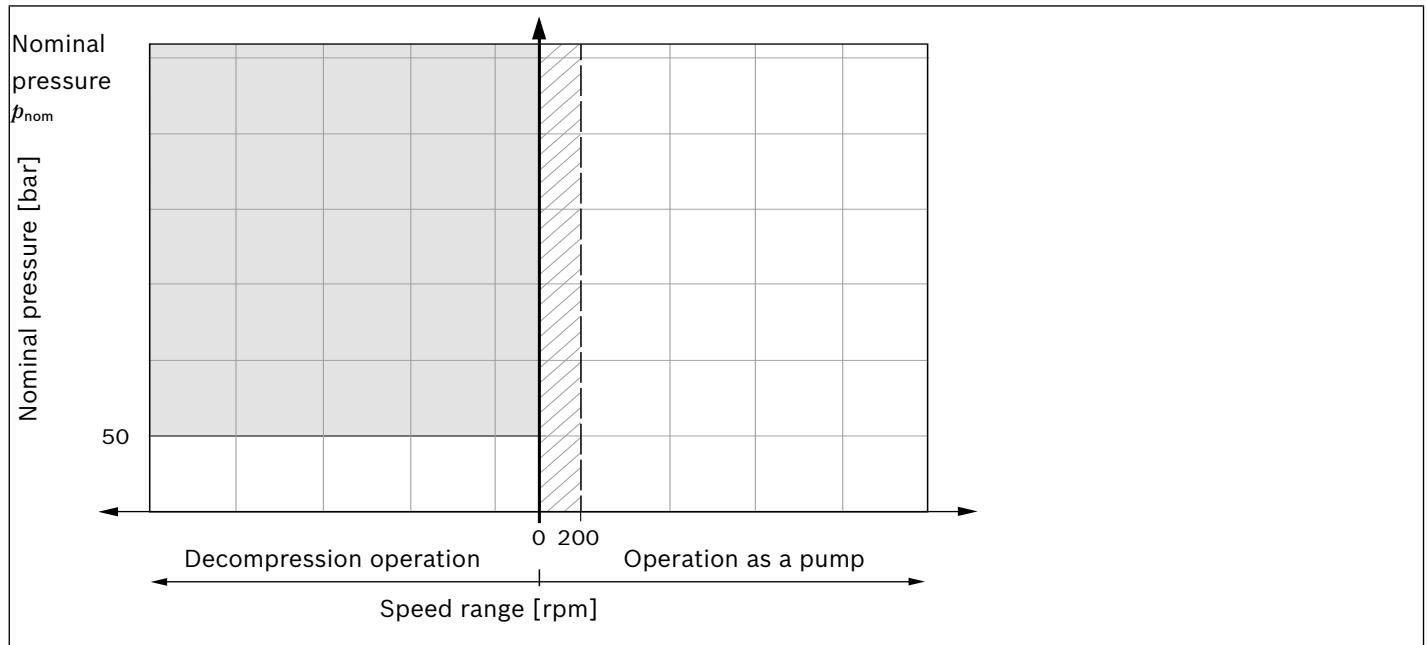
Flow direction

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 $t \leq 200\ ms$

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 at $V_{g \max}$ maximum ¹⁾									
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 and $\Delta p = 250$ bar	P	kW	5	10	15	16	–	–	–
Operation as a pump at n_{nom} , $V_{g \max}$ and $\Delta p = 315$ bar	P	kW	–	–	–	–	34	39	44
Torque at $V_{g \max}$ and $\Delta p = 250$ bar	T	Nm	14	24	32	42	–	–	–
at $V_{g \max}$ and $\Delta p = 315$ bar	T	Nm	–	–	–	–	90	140	225
at $V_{g \max}$ and $\Delta p = 100$ 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 $p_{\text{abs}} = 1$ bar at suction port **S**
 - For the optimal viscosity range of $\nu_{\text{opt}} = 36$ to $16 \text{ mm}^2/\text{s}$
 - 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		$V_{\text{g max}}$	cm ³	71.1	100	140	180
Rotational speed maximum ¹⁾	at $V_{\text{g max}}$						
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 $V_{\text{g max}}$	q_v	l/min	181	230	308	324
Power pump operation at n_{nom} , $V_{\text{g max}}$	and Δp = 280 bar	P	kW	84	107	143	151
Torque	at $V_{\text{g max}}$ and Δp = 280 bar	T	Nm	317	445	623	801
	at $V_{\text{g max}}$ 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	$= \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{\text{hm}}}$	[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 ($\eta_t = \eta_v \times \eta_{\text{hm}}$)

Notice

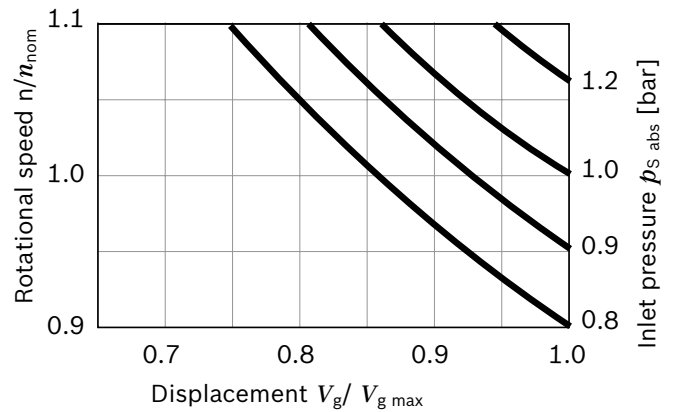
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommends testing the load by means of experiment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

For further information on speed increase, see page 33

- The values are applicable:
 - At absolute pressure $p_{\text{abs}} = 1$ bar at suction port **S**
 - For the optimal viscosity range of $\nu_{\text{opt}} = 36$ to 16 mm²/s
 - For hydraulic fluid based on mineral oils
- Higher values on request
- 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.
- 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.

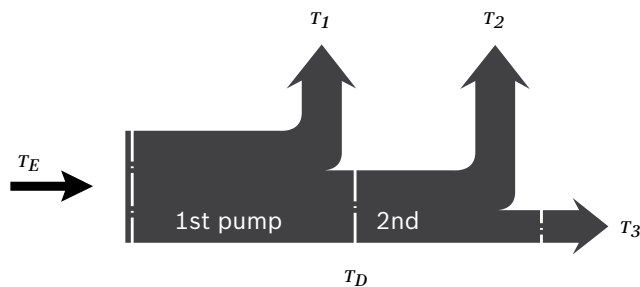


During continuous operation in overspeed over n_{nom} , a reduction in operational service life is to be expected due to cavitation erosion.

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



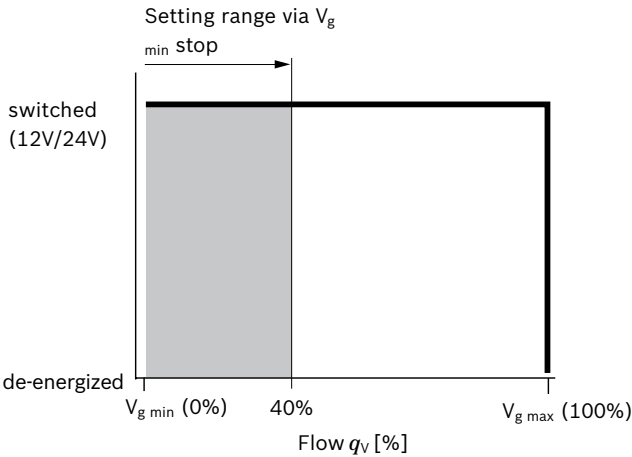
Torque at 1st pump	T_1
Torque at 2nd pump	T_2
Torque at 3rd pump	T_3
Input torque	$T_E = T_1 + T_2 + T_3$
	$T_E < T_{E max}$
Through-drive torque	$T_D = T_2 + T_3$
	$T_D < T_{D max}$

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

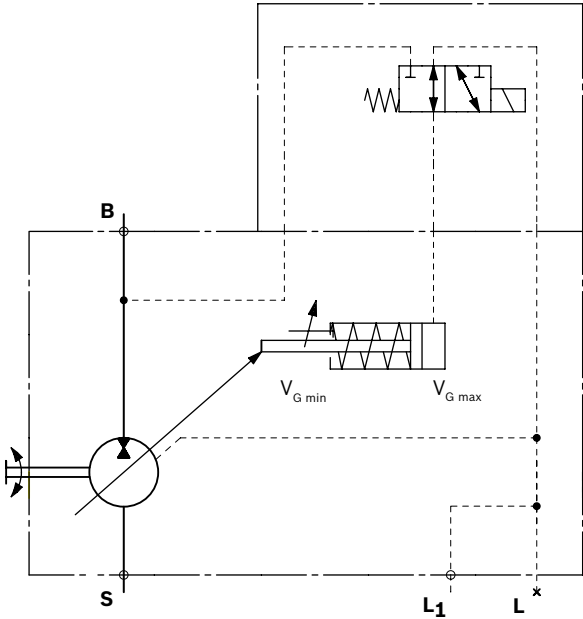


De-energized $\triangleq V_{g \max}$
 Current switch on $\triangleq V_{g \min}$

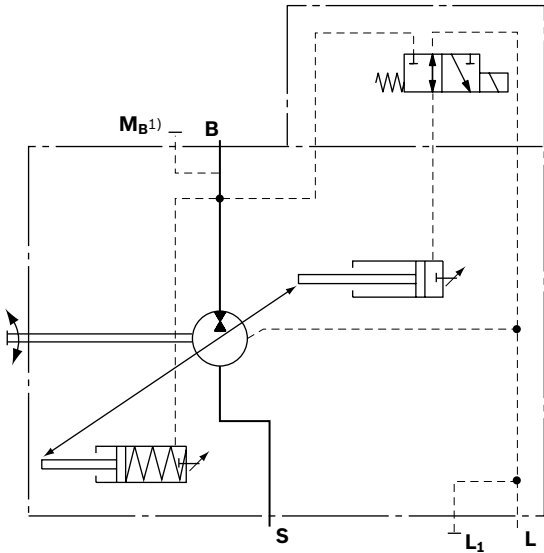
Technical data, solenoid	EZ300	EZ400
Voltage	12 V ($\pm 15\%$)	24 V ($\pm 15\%$)
Position $V_{g \max}$	de-energized	de-energized
Position $V_{g \min}$	Current switched on	Current switched on
Nominal current at 20 °C	1.5 A	0.8 A
Duty cycle	100%	100%
Type of protection: see connector version page 102		

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

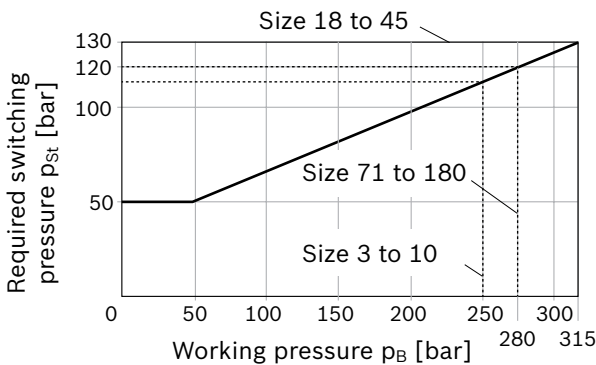
The variable pump can be set to a minimum swivel angle by connecting an external switching pressure to port **X**. This will supply control fluid directly to the stroking piston; a minimum pressure of $p_{st} \geq 50$ bar is required.

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).

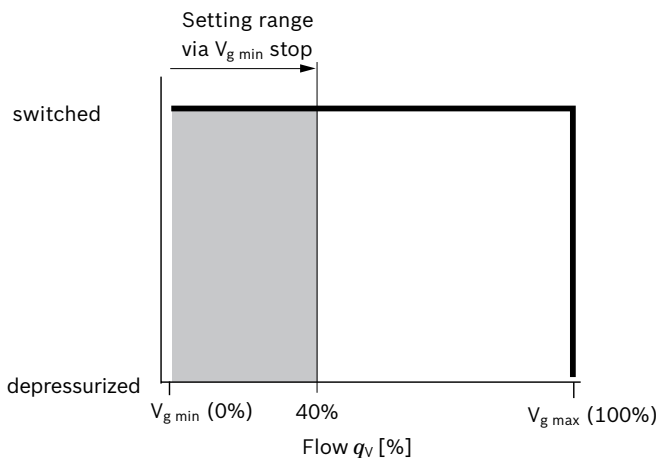
The maximum permissible switching pressure corresponds to the nominal pressure of the pump.

- ▶ Switching pressure p_{st} in $X = 0$ bar $\triangleq V_{g \max}$
- ▶ Switching pressure p_{st} in $X \geq 50$ bar $\triangleq V_{g \min}$

▼ Switching pressure characteristic curve

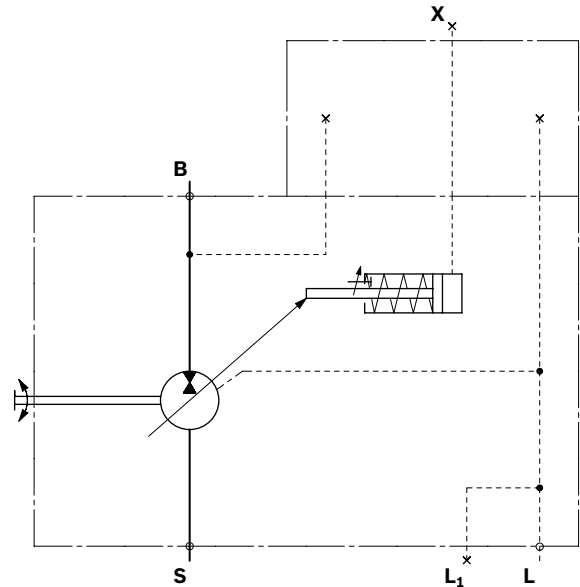


▼ Characteristic curve DG000

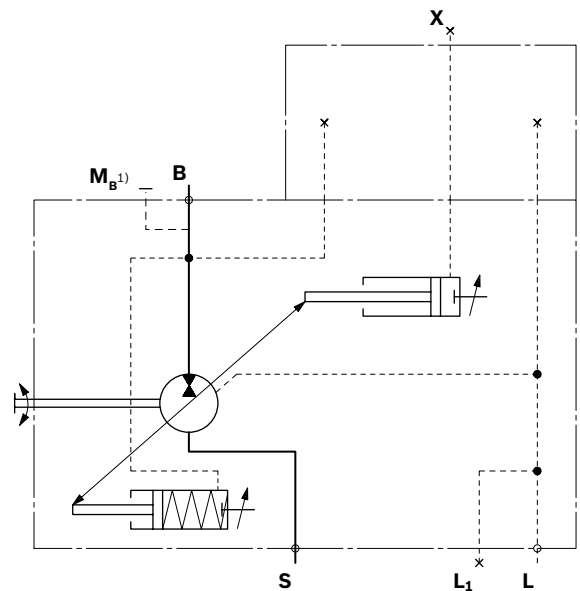


- Depressurized $\triangleq V_{g \max}$
- Pressure switch on $\triangleq V_{g \min}$

▼ Circuit diagram DG000; A10VZO sizes 3 to 10



▼ Circuit diagram DG000; A10VZO sizes 18 to 180



1) Only port plate 22

DR – Pressure controller

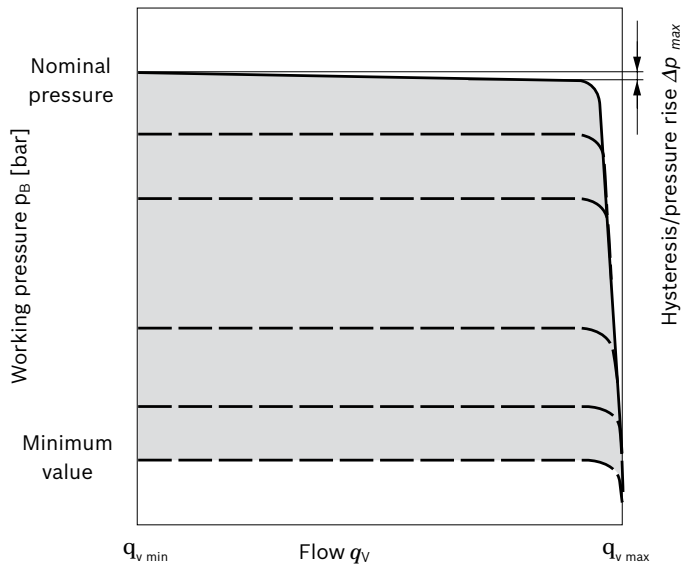
The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the working pressure exceeds the pressure command value at the pressure control valve, the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

- ▶ Initial position in depressurized state: $V_{g \max}$.
- ▶ Setting range¹⁾ 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 $\theta_{fluid} = 50$ °C.

Setting range pressure controller

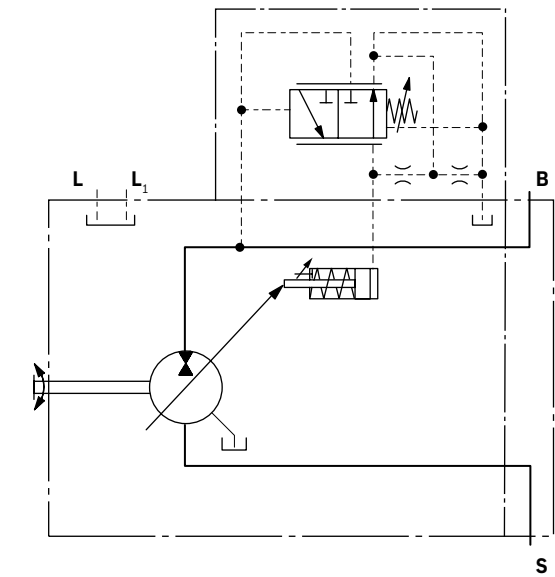
NG	10	18 to 45	71 to 180
Nominal pressure/ maximum value	250	315	280 ³⁾
Minimum value	20	60	60

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.

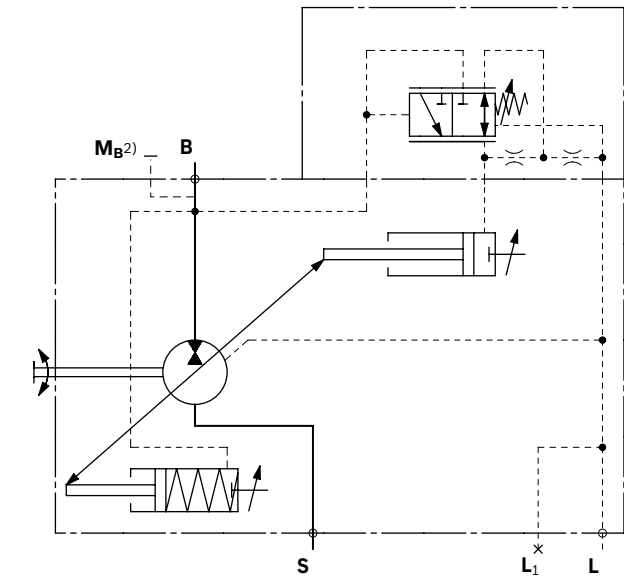
2) Only port plate 22

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 repeat-ability	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.

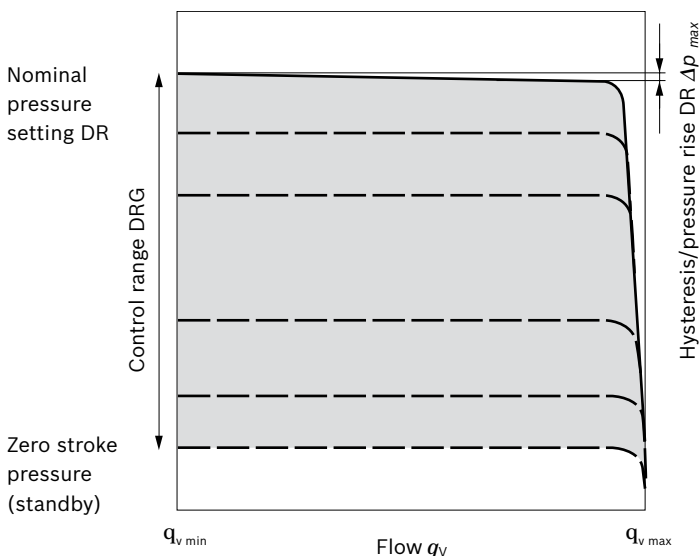
- ▶ Basic position in depressurized state: $V_{g \max}$.
- ▶ Setting range for differential pressure 10 to 22 bar standard is 20 bar.

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

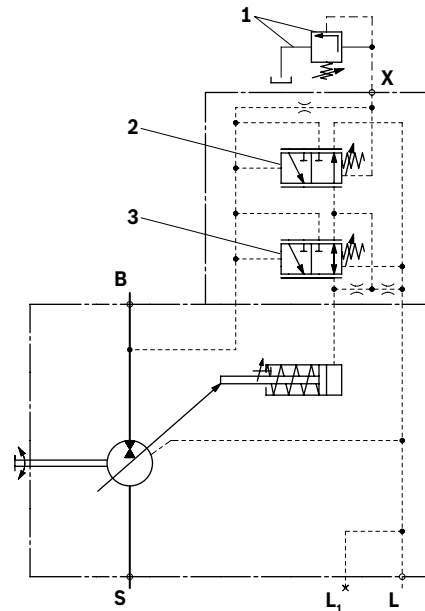
- ▶ The described function is only available in the selected direction of rotation (type code R/L). Please contact us regarding switching the direction of rotation

▼ Characteristic curve DRG



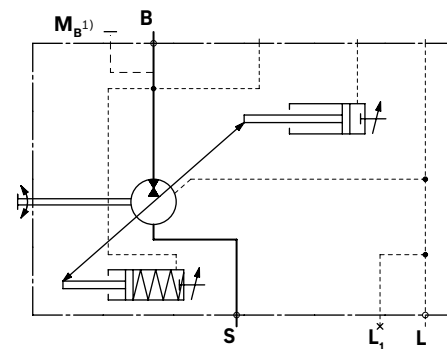
Characteristic curve valid at $n_1 = 1500$ rpm and $\theta_{\text{fluid}} = 50$ °C.

