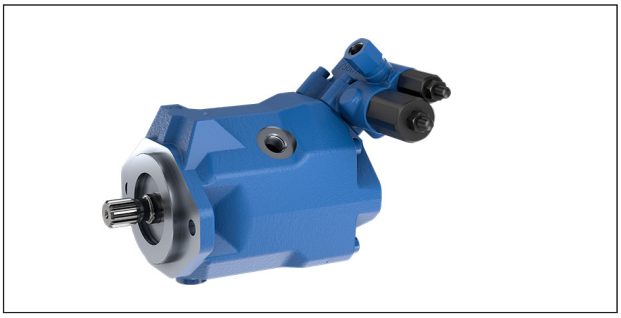
RE 92713/2023-07-06
Replaces –.–

rexroth
A Bosch Company

Axial piston variable pump A10VSO 10 series 52



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

Features

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

Contents

Type code

01	02	03	04		05	06		07	08	09	10	11	12
A10VS	**O**	**10**		**/**	**52**		**–**	**V**					

Axial piston unit

01	Swashplate design, variable, nominal pressure 250 bar (3600 psi), maximum pressure 315 bar (4550 psi)	**A10VS**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, see table of values on page 6	**10**

Control device

					SAE	ISO	
04	Pressure controller	Hydraulic			●	●	**DR**
	With flow controller	Hydraulic	X-T open		●	●	**DFR**
			X-T plugged	With flushing function	●	●	**DFR1**
	With pressure cut-off	Hydraulic	Remote controlled		●	●	**DRG**

Series

					SAE	ISO	
05	Series 5, index 2				●	●	**52**

Direction of rotation

					SAE	ISO	
06	Viewed on drive shaft			Clockwise	●	●	**R**
				Counter-clockwise	●	●	**L**

Sealing material

					SAE	ISO	
07	FKM (fluorocarbon rubber)				●	●	**V**

Drive shaft

					SAE	ISO	
08	Splined shaft ISO 3019-1	Standard shaft			●	●	**S**
		Reduced diameter			●	●	**U**
	Parallel keyed	Shaft DIN 6885			–	●	**P**
		Shaft ISO 3019-1			●	–	**K**

Mounting flange

					SAE	ISO	
09	Based on ISO 3019-2			2-hole	–	●	**A**
	Based on ISO 3019-1			2-hole	●	●	**C**

Working port

					SAE	ISO	
10	Threaded port, **metric**	Rear			–	●	**14**
	Threaded port, **UNC**	Rear			●	–	**64**

Through drive

					SAE	ISO	
11	Without through drive				●	●	**N00**

● = Available o = On request – = Not available

Notice

- ▶ Observe the general project planning notes on page 19 and the project planning notes regarding each control device.
- ▶ In addition to the type code, please specify the relevant technical data.

Hydraulic fluids

The A10VSO variable pump is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

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

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

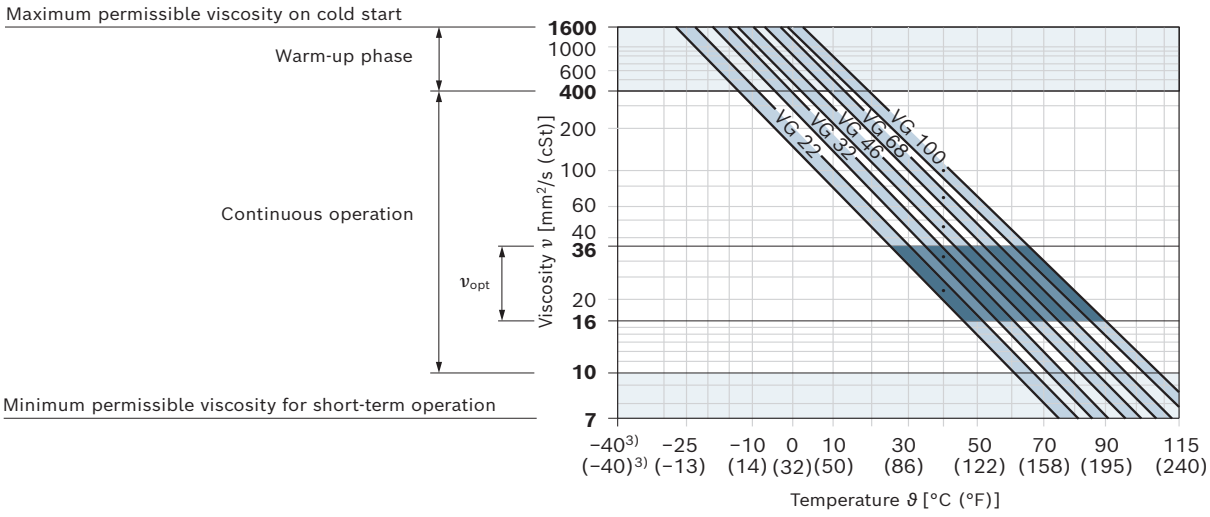
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

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

Viscosity and temperature of hydraulic fluids

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

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +4 °C to +85 °C (+39 °F to +113 °F) (see selection diagram)

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

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

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Filtration of the hydraulic fluid
Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.
A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406
At a hydraulic fluid viscosity of less than 10 mm²/s (cSt) (e.g., due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 acc. to ISO 4406 is required.

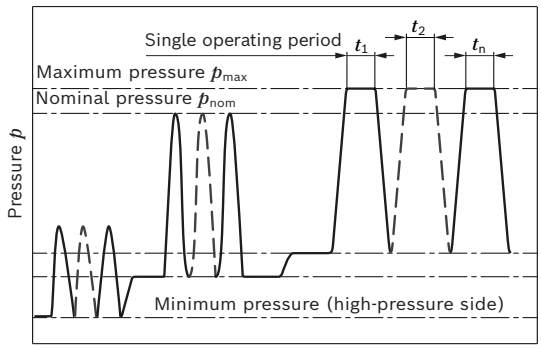
Examples of temperatures of hydraulic fluids at a viscosity of 10 mm²/s (cSt):
- 73 °C (163 °F) at HLP 32
- 85 °C (185 °F) at HLP 46

Working pressure range

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

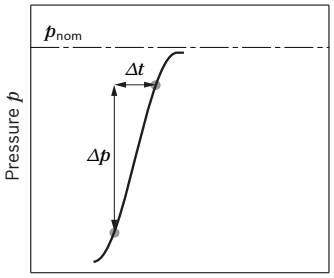
Notice
Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

▼ **Pressure definition**



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

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



Technical data

Size		NG		10
Geometric displacement, per revolution		$V_{g\,max}$	cm^3	10.5
			$inch^3$	0.64
Maximum rotational speed[1]	at $V_{g\,max}$	n_{nom}	rpm	3600
	at $V_g < V_{g\,max}$[2]	$n_{max\,perm}$	rpm	4320
Flow	at n_{nom} and $V_{g\,max}$	q_v	l/min	37
			gpm	9.7
	at n_E = 1500 rpm	q_{vE}	l/min	15
			gpm	4
Power	at n_{nom}, $V_{g\,max}$ and Δp = 250 bar (3600 psi)	P	kW	16
			HP	22
	at n_E = 1500 rpm	P_E	kW	7
			HP	9.4
Torque	at $V_{g\,max}$ and Δp = 250 bar (3600 psi)	M	Nm	42
			lb-ft	31
	at $V_{g\,max}$ and Δp = 100 bar (1450 psi)	M	Nm	17
			lb-ft	13
Rotary stiffness of drive shaft	S	c	kNm/rad	9.2
			lb-ft/rad	6760
	U	c	kNm/rad	6.8
			lb-ft/rad	5020
	P	c	kNm/rad	10.7
			lb-ft/rad	7892
	K	c	kNm/rad	10.8
			lb-ft/rad	7965
Moment of inertia of the rotary group		J_{TW}	kgm^2	0.0006
			$lb\text{-}ft^2$	0.0142
Maximum angular acceleration[3]		α	rad/s^2	8000
Case volume		V	l	0.2
			gal	0.05
Weight (approx.)		m	kg	8
			lbs	17