▼ 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 DRG

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							Order code
	18	28	45	71	100	140	180	
Beginning of control								
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]

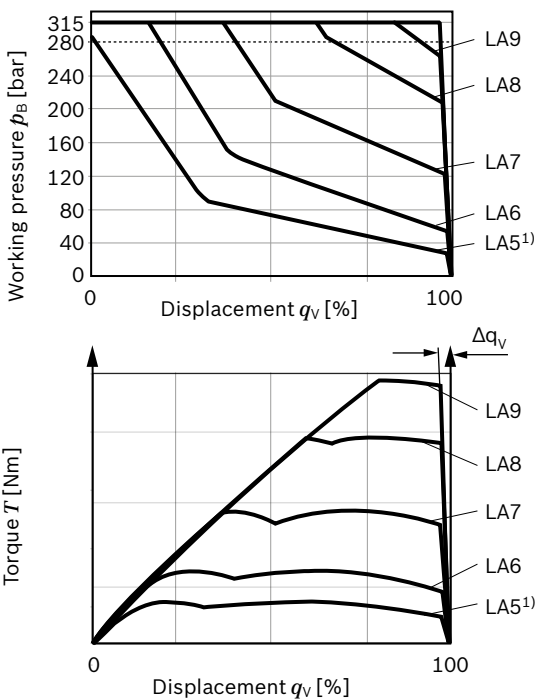
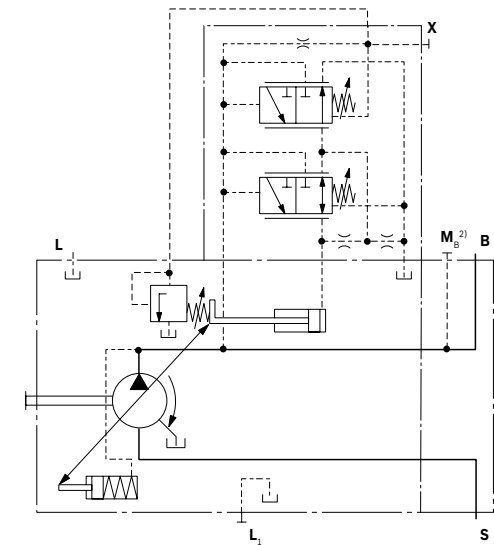
$$P = \frac{T}{6.4} \text{ [kW]} \quad (\text{at 1500 rpm})$$

or

$$P = \frac{2 \times T \times n}{60000} \text{ [kW]} \quad (\text{For rotational speeds see page 31 onwards})$$

▼ Circuit diagram LA.D

▼ Characteristic curve LA.D

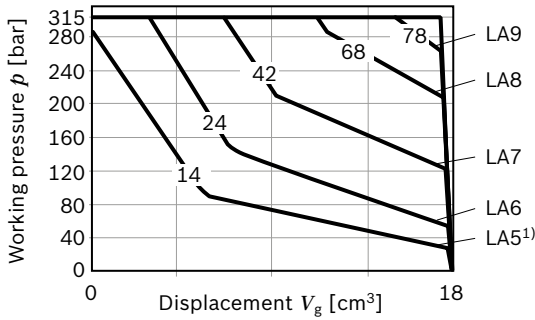


1) Please contact us.
2) Only with port plate 22

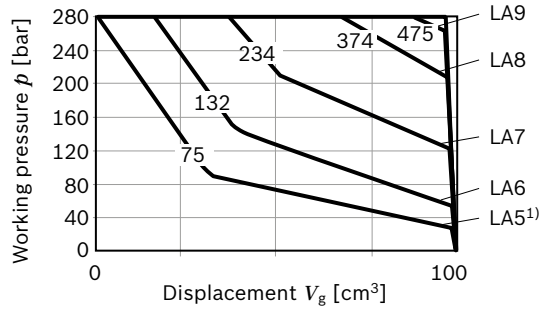
LA.D – Pressure and torque controller, characteristic curve

Torque characteristic curve in Nm

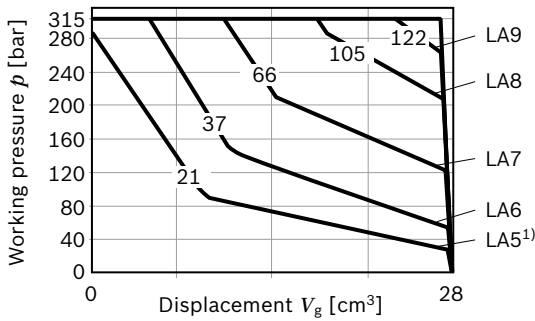
Size 18



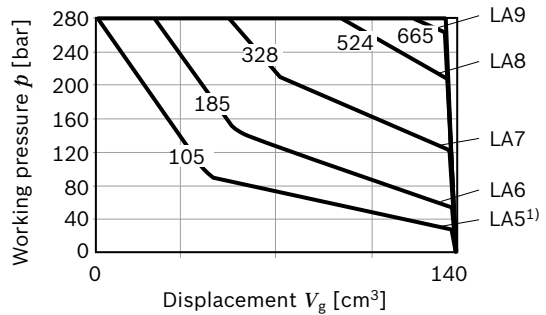
Size 100



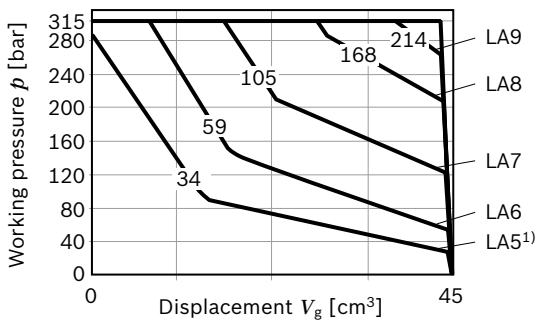
Size 28



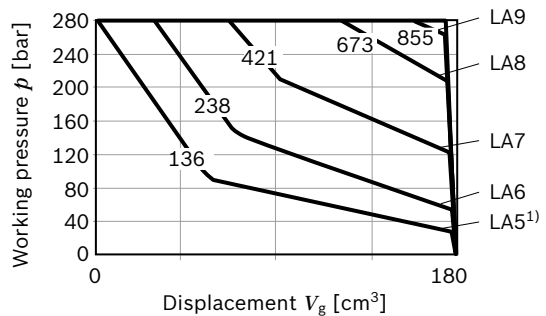
Size 140



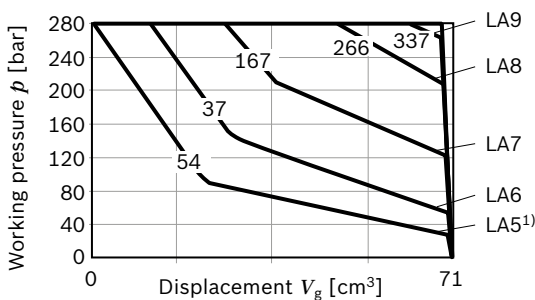
Size 45



Size 180



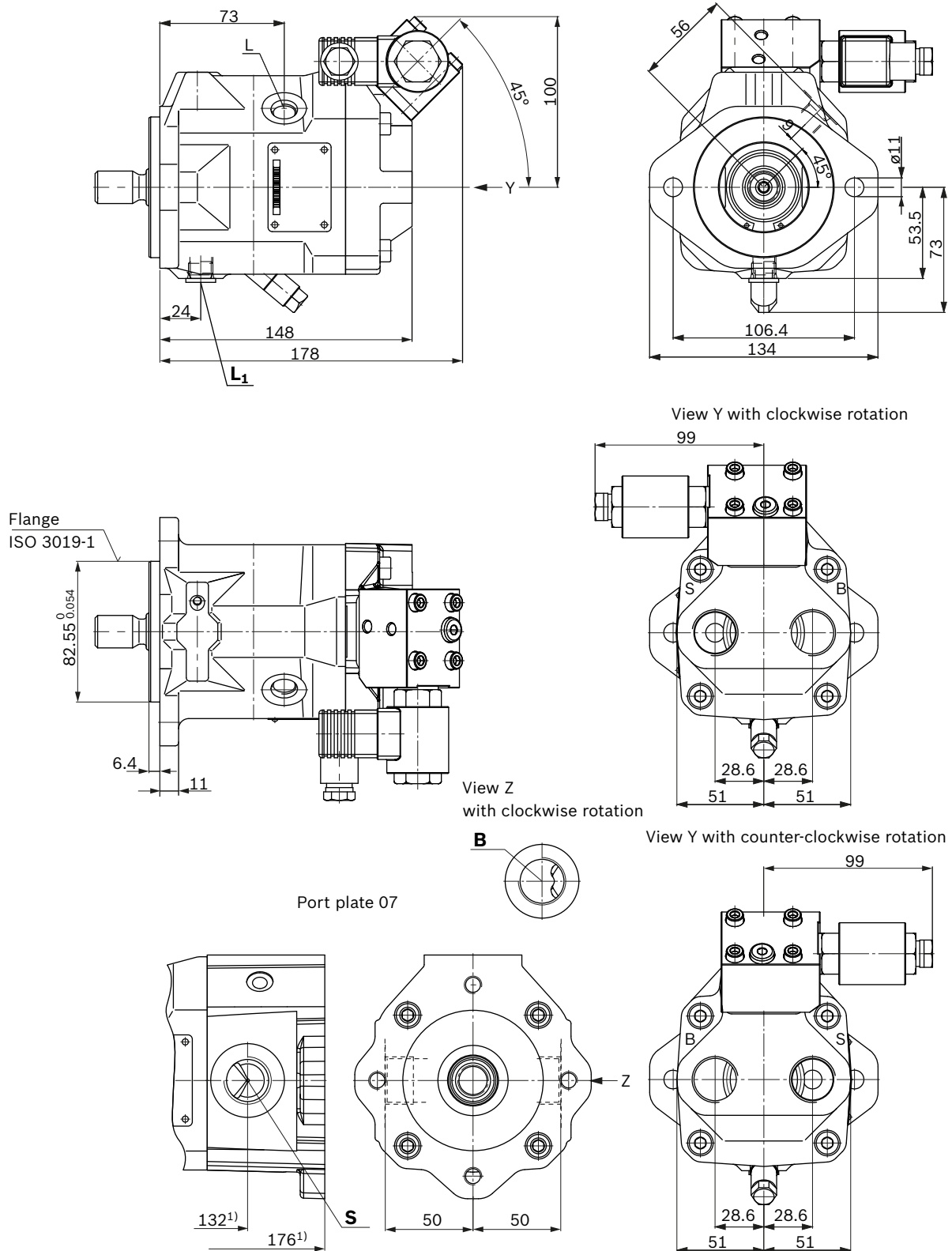
Size 71



1) Please contact us.

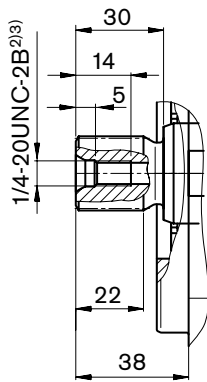
Dimensions A10VZO sizes 3 to 10

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



1) To flange surface

▼ Splined shaft 3/4 in SAE J744

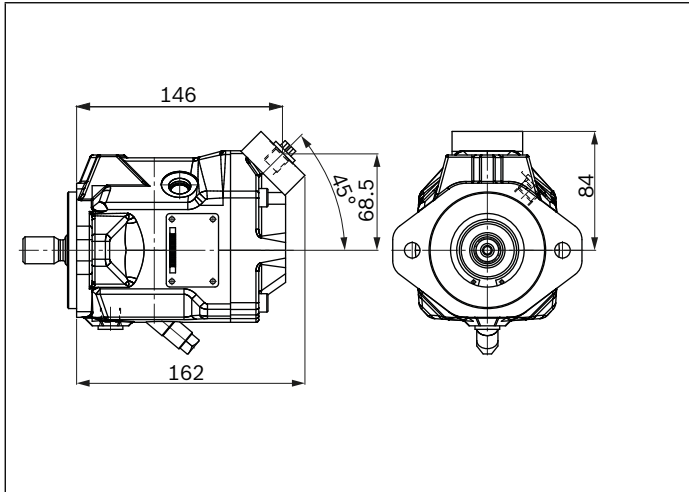
S – 11T 16/32DP¹⁾Connection table **A10VZO**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [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⁾
L₁	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

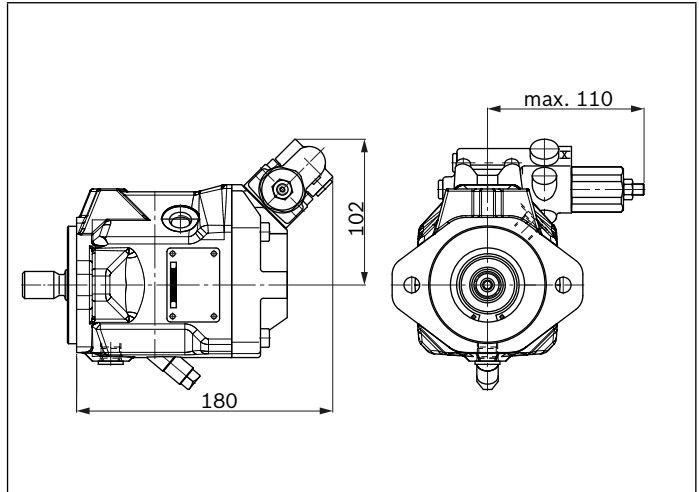
- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
- 3) Thread according to ASME B1.1
- 4) For notes on tightening torques, see the instruction manual.
- 5) Depending 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 L₁ must be connected (also see installation instructions starting on page 103).
- 9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

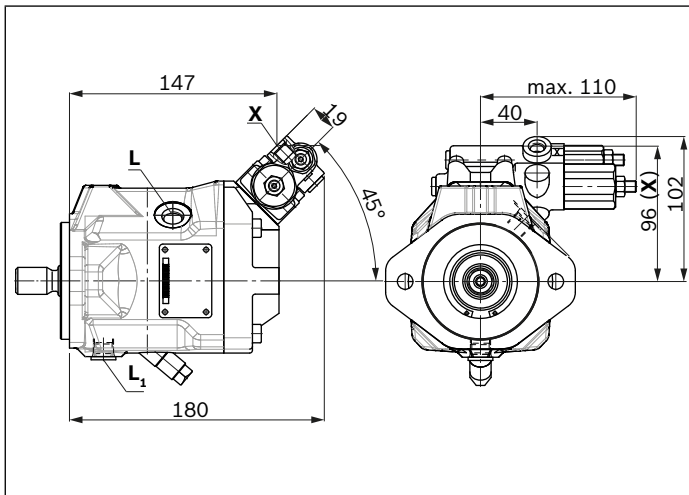
▼ **DG – Two-point control, direct operated, hydraulic**



▼ **DR – Pressure controller, hydraulic**

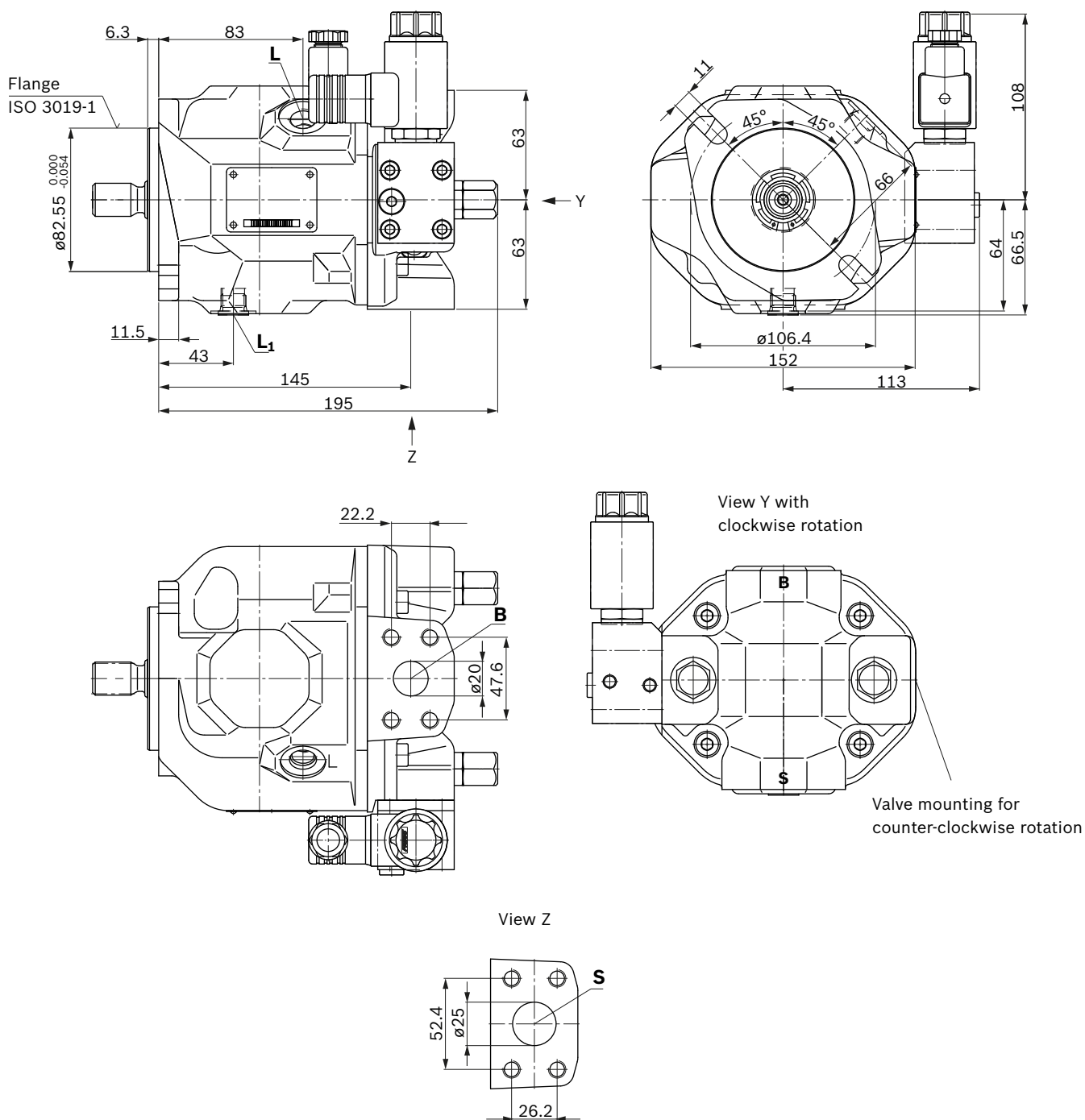


▼ **DRG – Pressure controller, remote controlled, hydraulic**

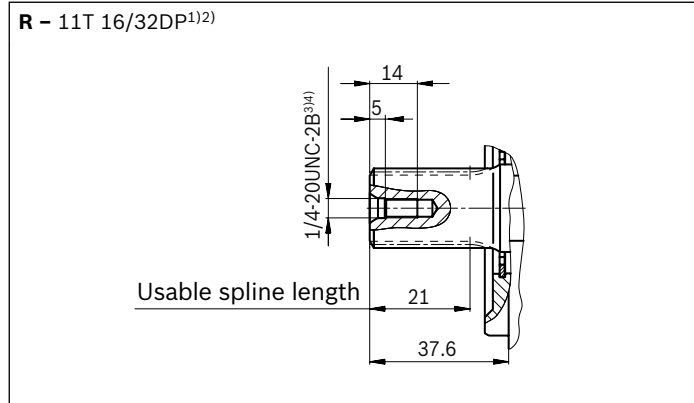


Notice

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**

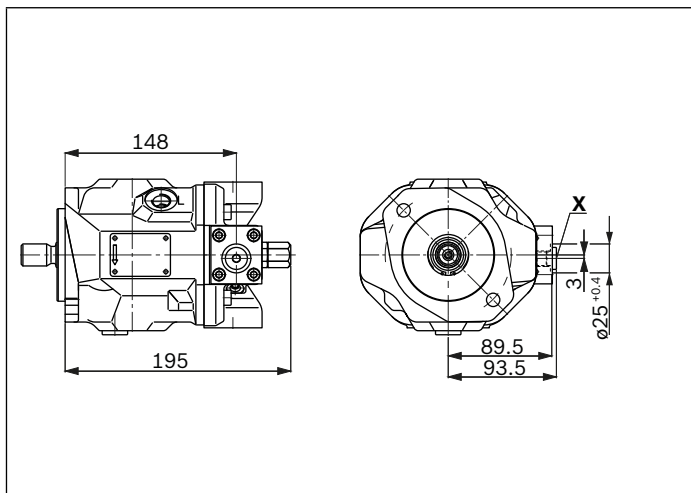
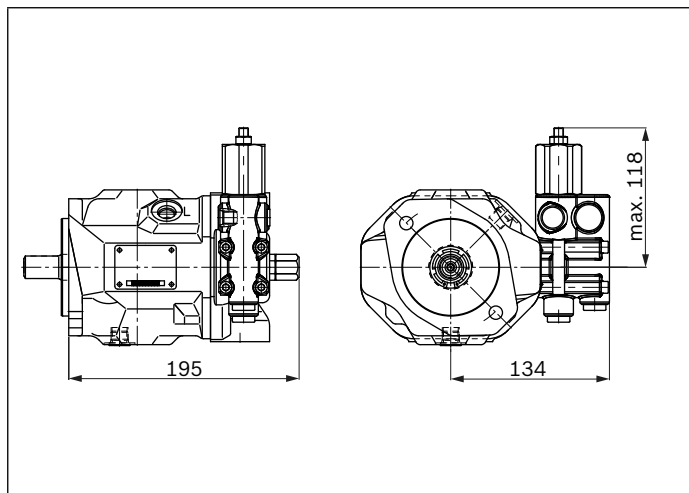
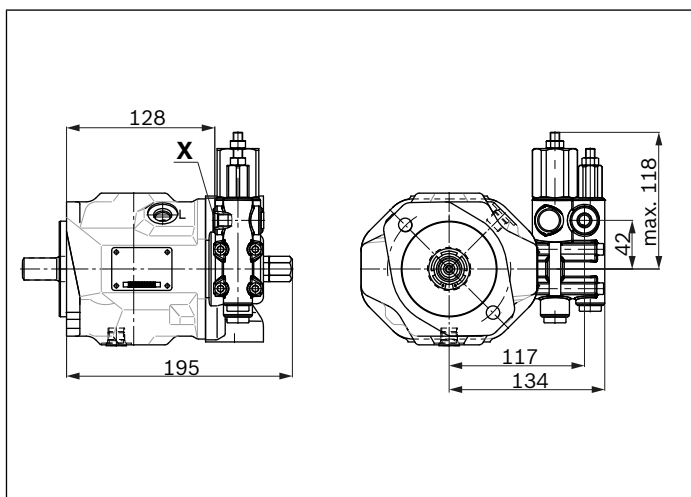
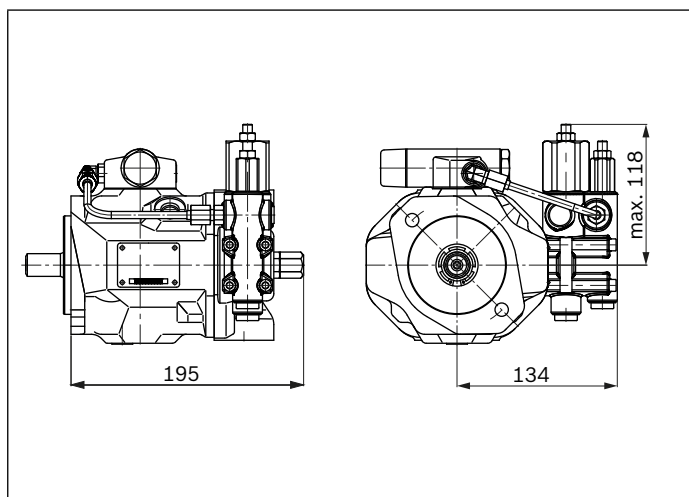


Connection table **A10VZO**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [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⁾
L₁	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.

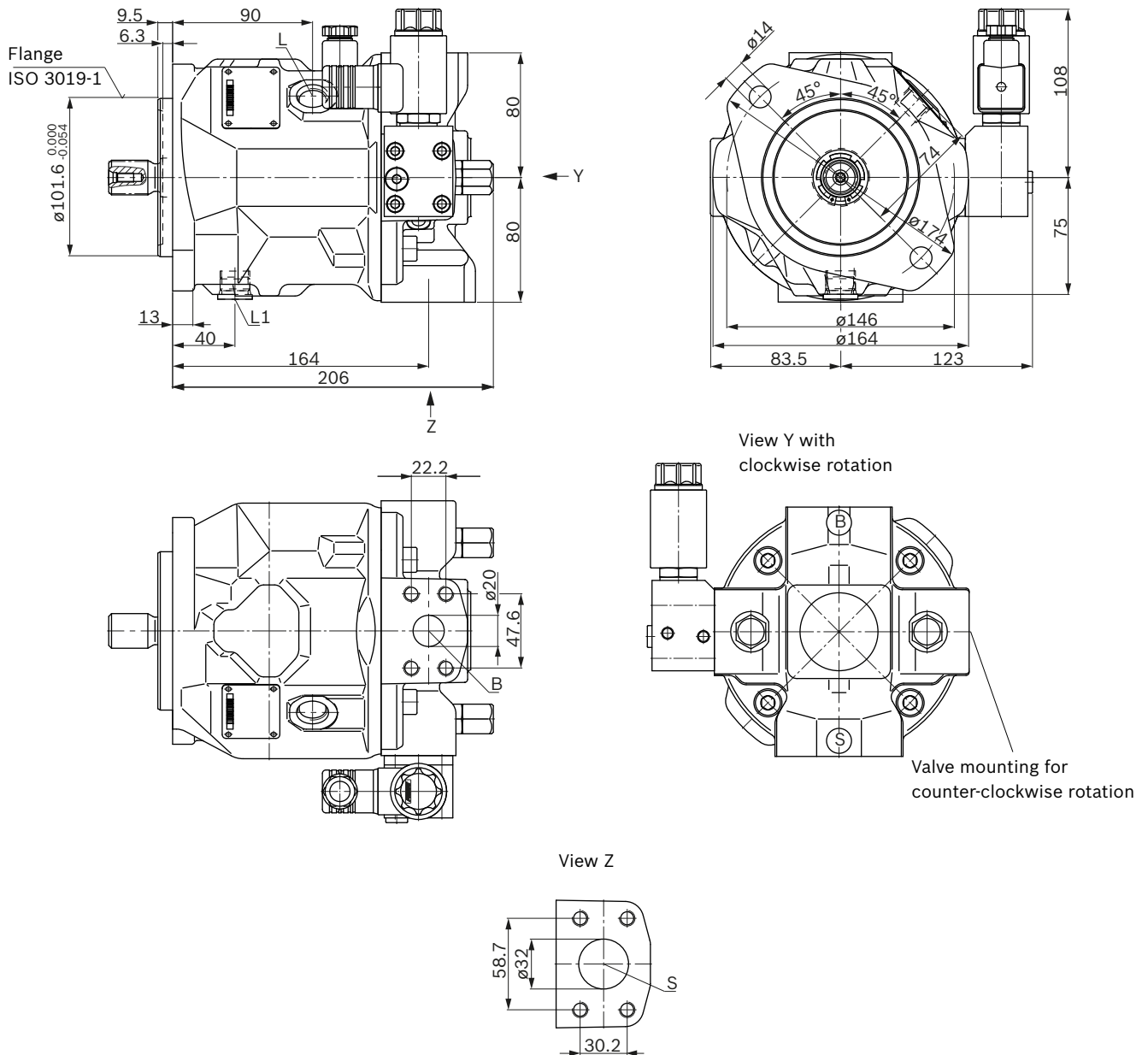
- 6) Metric fastening thread is a deviation from standard.
- 7) The countersink can be deeper than as specified in the standard.
- 8) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).
- 9) O = Must be connected (plugged when delivered)
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**

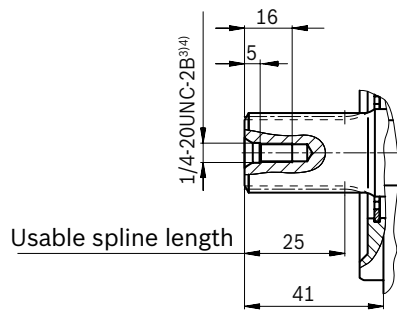
Valve mounting for counter-clockwise rotation see overall dimensions on page 43.

Dimensions A10VZO size 28

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



▼ Splined shaft 7/8 in SAE J744

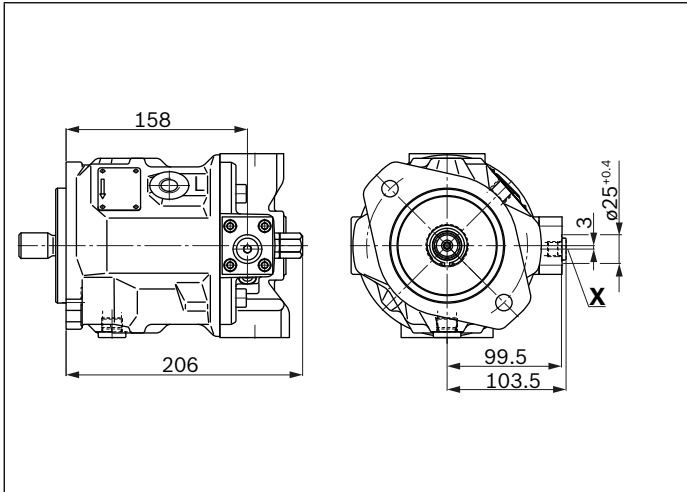
R – 13T 16/32DP¹⁾²⁾Connection table **A10VZO**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾
B	Working port (standard pressure series)	SAE J518 ⁶⁾	3/4 in	350	O
	Fastening thread	DIN 13	M10 × 1.5; 17 deep		
S	Suction port (standard pressure series)	SAE J518 ⁶⁾	1 1/4 in	10	O
		DIN 13	M10 × 1.5; 17 deep		
L	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 12 deep	2	O ⁸⁾
L₁	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

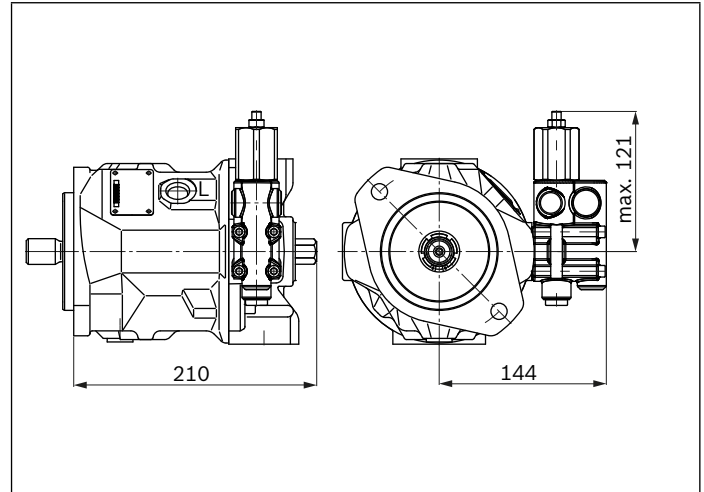
- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
- 3) Thread according to ASME B1.1
- 4) For notes on tightening torques, see the instruction manual.
- 5) Depending 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 L₁ must be connected (also see installation instructions starting on page 103).
- 9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

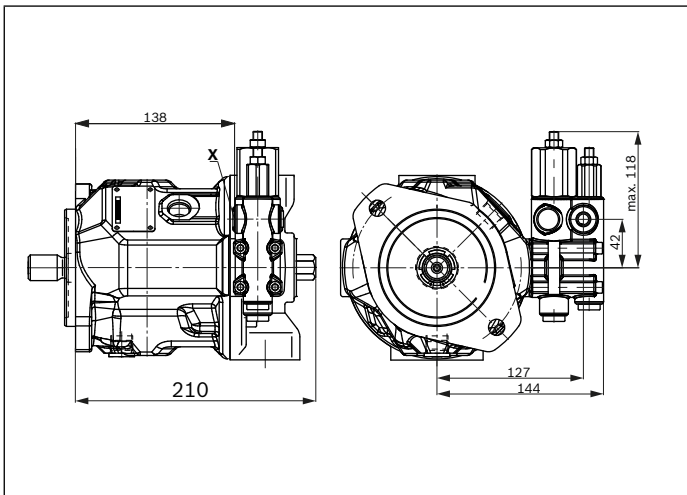
▼ **DG – Two-point control, direct operated, hydraulic**



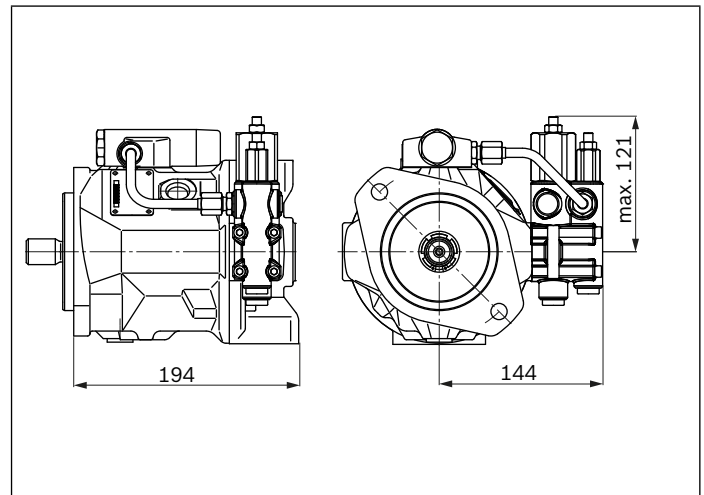
▼ **DR – Pressure controller, hydraulic**



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

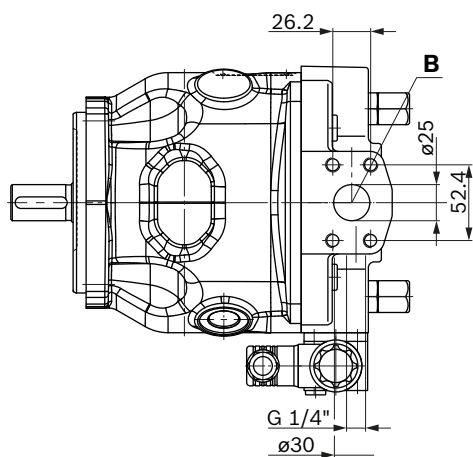
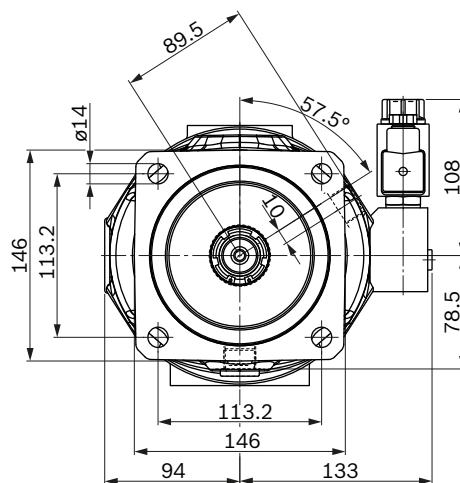
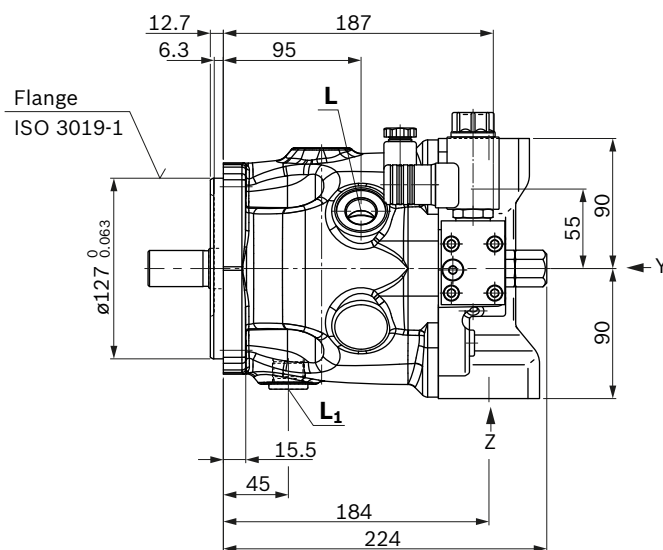
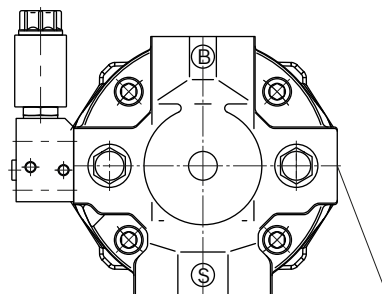


▼ **LAXD – Torque controller, hydraulic**

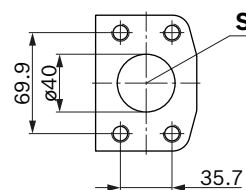


Notice

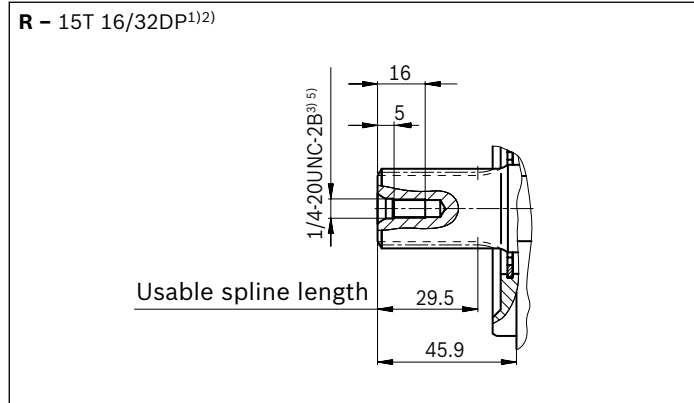
Valve mounting for counter-clockwise rotation see overall dimensions on page 46.

Dimensions A10VZO size 45**EZ3/4 – Two-point control electric, port plate 12, clockwise rotation**View Y with
clockwise rotationValve mounting for counter-
clockwise rotation

View Z



▼ **Splined shaft 1 in SAE J744**

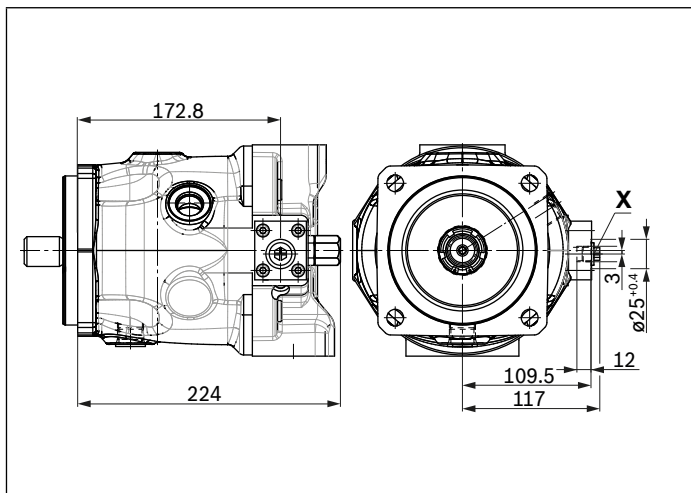
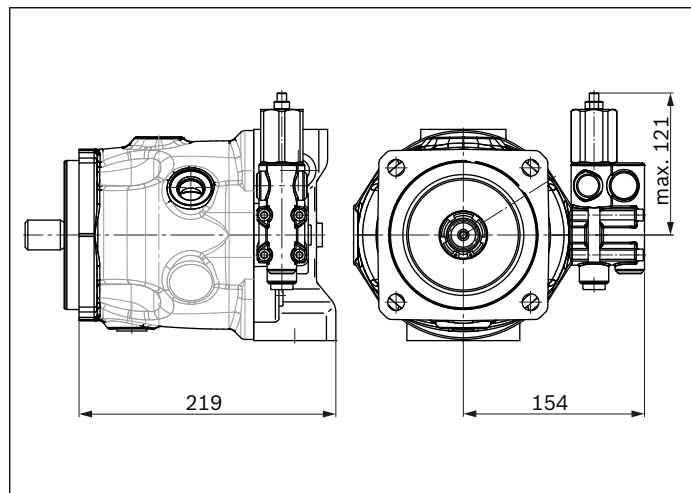
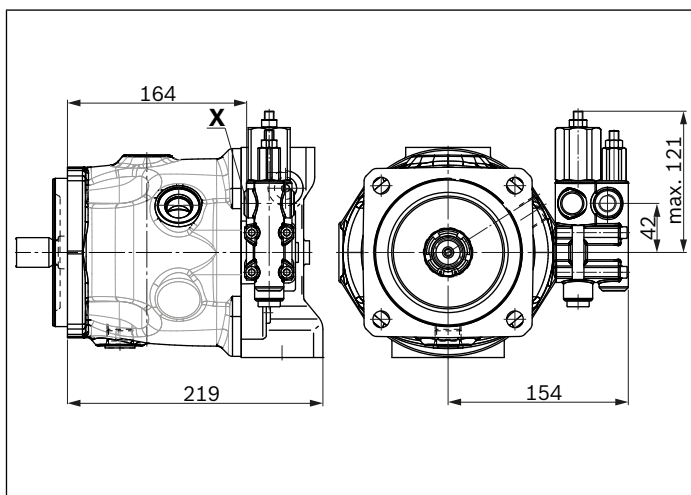
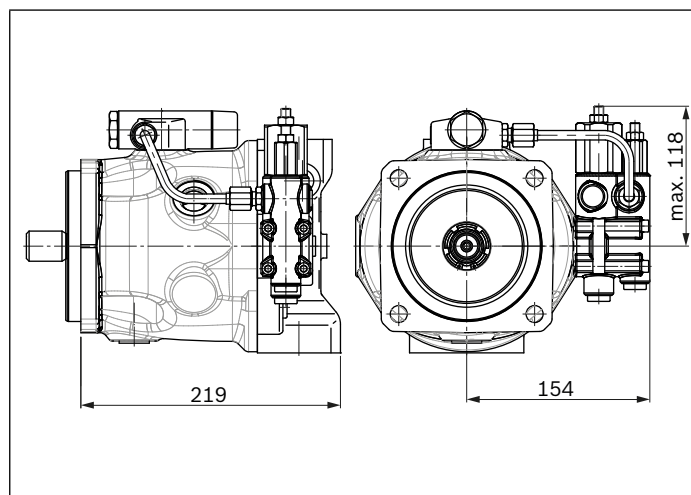


Connection table **A10VZO**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [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⁾
L₁	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.