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

2) See the diagram "Maximum permissible rotational speed (speed limit)"

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

Determination of the characteristics					
Flow	q_v	=	$\frac{V_g \times n \times \eta_v}{1000\ (231)}$		[l/min (gpm)]
Torque	M	=	$\frac{V_g \times \Delta p}{20\ (24) \times \pi \times \eta_{hm}}$		[Nm (lb-ft)]
Power	P	=	$\frac{2\,\pi \times M \times n}{60000\ (33000)}$	= $\frac{q_v \times \Delta p}{600\ (1714) \times \eta_t}$	[kW (HP)]

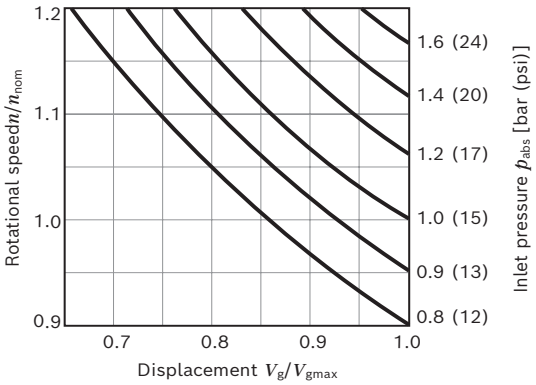
Key

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

Notice

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

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



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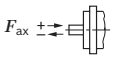
Permissible radial and axial loading of the drive shaft

Size		NG		10
Maximum radial force at a/2		$F_{q\ max}$	N	250
			lbf	56
Maximum axial force		$\pm F_{ax\ max}$	N	400
			lbf	90

Notice

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

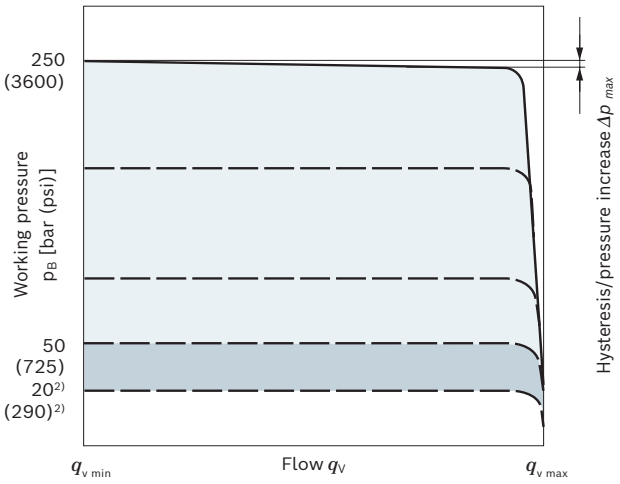
1) Efficiency not considered
2) For drive shafts with no radial force

DR – Pressure controller

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

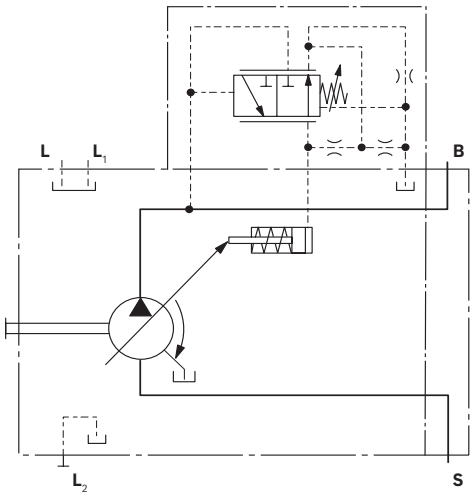
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] for pressure control 50 to 250 bar (725 to 3600 psi).
  Standard is 250 bar (3600 psi).

▼ **Characteristic curve DR**



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

▼ **Circuit diagram DR**



Controller data

Size		10
Pressure increase	Δp [bar]	6
	Δp [psi]	90
Hysteresis	Δp [bar]	Maximum 4
	Δp [psi]	Maximum 60
Pilot fluid consumption	l/min	Maximum approx. 3
	gpm	Maximum approx. 0.8

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) For settings below 50 bar (725 psi), please use the SO275 special pressure controller (setting range: 20 to 100 bar (290 to 1450 psi)).