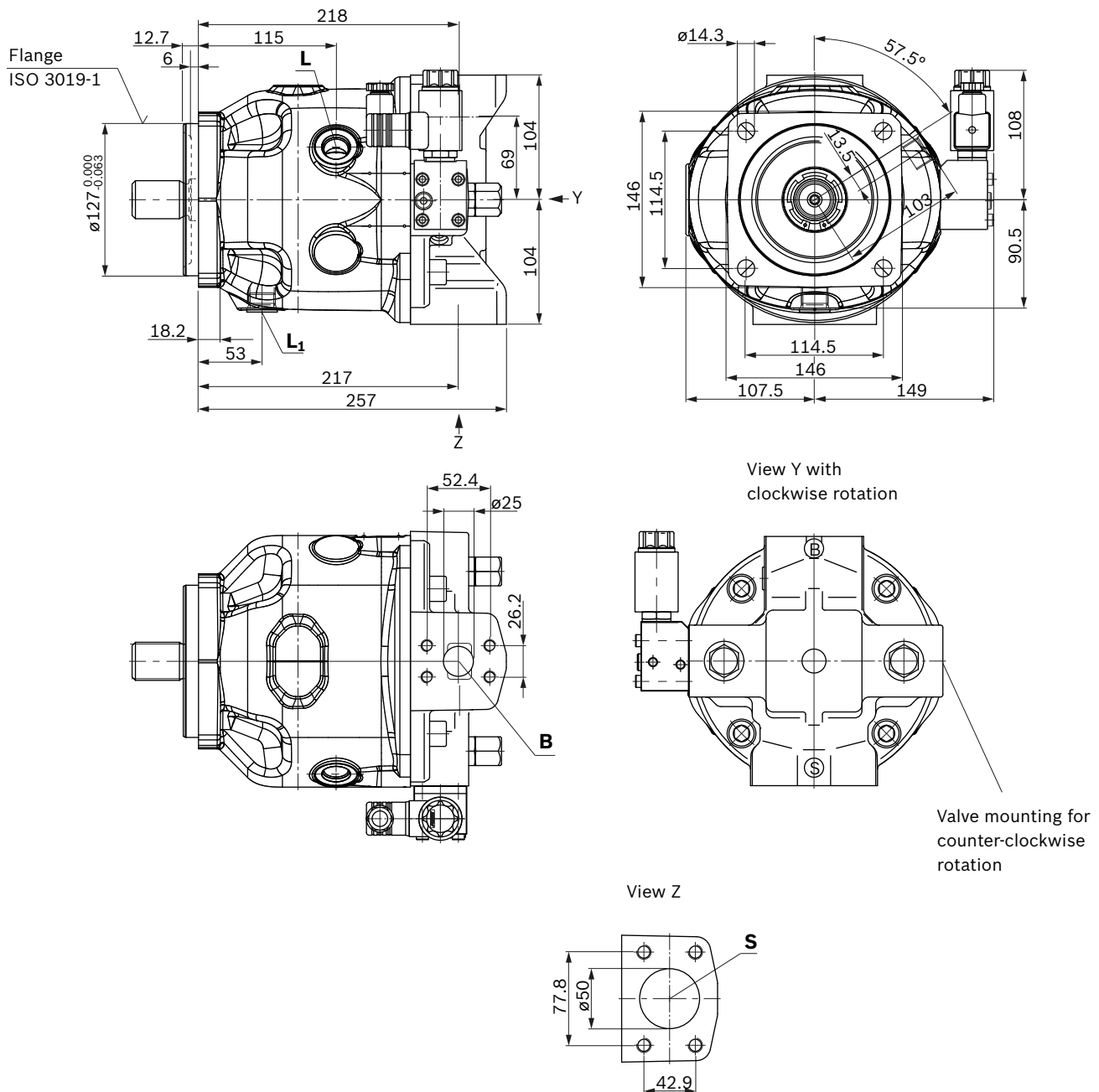
- 6) Metric fastening thread is a deviation from standard.
- 7) The countersink can be deeper than as specified in the standard.
- 8) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).
- 9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

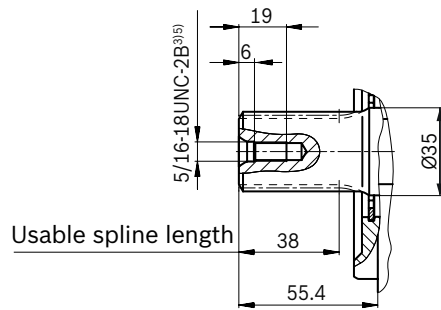
▼ **DG – Two-point control, direct operated, hydraulic**▼ **DR – Pressure controller, hydraulic**▼ **DRG – Pressure controller, remote controlled, hydraulic**▼ **LAXD – Torque controller, hydraulic****Notice**

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 12/24DP¹⁾²⁾Connection table **A10VZO**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾
B	Working port (standard pressure series)	SAE J518 ⁶⁾	1 in	350	O
	Fastening thread	DIN 13	M10 × 1.5; 17 deep		
S	Suction port (standard pressure series)	SAE J518 ⁶⁾	2 in	10	O
		DIN 13	M12 × 1.75; 20 deep		
L	Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 14 deep	2	O ⁸⁾
L₁	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.

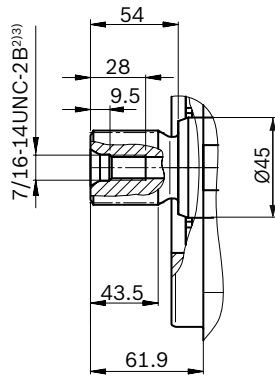
7) The countersink can be deeper than as specified in the standard.

8) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).

9) O = Must be connected (plugged when delivered)

X = Plugged (in normal operation)

▼ Splined shaft 1 1/2 in SAE J744

S – 17T 12/24DP¹⁾Connection table **A10VZO**

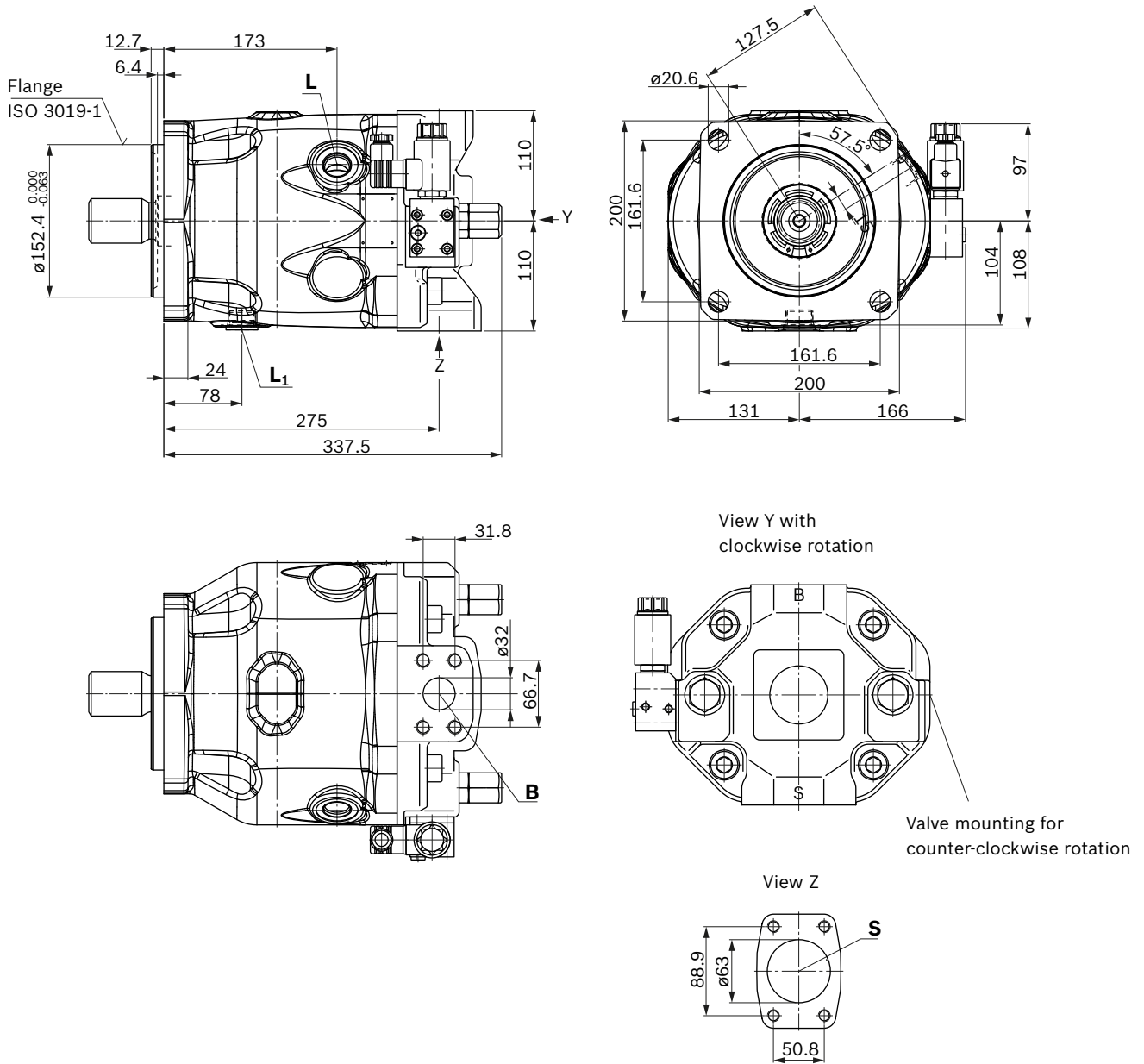
Ports		Standard	Size ³⁾	$p_{\max \text{ abs}}$ [bar] ⁴⁾	State ⁸⁾
B	Working port (standard pressure series) Fastening thread	SAE J518 ⁵⁾ DIN 13	1 1/4 in M14 × 2; 19 deep	350	O
S	Suction port (standard pressure series)	SAE J518 ⁵⁾ DIN 13	2 1/2 in M12 × 1.75; 17 deep	10	O
L	Drain port	ISO 11926 ⁶⁾	1 1/16-12UNF-2B; 16 deep	2	O ⁷⁾
L₁	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.

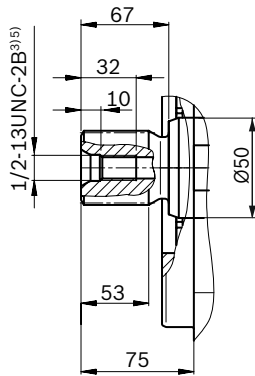
5) Metric fastening thread is a deviation from standard.
6) The countersink can be deeper than as specified in the standard.
7) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).
8) O = Must be connected (plugged when delivered)
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 8/16DP¹⁾Connection table **A10VZO**

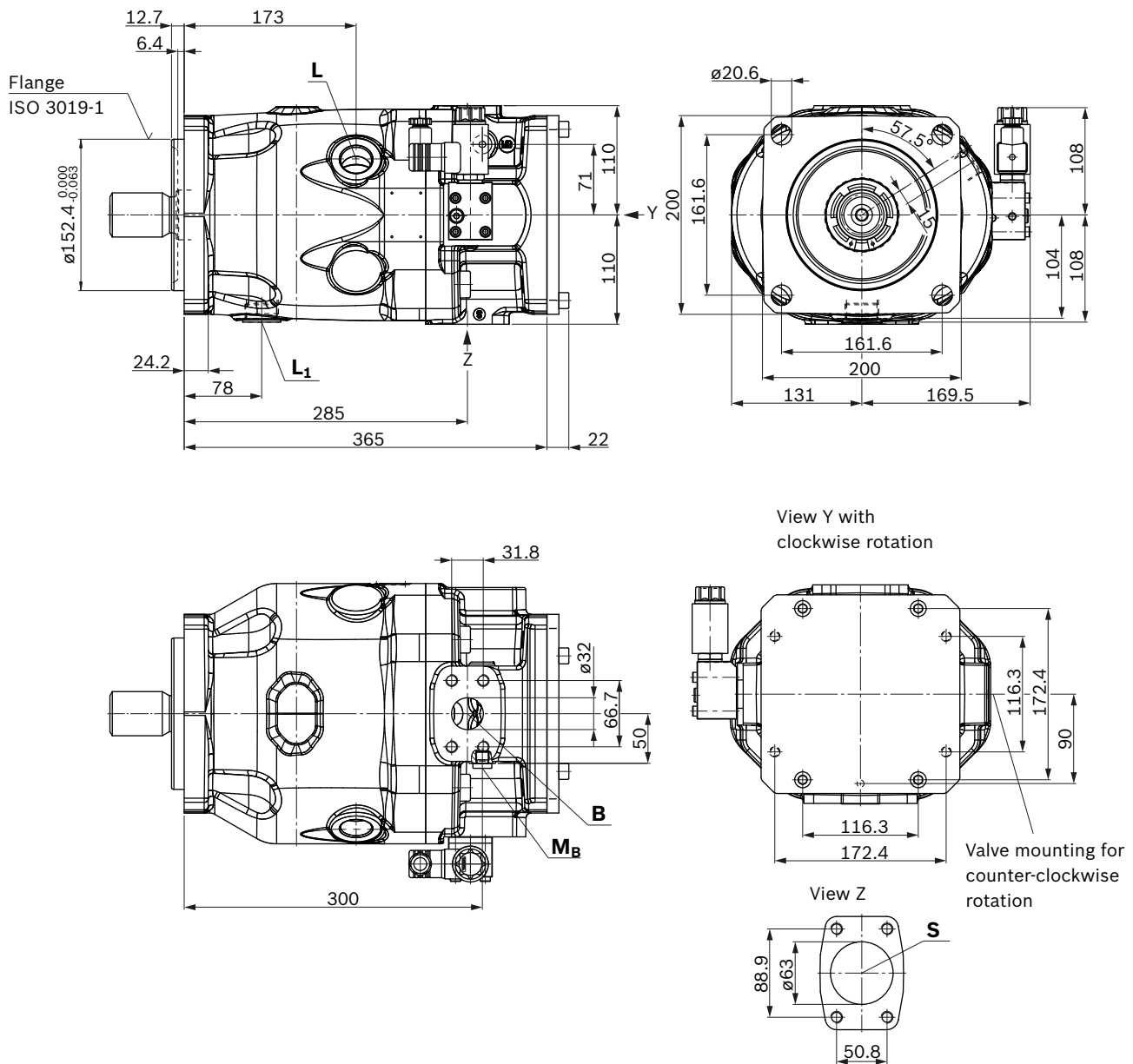
Ports		Standard	Size ³⁾	$p_{\max \text{ abs}}$ [bar] ⁴⁾	State ⁸⁾
B	Working port (high-pressure series)	SAE J518 ⁵⁾	1 1/4 in	350	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
S	Suction port (high-pressure series)	SAE J518 ⁵⁾	2 1/2 in	10	O
		DIN 13	M12 × 1.75; 17 deep		
L	Drain port	ISO 11926 ⁶⁾	1 1/16-12UNF-2B; 16 deep	2	O ⁷⁾
L₁	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.

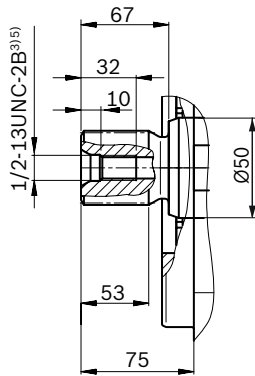
- 5) Metric fastening thread is a deviation from standard.
 6) The countersink can be deeper than as specified in the standard.
 7) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).
 8) O = Must be connected (plugged when delivered)
 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 8/16DP¹⁾Connection table **A10VZO**

Ports		Standard	Size ³⁾	$p_{\max \text{ abs}}$ [bar] ⁴⁾	State ⁸⁾
B	Working port (high-pressure series)	SAE J518 ⁵⁾	1 1/4 in	350	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
S	Suction port (high-pressure series)	SAE J518 ⁵⁾	2 1/2 in	10	O
		DIN 13	M12 × 1.75; 17 deep		
L	Drain port	ISO 11926 ⁶⁾	1 5/16-12UNF-2B; 15 deep	2	O ⁷⁾
L₁	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 L₁ must be connected (also see installation instructions starting on page 103).
 8) O = Must be connected (plugged when delivered)
 X = Plugged (in normal operation)

Axial piston fixed displacement unit A10FZG



- ▶ For variable-speed operation with synchronous and asynchronous motors
- ▶ Sizes 3 to 63
- ▶ Nominal pressure/maximum pressure 315/350 bar
- ▶ Open and closed circuits

Features

- ▶ For use in one-, two- or four-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 A10FZG units can be used as a pump in one, two and four-quadrant operation.

Type code A10FZG

01	02	03	04	05	06	07	08	09	10	11		
A10F	Z	G		/	10	W	-	V		C	02	

Axial piston unit

01	Swashplate design, fixed, nominal pressure 315 bar, maximum pressure 350 bar	A10F
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Application area

02	Variable-speed drives	Z
----	-----------------------	----------

Operating mode

03	Pump, open and closed circuit	G
----	-------------------------------	----------

Size Geometric displacement, see table of values on page 66 and 67

04		010	018	028	045	063
	Other available intermediate sizes	003, 006, 008	012, 014, 016	021, 022, 023, 025, 026, 027	032, 035, 037, 039, 040, 041, 042	051, 058

Series

05	Series 1, index 0	10
----	-------------------	-----------

Direction of rotation

06	Viewed on drive shaft	changing	W
----	-----------------------	----------	----------

Sealing material

07	FKM (fluoroelastomer)	V
----	-----------------------	----------

Drive shaft

08	Splined shaft	Standard shaft	●	-	-	-	-	S
	ANSI B92.1a	similar to shaft "S" however for higher torque	-	●	●	○	○	R

Mounting flange

09	ISO 3019-1 (SAE)	C
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Working port

10	SAE flange ports A and B , opposite sides, metric fastening thread	02
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Through drive (for mounting options, see page 100)

11	Flange	Hub for splined shaft ¹⁾						
	ISO 3019-1							
	Diameter	Diameter	010	018	028	045	063	
	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
		1 1/4 in 14T 12/24DP	-	-	-	-	○	K06

● = Available ○ = On request - = Not available

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

Preferred program A10FZG

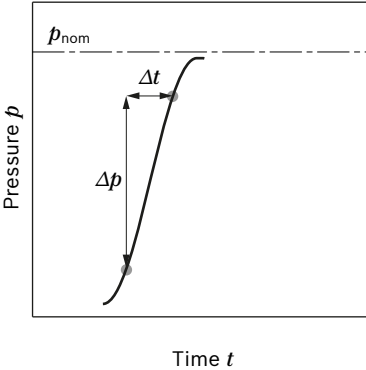
Overview of common configurations

Type	Material number
A A10FZG003/10W-VSC02N00	R902544378
A A10FZG006/10W-VSC02N00	R902544475
A A10FZG008/10W-VSC02N00	R902544393
A A10FZG010/10W-VSC02N00	R902544389
A A10FZG012/10W-VRC02N00	R902530960
A A10FZG014/10W-VRC02N00	R902530961
A A10FZG016/10W-VRC02N00	R902530962
A A10FZG018/10W-VRC02N00	R902530963
A A10FZG021/10W-VRC02N00	R902536290
A A10FZG022/10W-VRC02N00	R902557896
A A10FZG023/10W-VRC02N00	R902557897
A A10FZG025/10W-VRC02N00	R902557898
A A10FZG026/10W-VRC02N00	R902557899
A A10FZG027/10W-VRC02N00	R902557900
A A10FZG028/10W-VRC02N00	R902534818

Working pressure range A10FZG

Pressure at working port B or A			Definition
Nominal pressure p_{nom}	315 bar absolute		The nominal pressure corresponds to the maximum design pressure. 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.
Maximum pressure p_{max}	350 bar absolute		
Single operating period	2.0 ms		
Total operating period	300 h		
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 port A or B (low-pressure side)			
Minimum pressure p_{min}	Standard	0.8 bar absolute	Minimum pressure on the low-pressure side that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure			
			The sum of the pressures on ports A and B must not rise above 400 bar.
Case pressure at port L			
Maximum pressure $p_{L\ max}$	2 bar absolute ¹		Maximum 0.5 bar higher than inlet pressure at low-pressure port, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

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



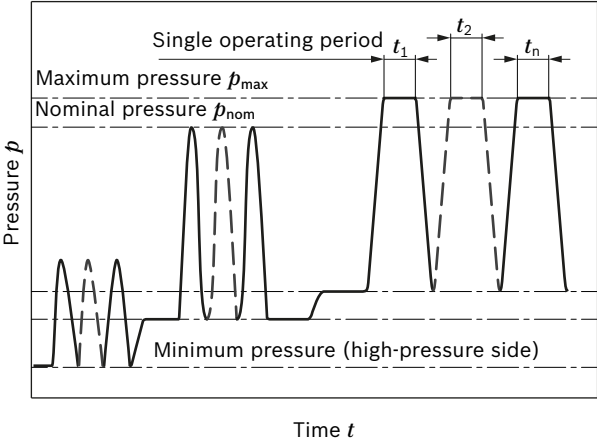
Notice

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 “W”	Clockwise	A to B
	Counterclockwise	B to A

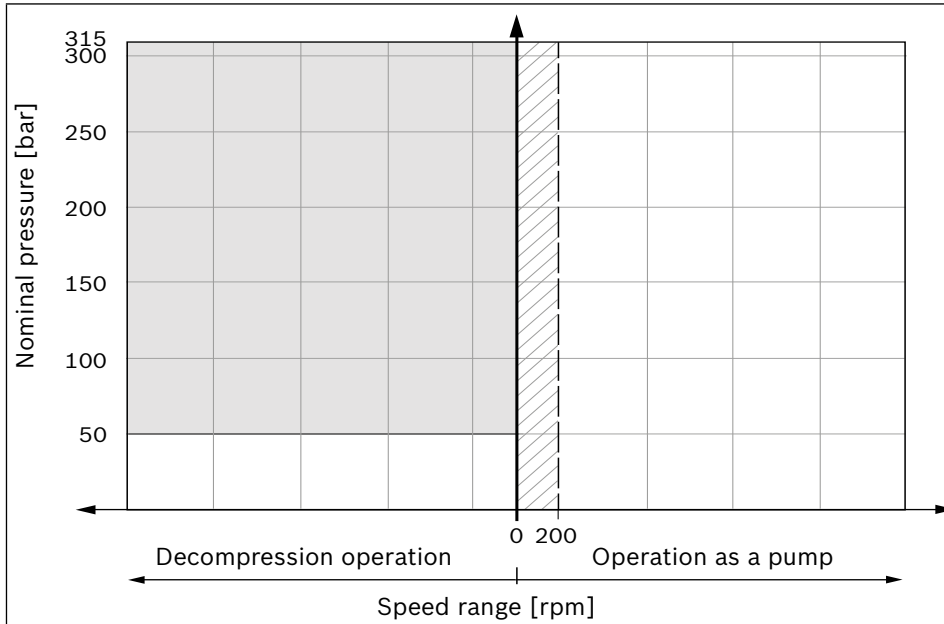
▼ Pressure definition



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

1) Higher values on request

A10FZG: Permissible operating data and operating ranges at $V_{g \max}$



Operating range

- ☐ Operation without restriction
- ☒ Permissible with single operating period $t \leq 3$ min; maximum cycle share 80%. For longer time periods $t > 3$ min, please use A10VZG.
- ☐ Operation as a motor possible with restrictions, please contact us. Permissible for short-term decompression operation $t \leq 200$ ms

Technical data A10FZG size 3 to 63

Superordinate size		NG	10				18				28			
Available intermediate sizes		NG	3	6	8	10	12	14	16	18	21	22	23	25
Displacement, geometric, per revolution	$V_{g \max}$	cm ³	3	6	8.1	10.6	12	14	16	18	21	22	23	25
Rotational speed at $V_{g \max}$ maximum ¹⁾														
Suction speed operation as a pump ¹⁾	n_{nom}	rpm	3600				3300				3000			
Max. speed decompression operation ²⁾	n_{nom}	rpm	3600				3300				3000			
Flow at n_{nom} and $V_{g \max}$	q_v	l/min	10.8	21.6	29	38.2	39.6	46.2	52.8	59.4	63	66	69	75
Power pump operation at n_{nom} , $V_{g \max}$ and $\Delta p = 315$ bar	P	kW	5.6	11.3	15.3	20	21	24.2	27.7	31.2	33	34	36.3	39
Torque at $V_{g \max}$ and $\Delta p = 315$ bar	T	Nm	15	30	40.5	53	60.2	70.2	80.2	90.3	105	110	116	125
	T	Nm	5	9.5	12.7	16.8	19.1	22.3	25.5	28.7	33.4	35	36.6	40
Rotary stiffness of drive shaft	S	c	9200				–				–			
	R	c	–				14800				26300			
Moment of inertia for rotary group	J_{TW}	kgm ²	0.0006				0.0009				0.0017			
Maximum angular acceleration ²⁾³⁾	α	rad/s ²	14000				12600				11200			
Case volume	V	l	0.11				0.19				0.6			
Weight (approx.)	m	kg	9				10				15.5			

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

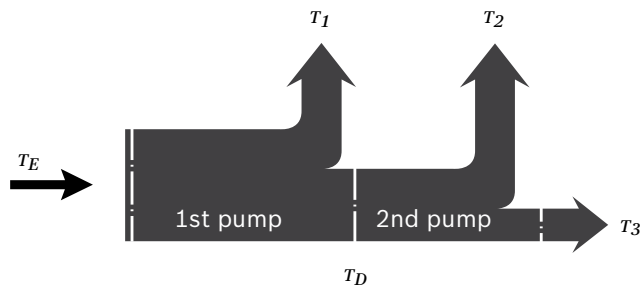
- The values are applicable:
 - At absolute pressure $p_{\text{abs}} \geq 1$ bar on the low-pressure side (input)
 - For the optimal viscosity range of $\nu_{\text{opt}} = 36$ to 16 mm²/s
 - For hydraulic fluid based on mineral oils
- Higher values on request
- The limit value is only valid for a single pump, multiple pump version available on request. The load capacity of the connecting parts must be considered.

	45											63		
	26	27	28	32	35	37	39	40	41	42	45	51	58	63
	26	27	28	32	35	37	39	40	41	42	45	51	58	63
	3000			On request										
	3000													
	78	81	84											
	41	42	44											
	130.4	135	140.4	160	175	185.6	195	200	206	210	225.7	256	291	316
	41.4	43	44.6	51	56	59	62	64	65	67	71.6	81	92	100
	–			–								–		
	26300			41000								69400		
	0.0017			0.003								0.0056		
	11200			9500								On request		
	0.6			0.7										
	15.5			21										

Permissible input and through-drive torques

Size			3	6	8	10	12	14	16	18	21	23	26	28	37	45	
Torque at $V_{g\ max}$ and $\Delta p = 315\ \text{bar}^{1)}$		T_{max}	Nm	15	30	40.5	53	60.2	70.2	80.2	90.3	105	115.5	130.4	140.4	185.6	225.7
Maximum input torque at drive shaft ²⁾	S	$T_{E\ max}$	Nm	126	126	126	126	–	–	–	–	–	–	–	–	–	–
		$\varnothing$	in	3/4	3/4	3/4	3/4	–	–	–	–	–	–	–	–	–	–
	R	$T_{E\ max}$	Nm	–	–	–	–	160	160	160	160	250	250	250	250	400	400
		$\varnothing$	in	–	–	–	–	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	1	1
Maximum through-drive torque	S	$T_{D\ max}$	Nm	41	41	41	41	–	–	–	–	–	–	–	–	–	–
	R	$T_{D\ max}$	Nm	–	–	–	–	92	92	92	92	127	127	127	127	929	292

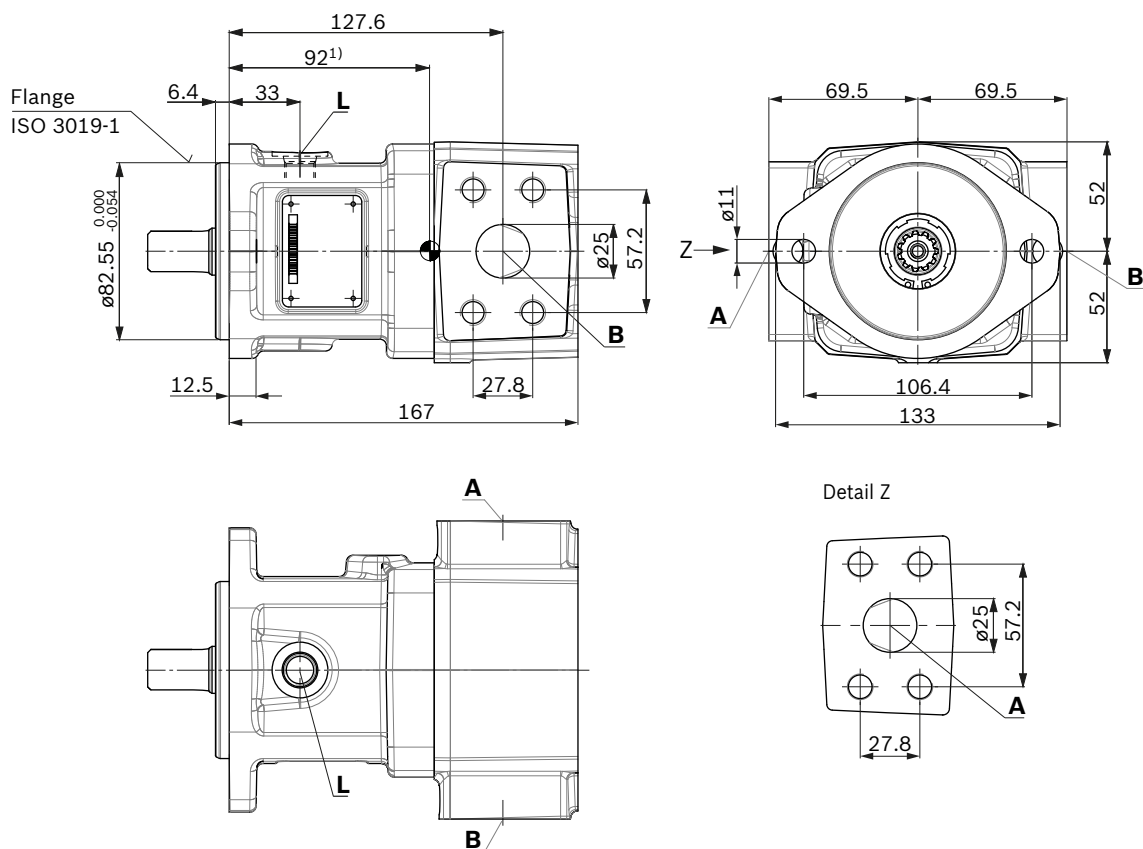
▼ Distribution of torques



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	$T_D = T_2 + T_3$
	$T_D < T_{D\ max}$

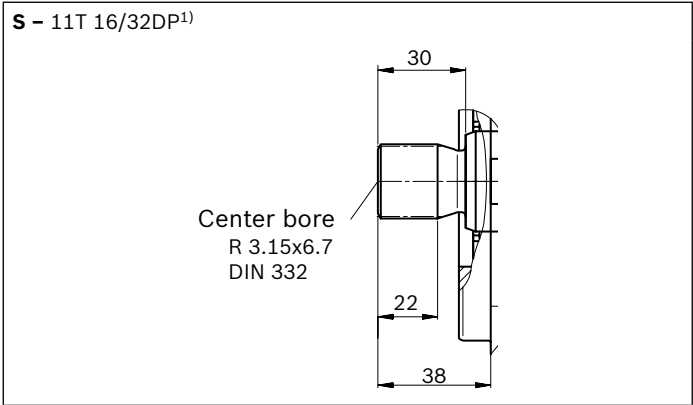
1) Efficiency not considered

2) For drive shafts with no radial force

Dimensions A10FZG, sizes 3 to 10**Direction of rotation changing (flow direction see table page 64)**

1) Center of gravity

▼ Splined shaft 3/4 in (SAE J744)

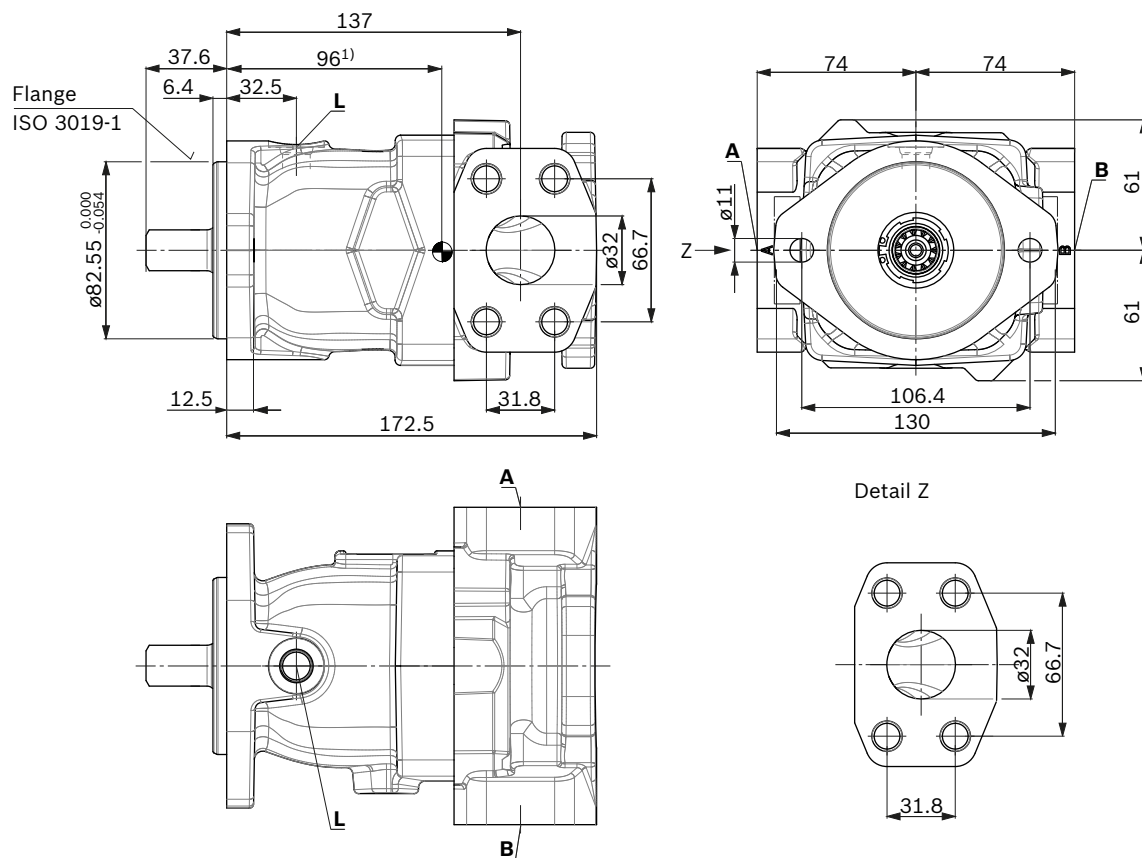


Connection table **A10FZG**

Ports		Standard	Size ²⁾	$p_{\text{max abs}}$ [bar] ³⁾	State ⁶⁾
A/B	Working port (high-pressure series)	SAE J518 ⁴⁾	1 in	350	O
	Fastening thread	DIN 13	M12 × 1.75; 17 deep		
L	Drain port	DIN 11926 ⁵⁾	9/16-18UNF-2B; 12.5 deep	2	O

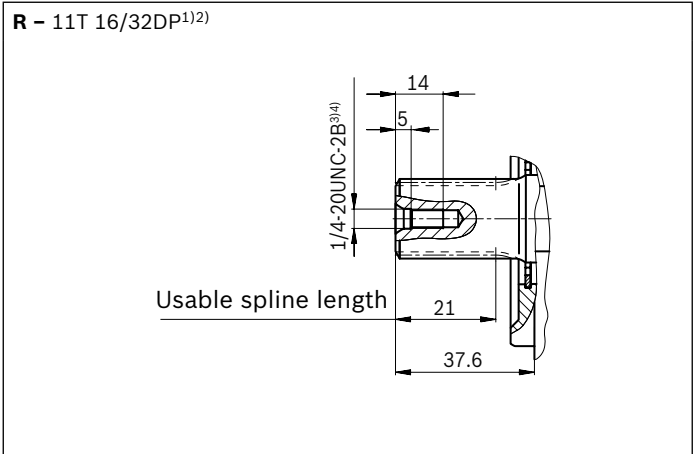
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) For notes on tightening torques, see the instruction manual.

3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Metric fastening thread is a deviation from standard.
5) The countersink can be deeper than as specified in the standard.
6) O = Must be connected (plugged on delivery)

Dimensions A10FZG, sizes 12 to 18**Direction of rotation changing (flow direction see table page 64)**

1) Center of gravity

▼ Splined shaft 3/4 in SAE J744

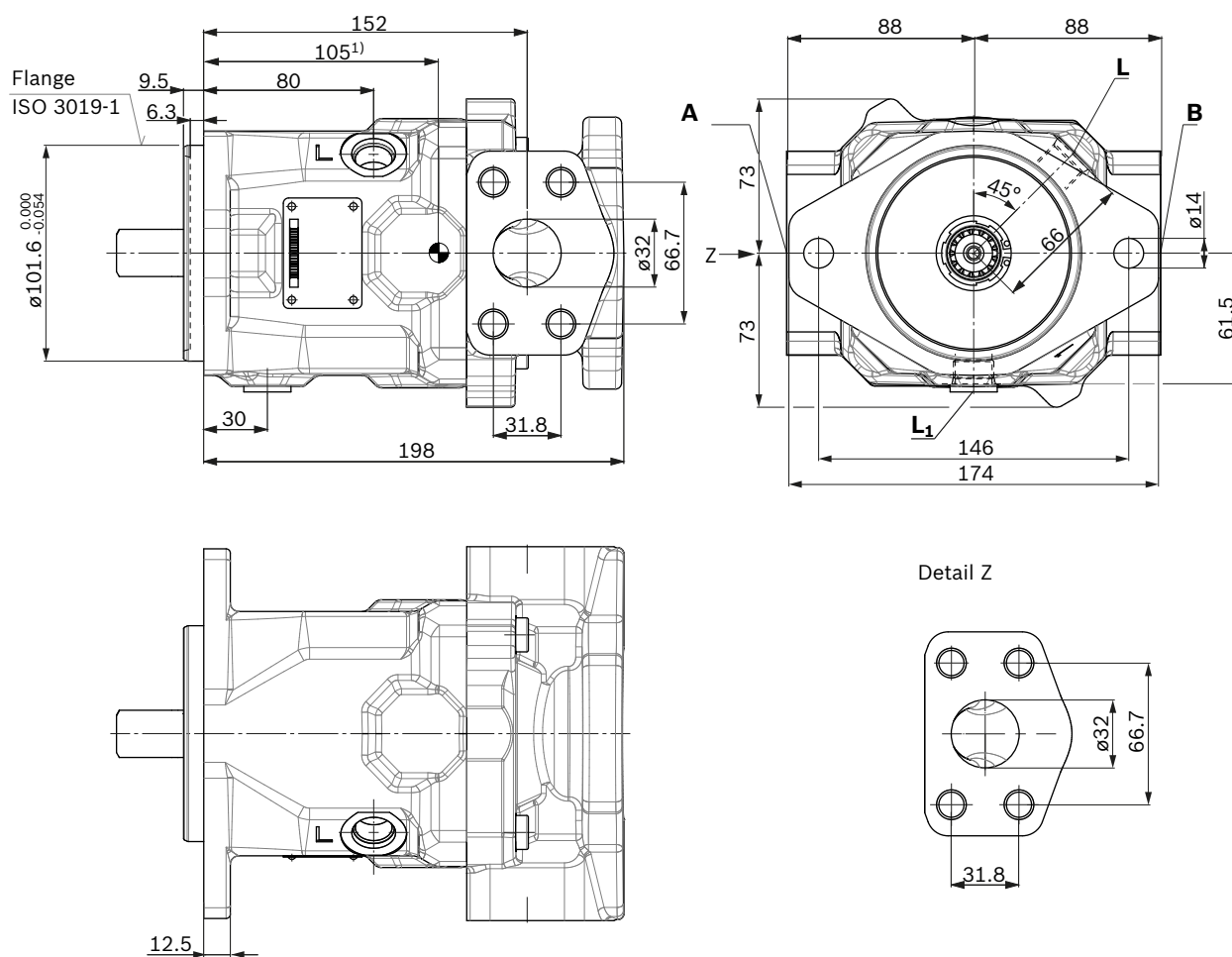


Connection table **A10FZG**

Ports		Standard	Size ⁴⁾	$p_{\text{max abs}}$ [bar] ⁵⁾	State ⁸⁾
A/B	Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	350	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
L	Drain port	DIN 11926 ⁷⁾	9/16-18UNF-2B; 12.5 deep	2	O

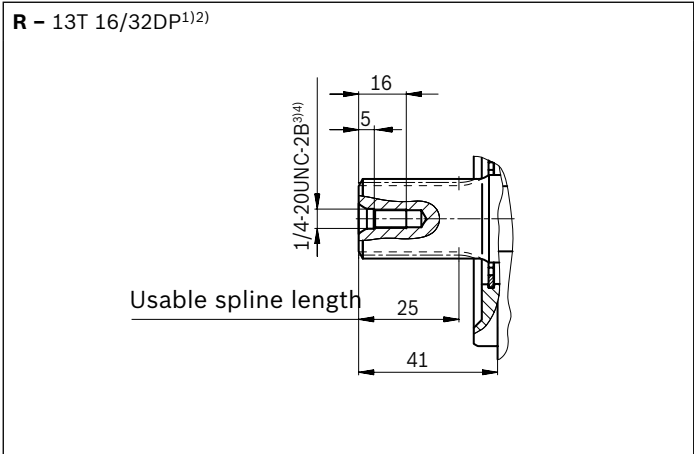
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the 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) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

Dimensions A10FZG, sizes 21 to 28**Direction of rotation changing (flow direction see table page 64)**