DRG – Pressure controller, remotely controlled

For the remote controlled pressure controller, the LS pressure relief is performed using a separately arranged pressure relief valve. Therefore, any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 8.
A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control. When there is differential pressure of 20 bar (290 psi) Δp, the quantity of control fluid at the port is **X** approx. 1.5 l/min (0.4 gpm). If another setting is required (range from 14 to 22 bar / 200 to 320 psi) please state in plain text.
As a separate pressure relief valve (**1**) we recommend:

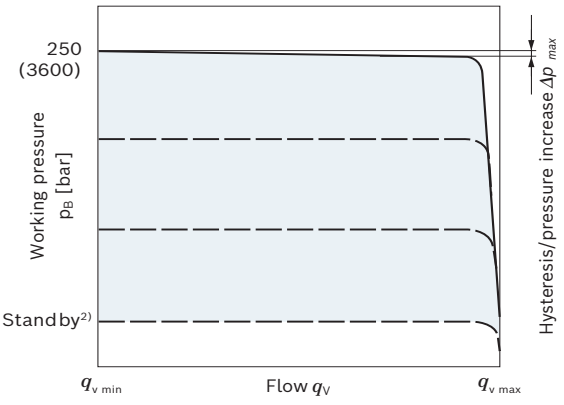
- A direct operated, hydraulic or electric proportional one, suitable for the control fluid mentioned above.

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

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

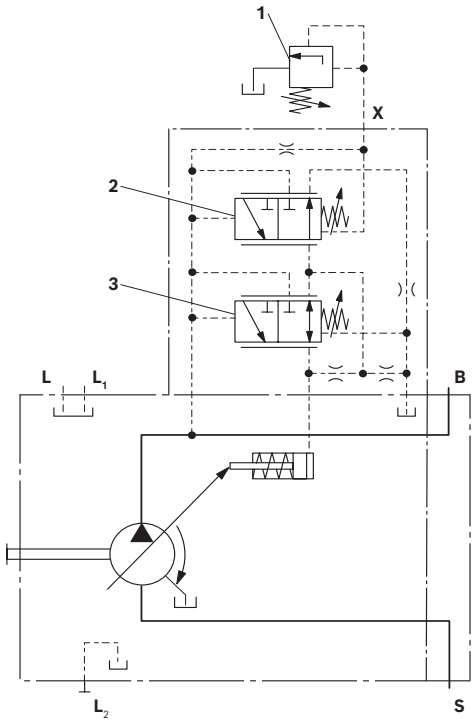
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure Δp, however system influences are not taken into account.

▼ **Characteristic curve DRG**



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

▼ **Circuit diagram DRG**



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

Controller data

Size		10
Pressure increase	Δp [bar]	6
	Δp [psi]	87
Hysteresis	Δp [bar]	Maximum 4
	Δp [psi]	Maximum 60
Pilot fluid consumption	l/min	Maximum approx. 3
	gpm	Maximum approx. 0.8

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

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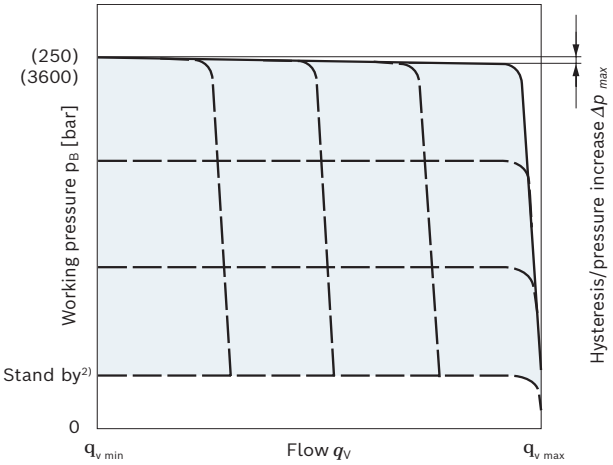
DFR/DFR1 – Pressure flow controller