1) Center of gravity

▼ Splined shaft 7/8 in SAE J744

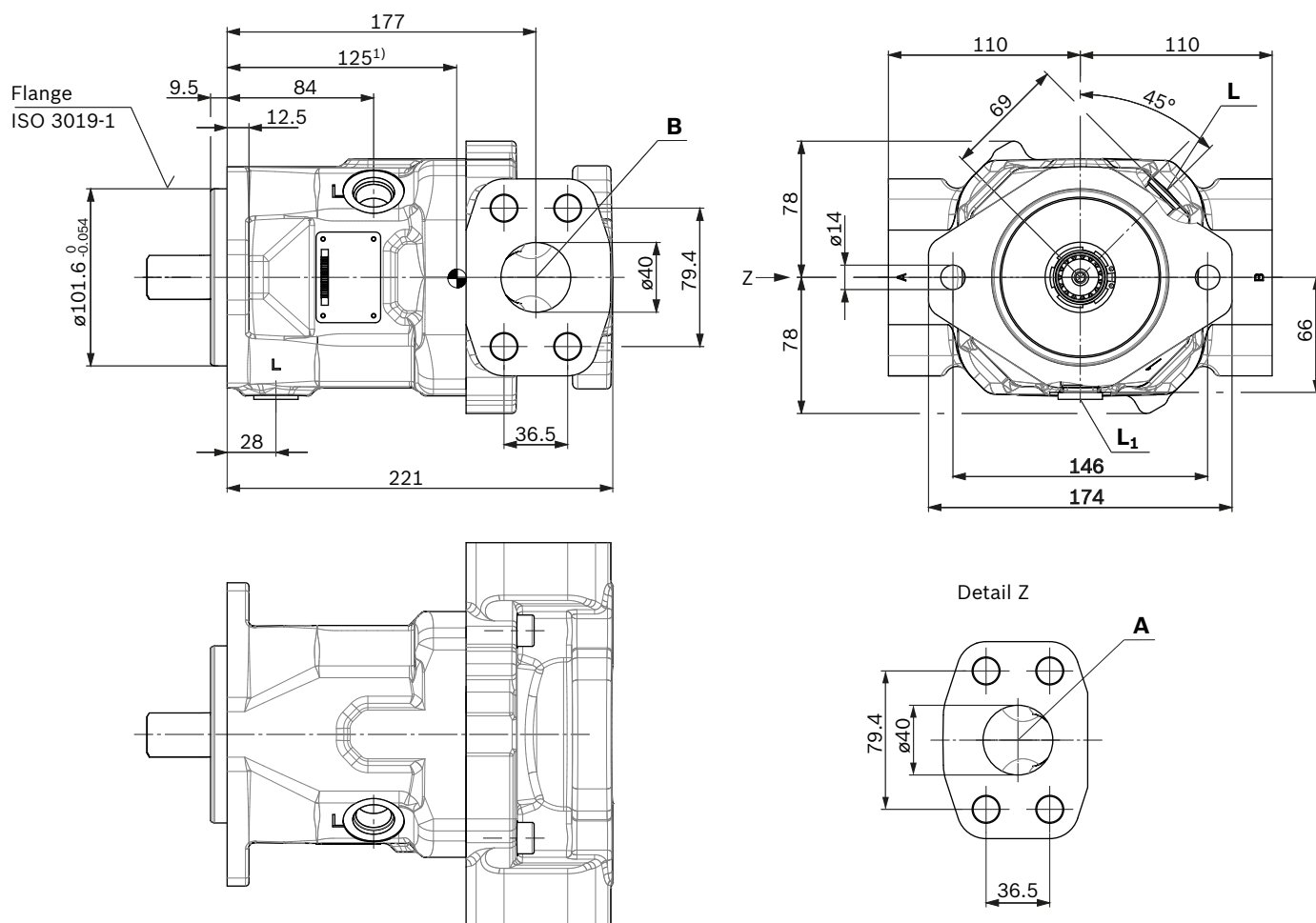


Connection table **A10FZG**

Ports		Standard	Size ⁴⁾	$p_{\text{max abs}}$ [bar] ⁵⁾	State ⁹⁾
A/B	Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	350	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
L	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	O ⁸⁾
L₁	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	X ⁸⁾

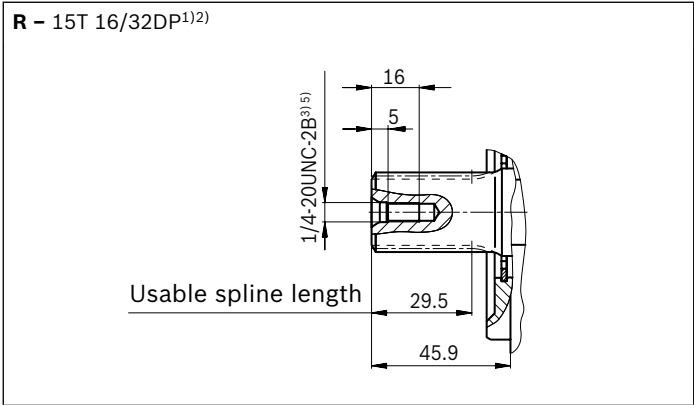
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the 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 L₁ 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 A10 A10FZG, sizes 32 to 45**Direction of rotation changing (flow direction see table page 64)**

1) Center of gravity

▼ Splined shaft 1 in SAE J744



Connection table **A10FZG**

Ports		Standard	Size ⁴⁾	$p_{\text{max abs}}$ [bar] ⁵⁾	State ⁹⁾
A/B	Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/2 in	350	O
	Fastening thread	DIN 13	M16 × 2; 21 deep		
L	Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 deep	2	O ⁸⁾
L₁	Drain port	ISO 11926 ⁷⁾	7/8-14UNF-2B; 16.5 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, L₁ or L₂ must be connected (also see installation instructions starting on page 103).
9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

Axial piston variable displacement unit A10VZG



Features

- ▶ For use in one-, two- or four-quadrant operation
- ▶ Suitable for start/stop operation
- ▶ Suitable for long pressure holding operation
- ▶ Proven A10 rotary group technology

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 A10VZG units can be used as a pump in one-, two- and four-quadrant operation.

- ▶ For variable-speed operation with synchronous and asynchronous motors
- ▶ Size 3 to 10
Nominal pressure/maximum pressure 250/315 bar
- ▶ Size 18 to 63
Nominal pressure/maximum pressure 280/315 bar
- ▶ Open and closed circuits

Type code A10VZG

01	02	03	04	05	06	07	08	9	10	11	12	13		
A10V	Z	G			/	10	W	-	V		C		N00	

Axial piston unit

01	Swashplate design, variable, nominal pressure 250/280 bar, maximum pressure 315 bar	A10V
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Application area

02	Variable-speed drives	Z
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Operating mode

03	Pump, closed circuit	G
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Size (NG)

04	Geometric displacement, see table of values on page 82	003	006	008	010	018	028	045	063
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Control device²⁾

05	Two-point control, electric	U = 12 V	●	●	●	●	●	●	○	○	EZ300¹⁾
		U = 24 V	●	●	●	●	●	●	○	○	EZ400¹⁾
	Two-point control, hydraulic		●	●	●	●	●	●	○	○	DG000¹⁾

Series

06	Series 1, index 0	10
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Direction of rotation

07	Viewed on drive shaft	changing	W
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Sealing material

08	FKM (fluoroelastomer)	V
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Drive shaft

9	Splined shaft	standard shaft	●	●	●	●	-	-	-	-	S
	ANSI B92.1a	similar to shaft "S" however for higher torque	-	-	-	-	●	●	○	○	R

Mounting flange

10	ISO 3019-1 (SAE)	C
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Working port

11	SAE flange ports A and B , opposite sides, metric fastening thread	-	-	-	-	●	●	○	○	02
	DIN 3852 threaded ports A and B , opposite sides	●	●	●	●	-	-	-	-	03

Through drive

12	without through drive	N00
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Connector for solenoids

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

● = Available ○ = On request - = Not available

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) Further controllers on request

Preferred program A10VZG

Overview of common configurations

Type	Material number
A10VZG003EZ400/10W -VSC03N00H	R902557901
A10VZG006EZ400/10W -VSC03N00H	R902557902
A10VZG008EZ400/10W -VSC03N00H	R902557903
A10VZG010EZ400/10W -VSC03N00H	R902543656
A10VZG018EZ400/10W -VRC02N00H	R902550318
A10VZG028EZ400/10W-VRC02N00H	R902535127

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

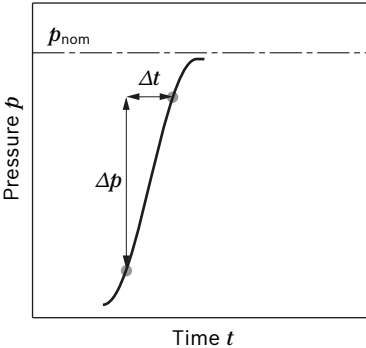
Setting ranges stop $V_{g \min}$ / $V_{g \max}$

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 7 cm ³ ; 1.3 cm ³ /U	9 to 18 cm ³ ; 1.3 cm ³ /U
28	0 to 11 cm ³ ; 1.7 cm ³ /U	14 to 28 cm ³ ; 1.7 cm ³ /U

Working pressure range A10VZG

Pressure at working port B or A			Definition
Nominal pressure p_{nom}	Size 10	250 bar absolute	The nominal pressure corresponds to the maximum design pressure.
	Size 18 to 63	280 bar absolute	
Maximum pressure p_{max}	Size 10	315 bar absolute	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.
	Size 18 to 63	315 bar absolute	
	Single operating period	2.0 ms	
	Total operating period	300 h	
Minimum pressure p_{abs} (high-pressure side)			Minimum pressure on the high-pressure side that is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$			Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
Pressure at port A or B (low-pressure side)			
Minimum pressure p_{min}	Standard	0.8 bar absolute	Minimum pressure on the low-pressure side that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure			
The sum of the pressures on ports A and B must not rise above 280 bar.			
Case pressure at port L			
Maximum pressure $p_{L\ max}$	2 bar absolute ²⁾		Maximum 0.5 bar higher than inlet pressure at port A , but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

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



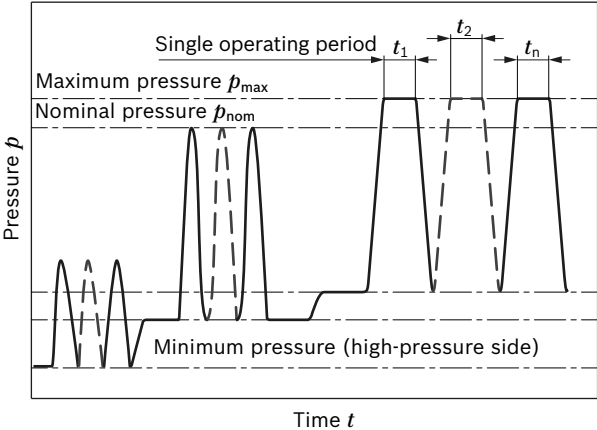
Notice

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 “W”	Clockwise	A to B
	Counterclockwise	B to A

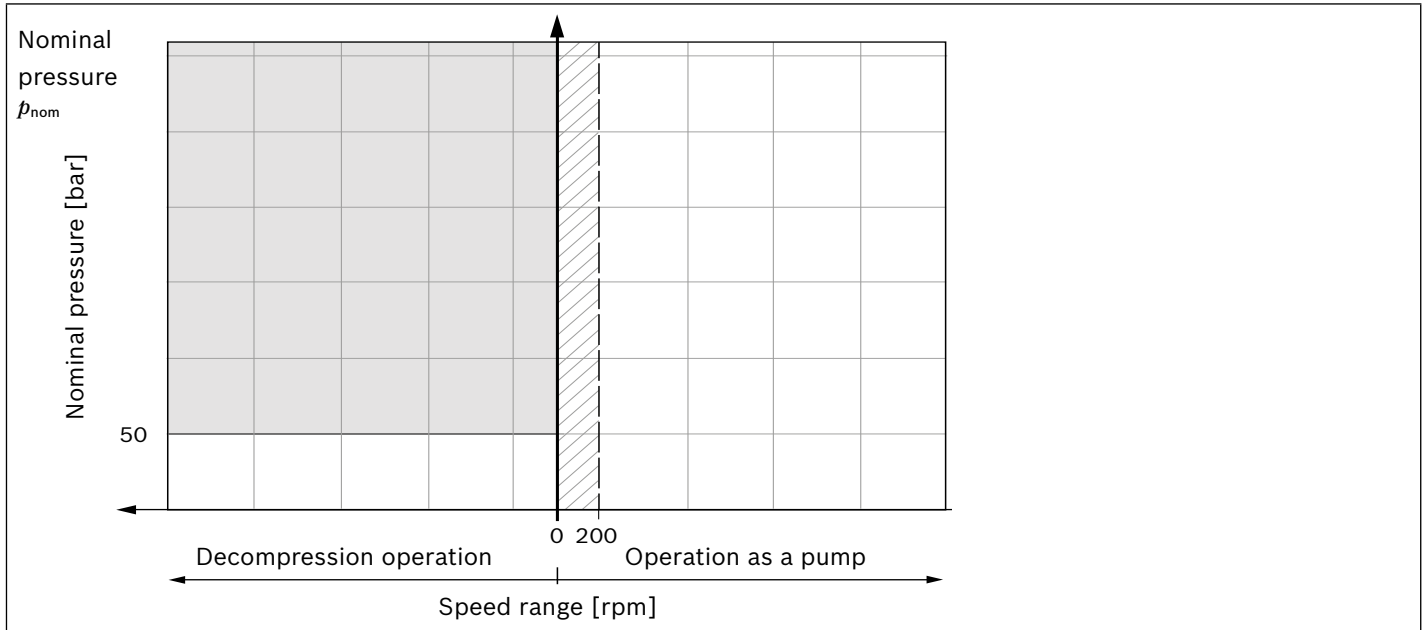
▼ Pressure definition



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

1) Please contact us about lower pressures
2) Higher values on request

A10VZG: 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 $t \leq 200$ ms

Technical data A10VZG

Size		NG	3	6	8	10	18	28
Displacement, geometric, per revolution		$V_{g \max}$ cm ³	3.5	6	8	10.5	18	28
Rotational speed at $V_{g \max}$ maximum ¹⁾								
Operation as a pump ¹⁾		n_{nom} rpm	3300	3300	3300	3300	3300	3000
Decompression operation ²⁾		n_{nom} rpm	3300	3300	3300	3300	3300	3000
Flow, operation as a pump	at n_{nom} and $V_{g \max}$	q_v l/min	12	20	26	35	59	84
Power operation as a pump	at n_{nom} , $V_{g \max}$ and $\Delta p = 250$ bar	P kW	5	8	11	14	–	–
	at n_{nom} , $V_{g \max}$ and $\Delta p = 280$ bar	P kW	–	–	–	–	28	39
Torque	at $V_{g \max}$ and $\Delta p = 250$ bar	T Nm	14	24	32	42	–	–
	at $V_{g \max}$ and $\Delta p = 280$ bar	T Nm	–	–	–	–	80	125
	at $V_{g \max}$ and $\Delta p = 100$ bar	T Nm	6	10	13	17	29	45
Rotary stiffness of drive shaft	S	c Nm/rad	9200	9200	9200	9200	–	–
	R	c Nm/rad	–	–	–	–	14800	26300
Moment of inertia for rotary group		J_{TW} kgm ²	0.0006	0.0006	0.0006	0.0006	0.0009	0.0017
Maximum angular acceleration ²⁾³⁾		α rad/s ²	14000	14000	14000	14000	12600	11200
Case volume		V l	0.2	0.2	0.2	0.2	0.32	0.5
Weight (approx.)		m kg	11.3	11.3	11.3	11.3	13.5	20

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

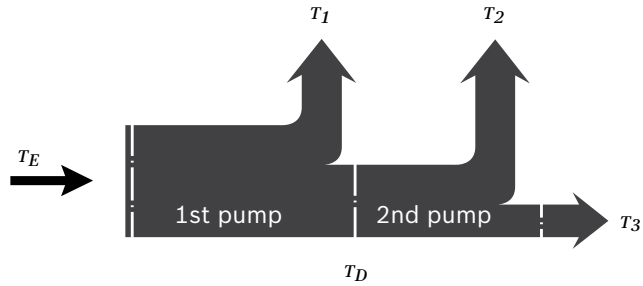
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommends testing the load by means of experiment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

- 1) The values are applicable:
 - At absolute pressure $p_{abs} \geq 1$ bar on the low-pressure side (input)
 - For the optimal viscosity range of $\nu_{opt} = 36$ to 16 mm²/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.

Permissible input and through-drive torques

Size			10	18	28
Torque at $V_{g\ max}$ and $\Delta p = 250\ \text{bar}^{1)}$	T_{max}	Nm	42	–	–
Torque at $V_{g\ max}$ and $\Delta p = 280\ \text{bar}^{1)}$	T_{max}	Nm	–	80	125
Maximum input torque at drive shaft ²⁾					
S	$T_{E\ max}$	Nm	126	–	–
	$\emptyset$	in	3/4	–	–
R	$T_{E\ max}$	Nm	–	160	250
	$\emptyset$	in	–	3/4	7/8

▼ 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	$T_D = T_2 + T_3$
	$T_D < T_{D\ max}$

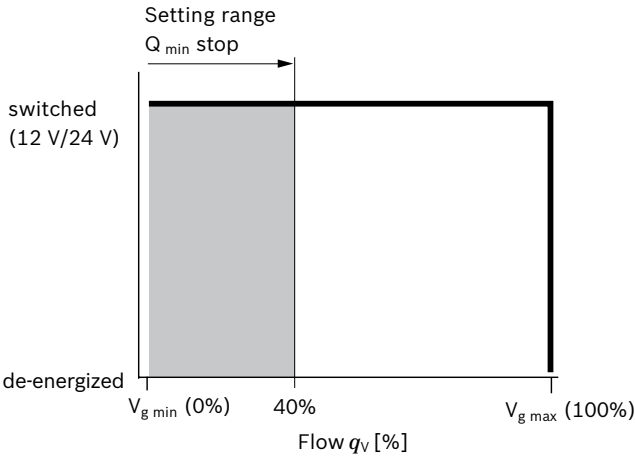
1) Efficiency not considered

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 via the shuttle valve from the current 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

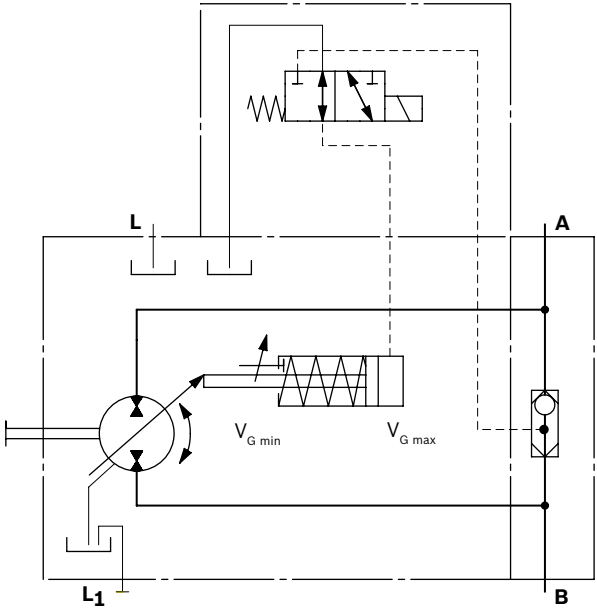


De-energized $\triangleq V_{g \max}$
 Current switch on $\triangleq V_{g \min}$

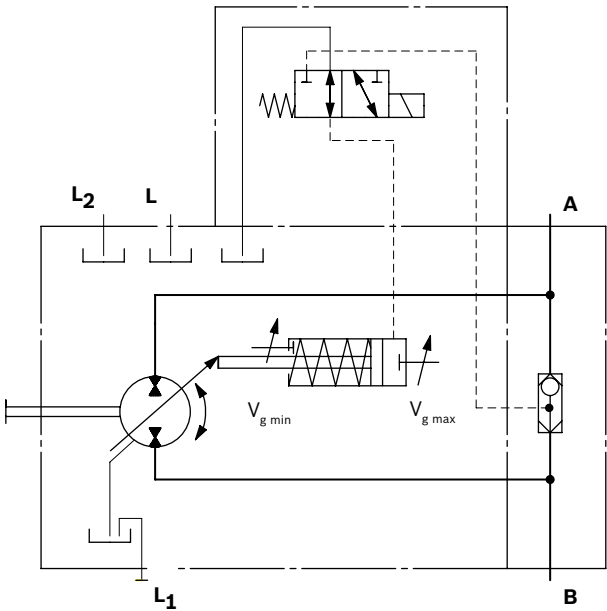
Technical data, solenoid	EZ300	EZ400
Voltage	12 V ($\pm 15\%$)	24 V ($\pm 15\%$)
Position $V_{g \max}$	de-energized	de-energized
Position $V_{g \min}$	Current switched on	Current switched on
Nominal current at 20 °C	1.5 A	0.8 A
Duty cycle	100%	100%
Type of protection: see connector version page 102		

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

▼ Schematic A10VZG...EZ 3/4 sizes 3 to 10



▼ Schematic A10VZG...EZ 3/4 sizes 18 to 28



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.

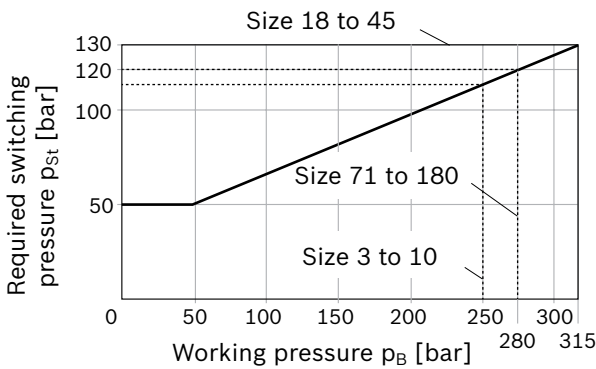
The variable pump can only be switched between $V_{g \min}$ and $V_{g \max}$. Specify the pre-setting in plain text.

Please note that the required switching pressure at port **X** is directly dependent on the actual working pressure p_B on working port **A** or **B**. (See switching pressure characteristic curve).

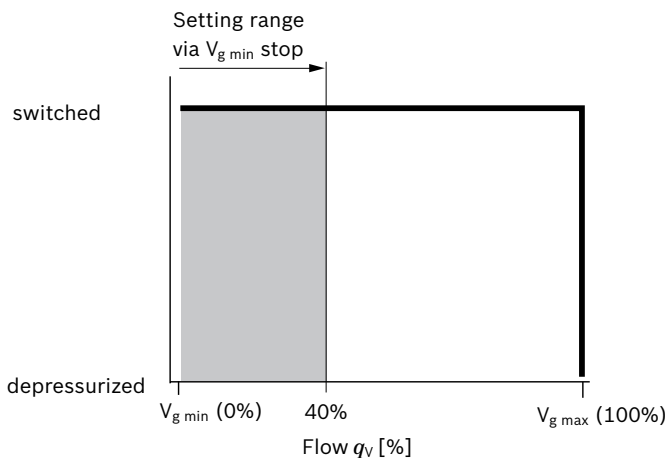
The maximum permissible switching pressure corresponds to the nominal pressure of the pump.

- Switching pressure p_{st} in $X = 0$ bar $\triangleq V_{g \max}$
- Switching pressure p_{st} in $X \geq 50$ bar $\triangleq V_{g \min}$

▼ Switching pressure characteristic curve

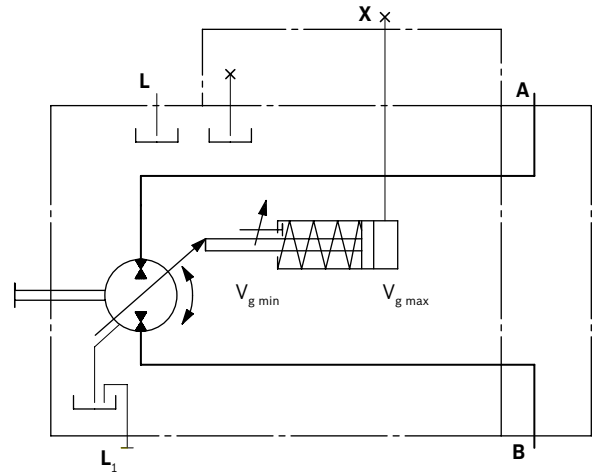


▼ Characteristic curve DG000

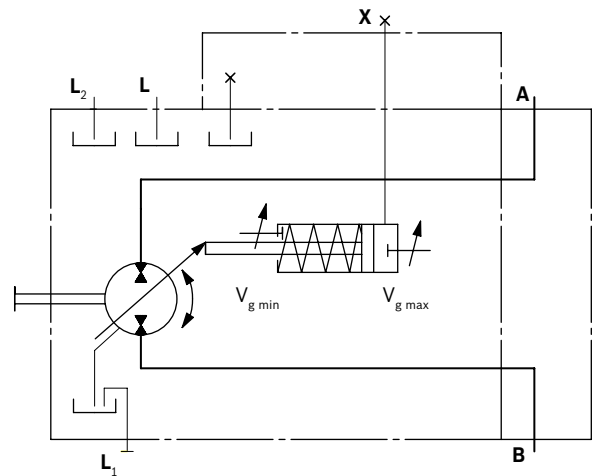


- Depressurized $\triangleq V_{g \max}$
- Pressure switch on $\triangleq V_{g \min}$

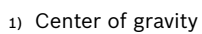
▼ Circuit diagram DG; A10VZG size 3 to 10



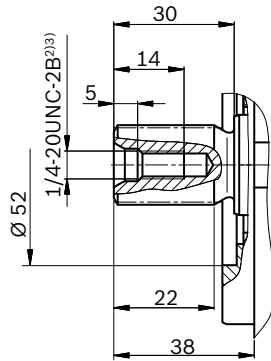
▼ Circuit diagram DG; A10VZG size 18 to 28



EZx – two-point control electric, direction of rotation changing (flow direction see table page 80)



▼ Splined shaft 3/4 in SAE J744

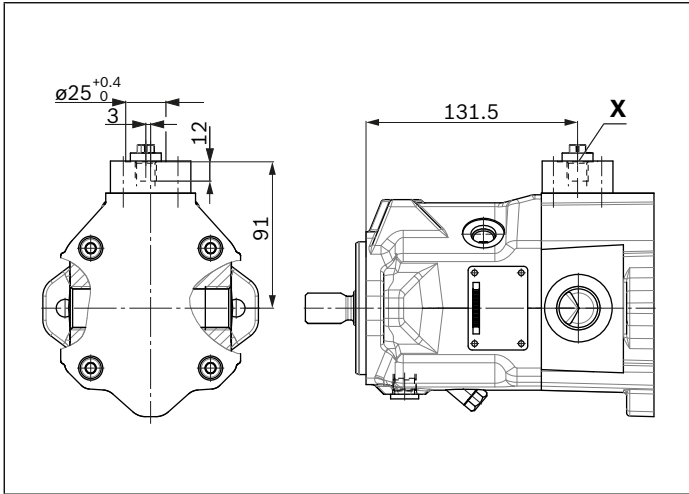
S – 11T 16/32DP¹⁾Connection table **A10VZG**

Ports		Standard	Size ³⁾	$p_{\max \text{ abs}}$ [bar] ⁴⁾	State ⁷⁾
A/B	Working port (standard pressure series)	DIN 3852-1	M27 × 2; 16 deep	315	O
L	Drain port	ISO 11926 ⁵⁾	9/16-18UNF-2B; 12.5 deep	2	O ⁶⁾
L₁	Drain port	ISO 11926 ⁵⁾	9/16-18UNF-2B; 12.5 deep	2	X ⁶⁾
X	Pilot pressure port (DG only)	DIN ISO 228 ⁵⁾	G 1/4; 12 deep	315	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) 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.

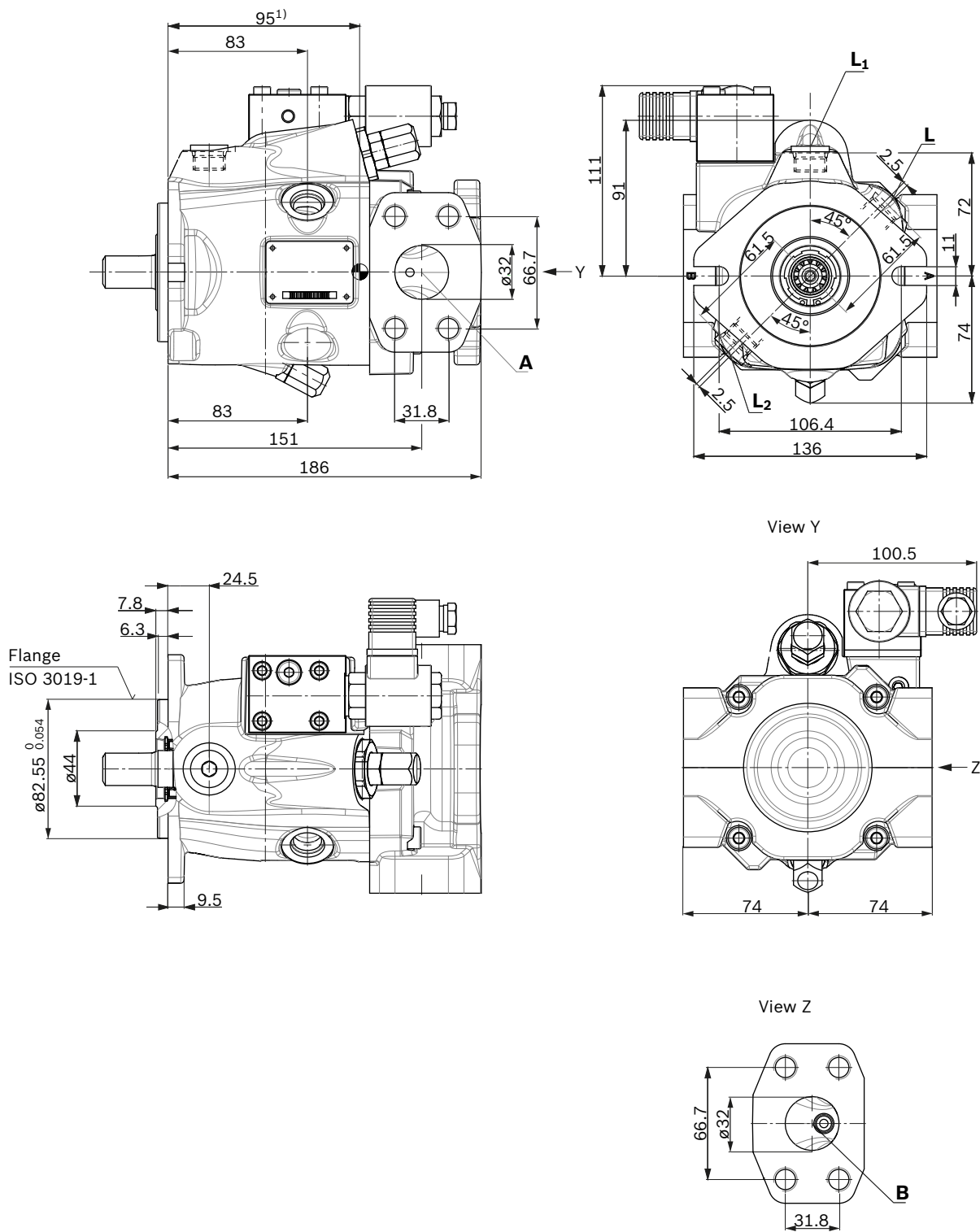
- 5) The countersink can be deeper than as specified in the standard.
- 6) Depending on the installation position, L or L₁ must be connected (also see installation instructions starting on page 103).
- 7) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

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



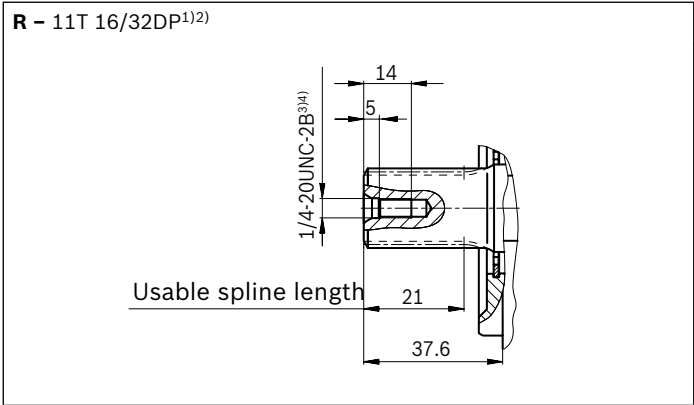
Dimensions A10 VZG size 18

EZx – two-point control electric, direction of rotation changing (flow direction see table page 80)



1) Center of gravity

▼ Splined shaft 3/4 in SAE J744

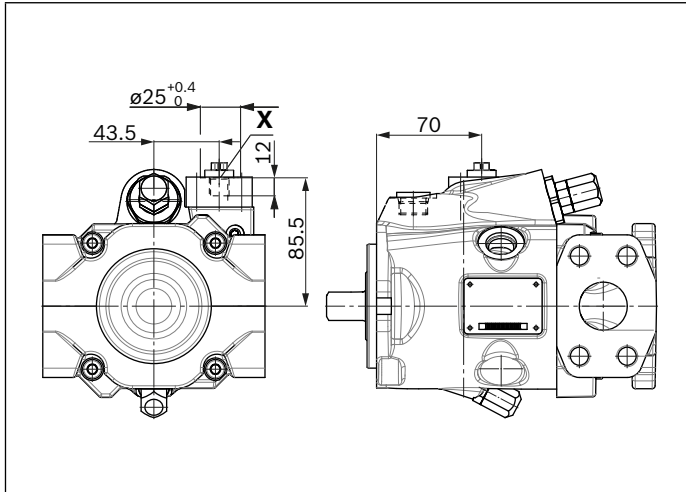


Connection table **A10VZG**

Ports		Standard	Size ⁴⁾	$p_{\text{max abs}}$ [bar] ⁵⁾	State ⁹⁾
A/B	Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	315	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
L	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	O ⁸⁾
L₁, L₂	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	X ⁸⁾
X	Pilot pressure port (DG only)	DIN ISO 228 ⁷⁾	G 1/4; 12 deep	315	O

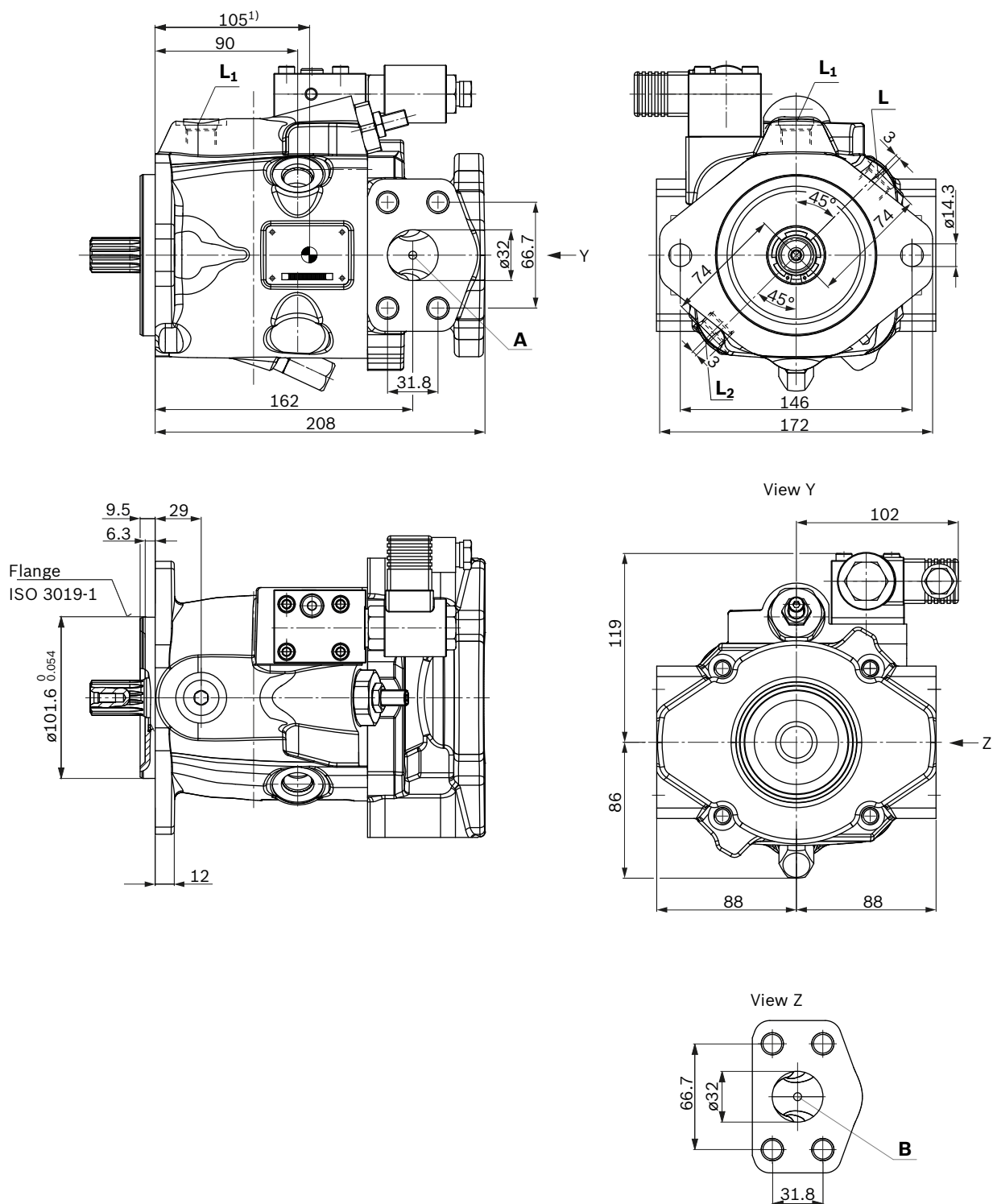
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard.
3) Thread according to ASME B1.1
4) For notes on tightening torques, see the instruction manual.
5) Depending on the 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, L₁ or L₂ 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**

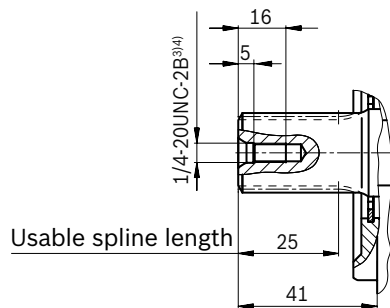
Dimensions A10 VZG size 28

EZx – two-point control electric, direction of rotation changing (flow direction see table page 80)



1) Center of gravity

▼ Splined shaft 7/8 in SAE J744

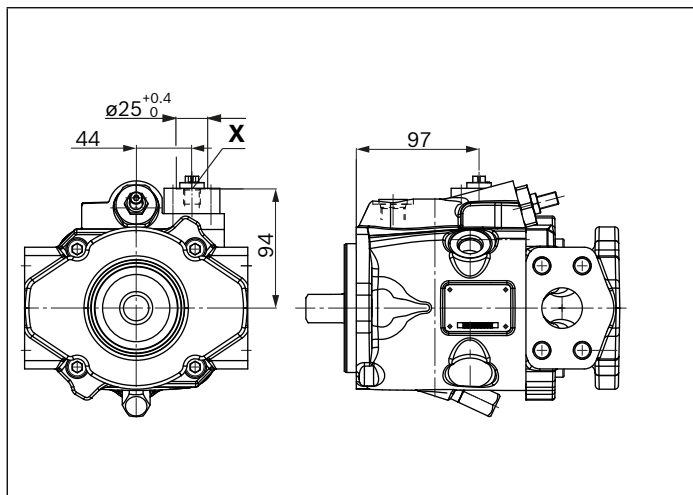
R – 13T 16/32DP¹⁾²⁾Connection table **A10VZG**

Ports		Standard	Size ⁴⁾	$p_{\max \text{ abs}}$ [bar] ⁵⁾	State ⁹⁾
A/B	Working port (high-pressure series)	SAE J518 ⁶⁾	1 1/4 in	315	O
	Fastening thread	DIN 13	M14 × 2; 19 deep		
L	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	O ⁸⁾
L₁, L₂	Drain port	ISO 11926 ⁷⁾	3/4-16UNF-2B; 14 deep	2	X ⁸⁾
X	Pilot pressure port (DG only)	DIN ISO 228 ⁷⁾	G 1/4; 12 deep	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, L₁ or L₂ must be connected (also see installation instructions starting on page 103).
- 9) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

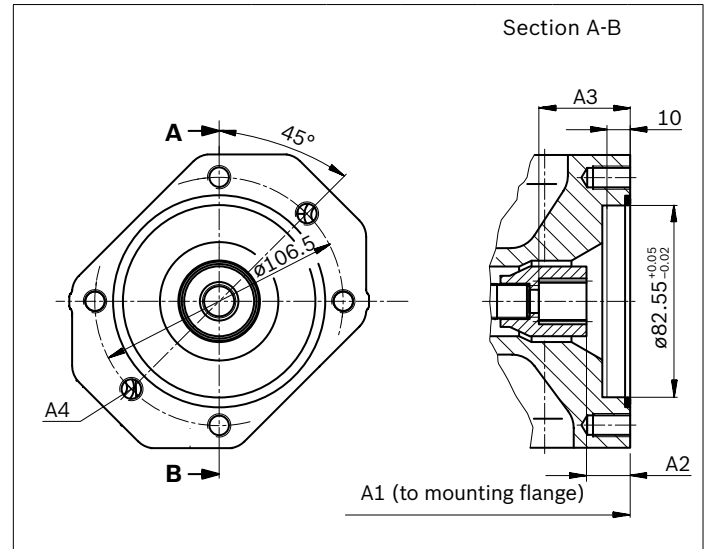
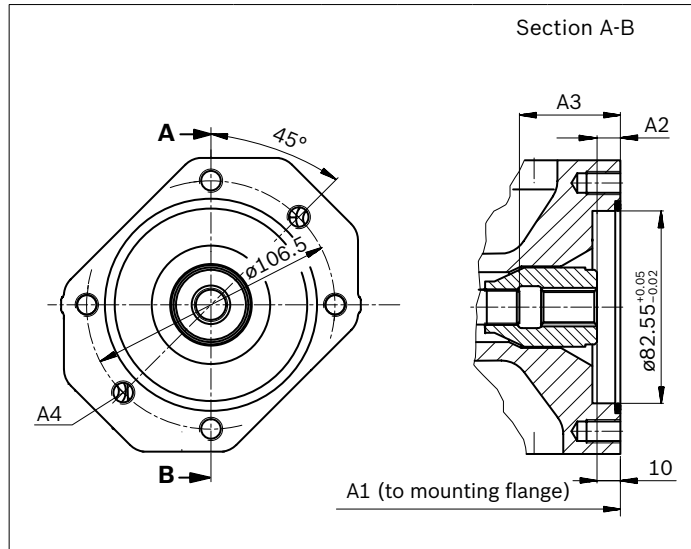
▼ **DG – Two-point control, direct operated**



Dimensions through drive for port plates 07 and 12 (A10VZO)

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾		Availability over sizes				Code
Diameter	Symbol ²⁾	Diameter		3 to 10	18	28	45	
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	A3	A4 ³⁾
	10	176	9.3	31.8	M10×1.5; 14.5 deep
	18	182	10	43.3	M10×1.5; 14.5 deep
	28	204	10	33.7	M10×1.5; 16 deep
	45	229	10.7	33.7	M10×1.5; 16 deep

K52 (SAE J744 19-4 (A-B))	NG	A1	A2	A3	A4 ³⁾
	10	176	16	38	M10×1.5; 14.5 deep
	18	182	18.8	38.7	M10×1.5; 14.5 deep
	28	204	18.8	38.7	M10×1.5; 16 deep
	45	229	18.9	38.7	M10×1.5; 16 deep

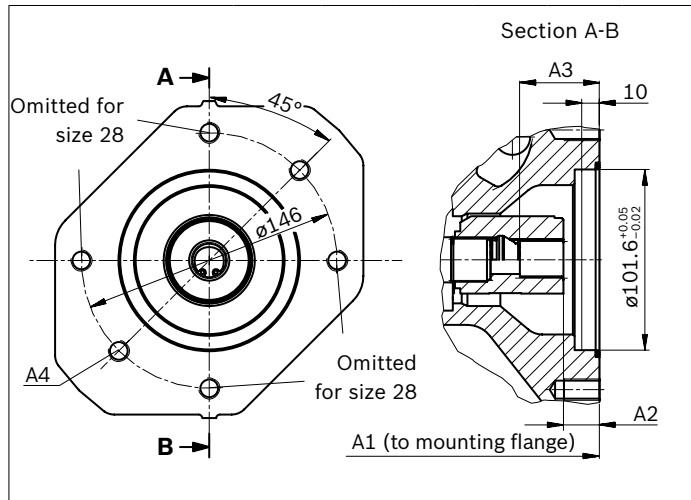
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top