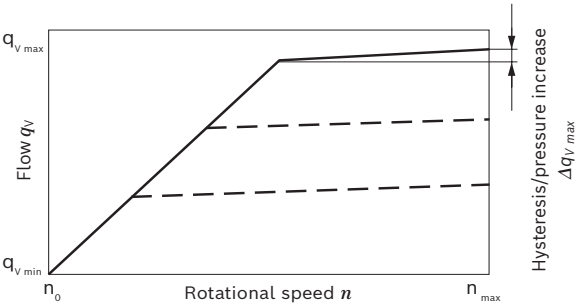
In addition to the pressure controller function (see page 8), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the V_g reduction has priority.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] to 250 bar (3600 psi)
- DR pressure controller data see page 8

▼ Characteristic curve DFR / DFR1

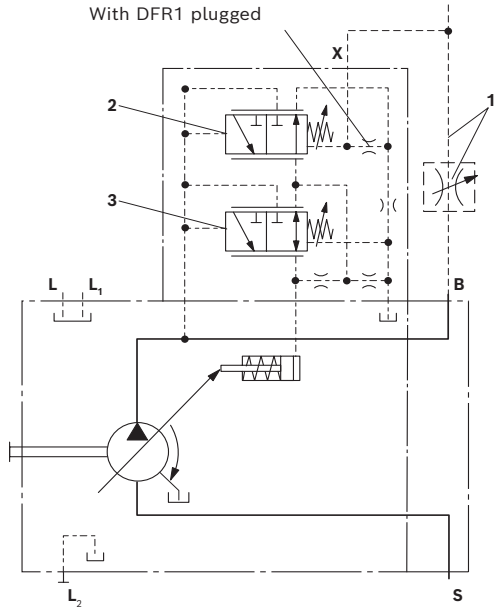


▼ Characteristic curve at variable rotational speed



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

▼ Circuit diagram DFR



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

Notice
The DFR1 version has no unloading between **X** and the reservoir.
The LS must thus be unloaded in the system.
Because of the flushing function of the flow controller in the DFR1 control valve, sufficient unloading of the **X**-line must also be provided.
If this unloading of the **X** line cannot be ensured, the DFR control valve must be used.

For further information see page 11

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

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Differential pressure Δp:

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

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

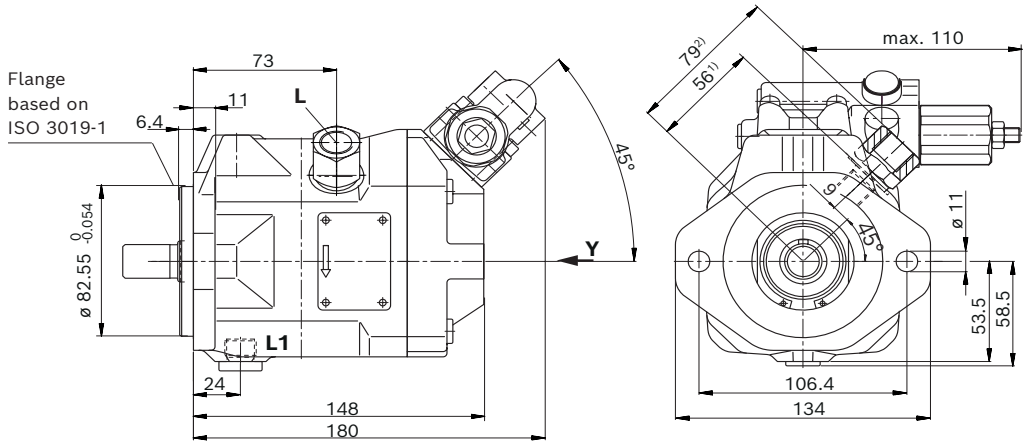
Controller data

- DR pressure controller data, see page 8
- Maximum flow deviation measured at drive speed n = 1500 rpm.