3) Thread according to DIN 13, see instruction manual for details on tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾		Availability over sizes				Code
Diameter	Symbol ²⁾	Diameter		3 to 10	18	28	45	
101-2 (B)	ϕ, ∞	7/8 in	13T 16/32DP	-	-	•	•	K68
		1 in	15T 16/32DP	-	-	-	•	K04

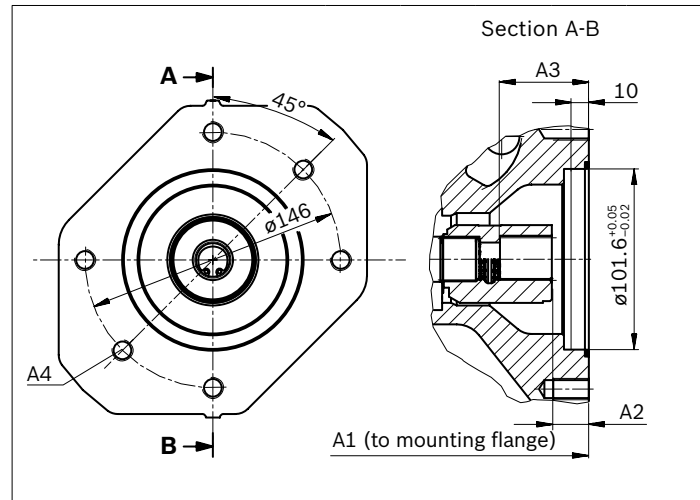
• = Available ∅ = On request - = Not available

▼ 101-2



K68 (SAE J744 22-4 (B))	NG	A1	A2	A3	A4 ³⁾
	28	204	17.8	41.7	M12×1.75; 18 deep
	45	229	17.9	41.7	M12×1.75; 18 deep

▼ 101-2



K04 (SAE J744 25-4 (B-B))	NG	A1	A2	A3	A4 ³⁾
	45	229	18.4	46.7	M12×1.75; 18 deep

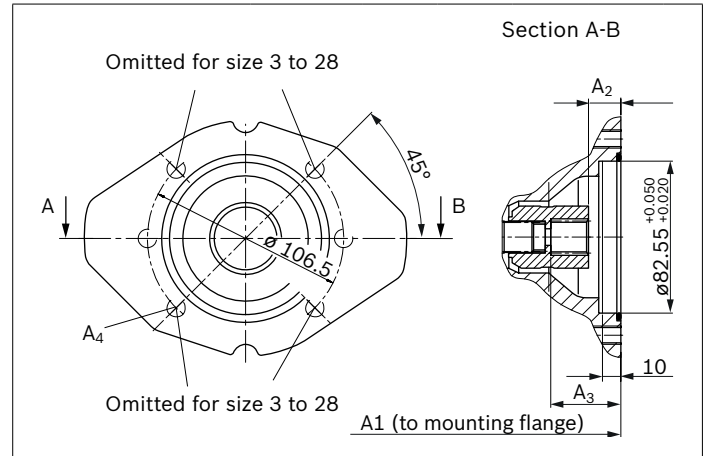
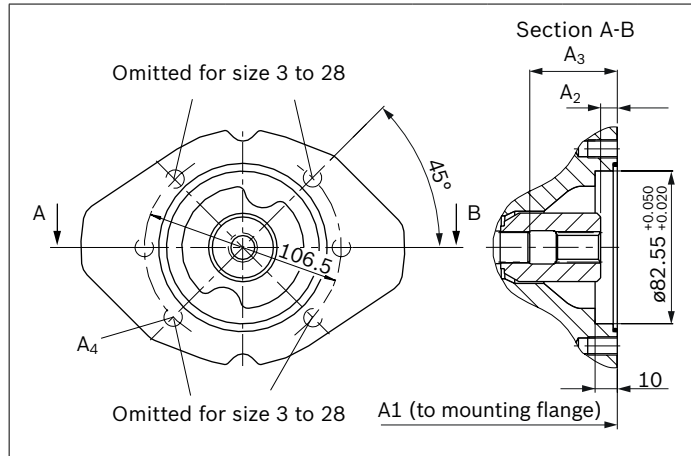
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top

3) Thread according to DIN 13, see instruction manual for details on tightening torques.

Dimensions through drive for port plate 02 (A10FZO and FZG)

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾		Availability over sizes					Code
Diameter	Symbol ²⁾	Diameter		3 to 10	12 to 18	21 to 28	37 to 45	58 to 63	
82-2 (A)	ϕ , ∞	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	A3	A4³⁾
	3 to 10	163	10.8	33.3	M10×1.5; 14.5 deep
	12 to 18	168	9.3	43.3	M10×1.5; 14.5 deep
	21 to 28	194	9.9	47	M10×1.5; 16 deep
	37 to 45	217	10.7	53	M10×1.5; 16 deep
	58 to 63	243	9.5	59	M10×1.5; 16 deep

K52 (SAE J744 19-4 (A-B))	NG	A1	A2	A3	A4³⁾
	3 to 10	163	17.6	39.6	M10×1.5; 14.5 deep
	12 to 18	168	18.8	39	M10×1.5; 14.5 deep
	21 to 28	194	18.8	39.3	M10×1.5; 16 deep
	37 to 45	217	18.7	39.2	M10×1.5; 16 deep
	58 to 63	243	18.9	39.4	M10×1.5; 16 deep

¹⁾ According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

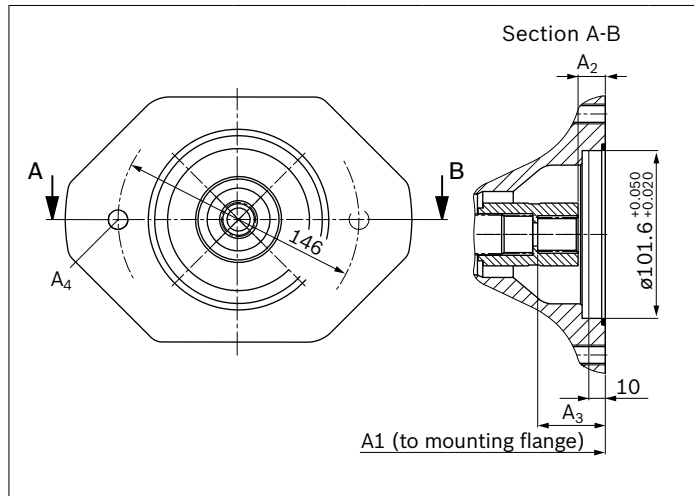
²⁾ Mounting holes pattern viewed on through drive with control at top

³⁾ Thread according to DIN 13, see instruction manual for details on tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾		Availability over sizes					Code
Diameter	Symbol ²⁾	Diameter		3 to 10	12 to 18	21 to 28	37 to 45	58 to 63	
101-2 (B)	∞	7/8 in	13T 16/32DP	-	-	•	•	•	K68
		1 in	15T 16/32DP	-	-	-	•	•	K04

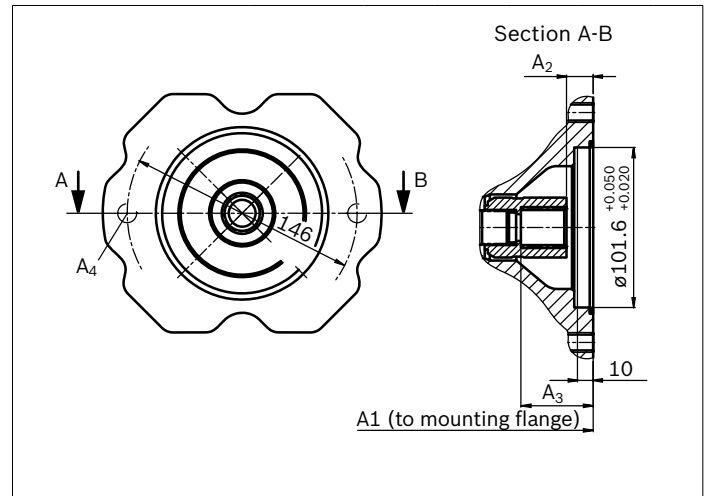
• = Available ∞ = On request - = Not available

▼ 101-2



K68 (SAE J744 22-4 (B))	NG	A1	A2	A3	A4 ³⁾
	21 to 28	194	17.8	42.3	M12×1.75; 18 deep
	37 to 45	217	17.7	42.2	M12×1.75; 18 deep
	58 to 63	243	17.9	42.4	M12×1.75; 18 deep

▼ 101-2



K04 (SAE J744 25-4 (B-B))	NG	A1	A2	A3	A4 ³⁾
	37 to 45	217	18.9	47.9	M12×1.75; 18 deep
	58 to 63	243	18.2	47.2	M12×1.75; 18 deep

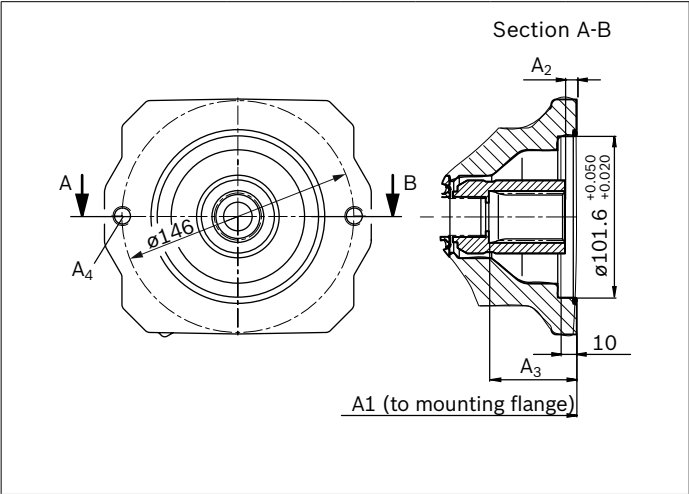
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top

3) Thread according to DIN 13, see instruction manual for details on tightening torques.

Flange ISO 3019-1 (SAE)		Hub for splined shaft ¹⁾	Availability over sizes					Code
Diameter	Symbol ²⁾	Diameter	3 to 10	12 to 18	21 to 28	37 to 45	58 to 63	
101-2 (B)	⊙	1 1/4 in 14T 12/24DP	-	-	-	-	●	K06

● = Available ⊙ = On request - = Not available

▼ 101-2



K06	NG	A1	A2	A3	A4 ³⁾
(SAE J744 32-4 (C))	58 to 63	243	7.4	55.4	M12×1.75; 18 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, see instruction manual for details on tightening torques.

Overview of mounting options for A10VZO with port plate 07 and 12 or A10FZO, A10FZG with port plate 02

Overview of mounting options for A10VZO with port plate 07 and 12 or A10FZO, A10FZG with port plate 02

Through drive		Mounting options – 2nd pump				
Flange ISO 3019-1	Hub for splined shaft	Code	A10VZO/10 NG (shaft)	A10FZO	A10FZG	A10VZG
82-2 (A)	3/4 in	K52	3 to 10 (S) 18 (S) 18 (R)	3 to 10 (S) 11 to 18 (R)	3 to 10 (S) 11 to 18 (R)	3 to 10 (S) 18 (R)
101-2 (B)	7/8 in	K68	28 (R)	21 to 28 (R)	21 to 28 (R)	28 (R)
	1 in	K04	–	37 to 45 (R)	37 to 45 (R)	45 (R)
	1 1/4 in	K06	–	63 (R)	–	–

Overview of mounting options for A10VZO with port plate 22U

Through drive		Mounting options – 2nd pump				
Flange (SAE) ISO 3019-1	Hub for splined shaft	Code	A10VZO/10 NG (shaft)	A10FZO	A10FZG	A10VZG
82-2 (A)	3/4 in	U52	10 (S) , 18 (R)	3 to 10 (S) 11 to 18 (R)	3 to 10 (S) 11 to 18 (R)	3 to 10 (S) 18 (R)
101-2 (B)	7/8 in	U68	28 (R)	21 to 28 (R)	21 to 28 (R)	28 (R)
	1 in	U04	–	37 to 45 (R)	37 to 45 (R)	45 (R)
	1 1/4 in	U06	–	63 (R)	–	–
127-4 (C)	1 in	UE2	45 (R)			
127-4 (C)	1 1/4 in	U15	71 (R)			
152-4 (D)	1 1/2 in	U96	100 (S)			
	1 3/4 in	U17	140, 180 (S)			

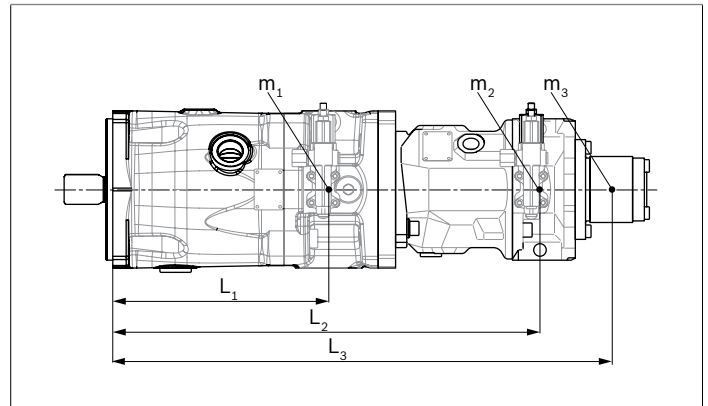
Combination pumps A10VZO + A10VZO, A10VZG, A10FZO or A10FZG

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

Order example:**A10VZO71LA5D/10R-VRD22UE2+****A10VZO45DRG/10R-VRD12N00**

It is permissible to use a combination of two single pumps of the same nominal size (tandem pump) considering a dynamic mass acceleration of maximum 10 g ($= 98.1\text{ m/s}^2$) without additional support brackets.

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



m_1, m_2, m_3 Weight of pump [kg]

l_1, l_2, l_3 Distance from center of gravity [mm]

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

Permissible mass moment of inertia A10VZO

Size			10	18	28	45	71	100	140	180
static	T_m	Nm	500	500	880	1370	3000	4500	4500	4500
dynamic at 10 g (98.1 m/s^2)	T_m	Nm	50	50	88	137	300	450	450	450
Weight with through-drive plate	m	kg	10.5	14	19	30				
Weight without through-drive plate (e.g. 2nd pump)			9	12	15	26	47	69	73	78
Distance, center of gravity without through drive	l_1	mm		90	110	130	142	169	172	196
Distance, center of gravity with through drive	l_1	mm								on request

Permissible mass moment of inertia A10FZO, A10FZG

Size			3 to 10	12 to 18	21 to 28	37 to 45	58 to 63
static	T_m	Nm	500	500	890	900	1370
dynamic at 10 g (98.1 m/s^2)	T_m	Nm	50	50	89	90	137
Weight (approx.)	m	kg	9	10	15.5	21	26
Distance from center of gravity	l_1	mm	92	96	105	125	136

Connector for solenoids

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

without bidirectional suppressor diode _____H

There is the following degree of protection with the installed mating connector:

- IP65 (DIN/EN 60529)

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

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

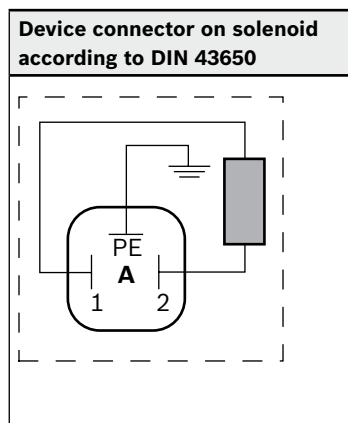
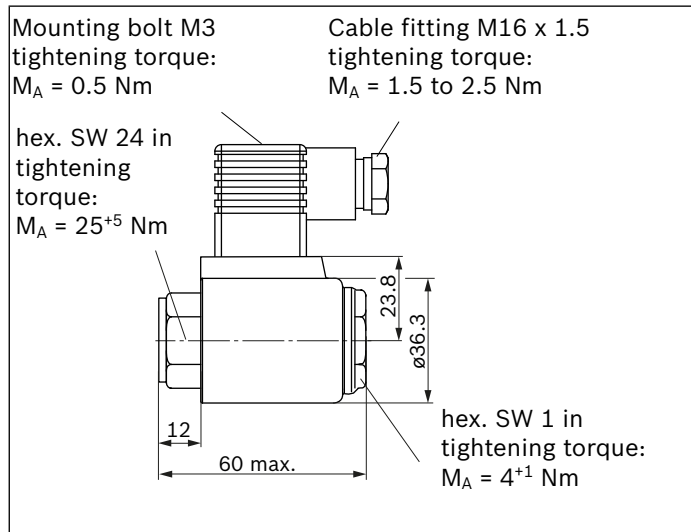
This can be supplied by Bosch Rexroth on request.

Bosch Rexroth material number: R902602623

Notice

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

The procedure is defined in the instruction manual.



Installation instructions A10FZO; A10VZO; A10FZG; A10VZG

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, for example, a danger of dry running. The leakage in the housing area must be discharged to the reservoir via the highest available tank port (**L**, **L₁**).

If a shared drain line is used for several units, make sure that the respective case pressure 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 operational conditions, particularly at cold start. If this is not possible, separate drain lines must be installed if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level.

The permissible suction height h_s results from the total pressure loss. However, it must not be higher than $h_{s\max} = 800$ mm. The minimum suction pressure at port **S(A/B)** must also not fall below 0.8 bar absolute during operation and during cold start. Above-reservoir installation reduces the permissible maximum speed.

When designing the reservoir, ensure that there is adequate spacing between the suction line and the drain line. This reduces turbulence in the hydraulic fluid and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

For key, see page 104.

Installation position

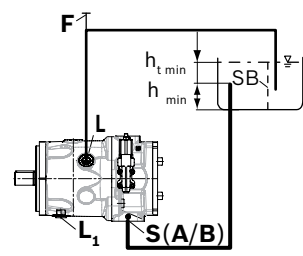
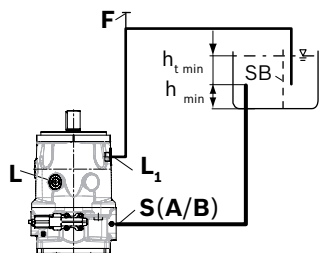
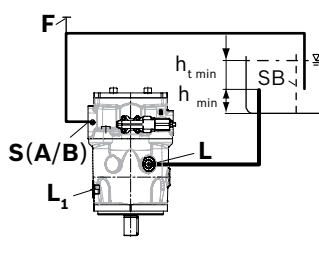
See the following examples **1** to **8**.

Further installation positions are available upon request.

Recommended installation position: **1** to **4**

Below-reservoir installation (standard)

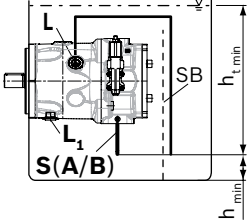
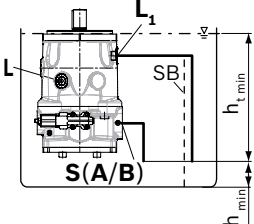
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir and below the minimum fluid level of the reservoir.

Installation position	Air bleed	Filling
1	F	L or L₁
		
2¹⁾	F	L₁
		
3¹⁾	F	L₁
		

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 electric components (e.g. electric controls, sensors) must not be installed in a reservoir below the fluid level.

Installation position	Air bleed	Filling
4 	Via the highest available port L	Automatically via the open port L or L₁ due to the position under the hydraulic fluid level
5¹⁾ 	Via the highest available port L₁	Automatically via the open port L, L₁ due to the position under the hydraulic fluid level

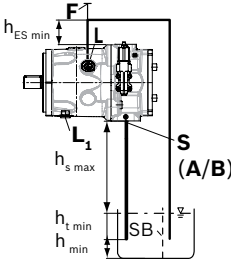
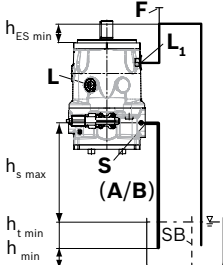
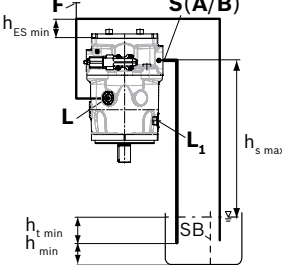
A check valve in the drain line is only permissible in isolated cases. Consult us for approval.

Key and assembly note

Key	
F	Filling / air bleeding
S	Suction port (with A10FZG; A10FZO and A10VZG A/B)
L; L₁	Tank port
SB	Baffle (baffle plate)
ht min	Minimum required immersion depth (200 mm)
hmin	Minimum required distance to the reservoir bottom (100 mm)
hES min	Minimum necessary height required to protect the axial piston unit from draining (25 mm)
hs max	Maximum permissible suction height (800 mm)

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining in position 6 to 8, the height difference hES min must be at least 25 mm. Observe the maximum permissible suction height $h_{s\ max} = 800\text{ mm}$. The maximum speed in above-reservoir installation is only permissible if at least 1 bar absolute is complied with on input **S(A/B)**.

Installation position	Air bleed	Filling
6 	F	L₁ or L
7¹⁾ 	F	L₁
8¹⁾ 	F	L₁

Notice

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

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

Project planning notes

- ▶ The axial piston units A10FZO and A10VZO are designed to be used in open circuit.
- ▶ The axial piston units A10FZG and A10VZG are designed to be used in open or closed circuit.
- ▶ The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ Before finalizing your design, 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 curves may shift.
- ▶ Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative 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 in the instruction manual.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person 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. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference. Other behavior can result when a modulated direct current (e.g. PWM signal) is applied.
- ▶ Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.
- ▶ Pressure controllers are not protection against overpressure. A pressure relief valve is to be provided for the hydraulic system.
- ▶ Working ports:
 - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
 - The working ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- ▶ During and shortly after operation, there is a risk of 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. impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer 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.

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