Size		10
Flow deviation	Δq_{vmax} [l/min]	0.5
	Δq_{vmax} [gpm]	0.13
Hysteresis;	Δp [bar]	Maximum 4
	Δp [psi]	Maximum 60
Pilot fluid consumption	l/min	Maximum approx. 3 to 4.5 (DFR) Maximum approx. 3 (DFR1)
	gpm	Maximum approx. 0.8 to 1.2 (DFR) Maximum approx. 0.8 (DFR1)

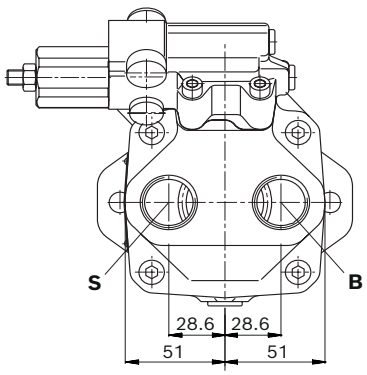
Dimensions, size 10

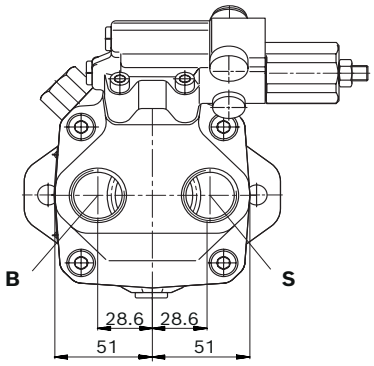
DR – Pressure controller; mounting flange C SAE version; port plate 64 and 14



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

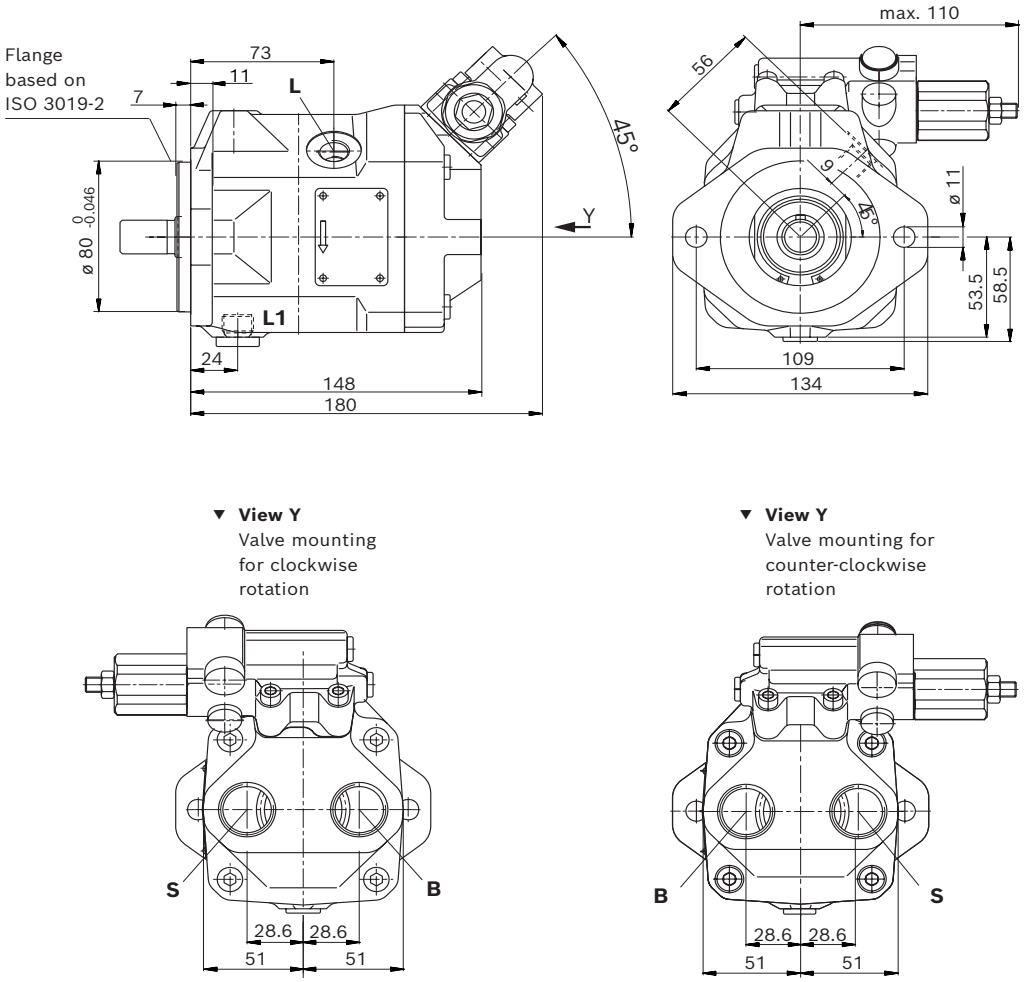
▼ **View Y**
Valve mounting for
counter-clockwise
rotation





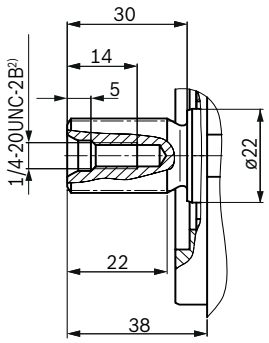
1) With port plate 64
2) With port plate 14

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



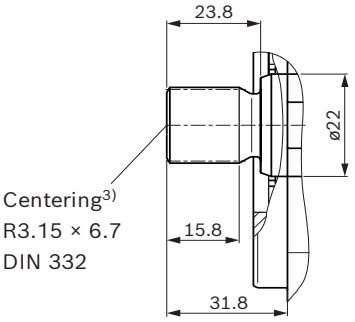
▼ **Splined shaft 3/4 in (19-4, ISO 3019-1)**

S – 11T 16/32DP[1)]



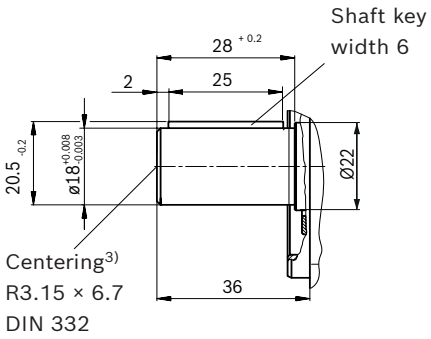
▼ **Splined shaft 5/8 in (16-4, ISO 3019-1)**

U – 9T 16/32DP[1)]



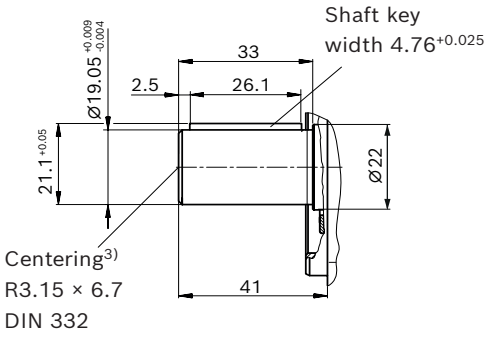
▼ **Parallel keyed shaft DIN 6885**

P – A6x6x25



▼ **Parallel keyed shaft DIN 6885**

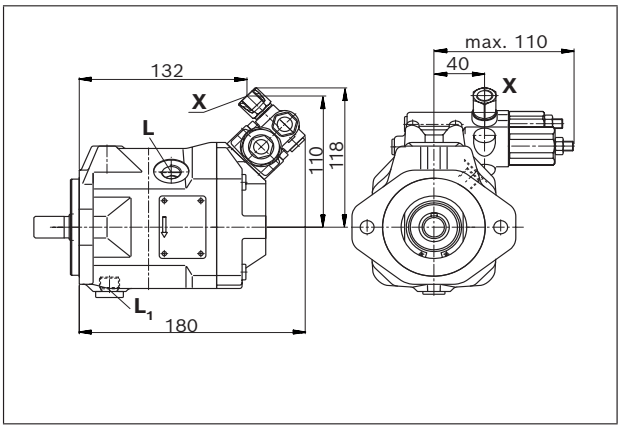
K - 19-1



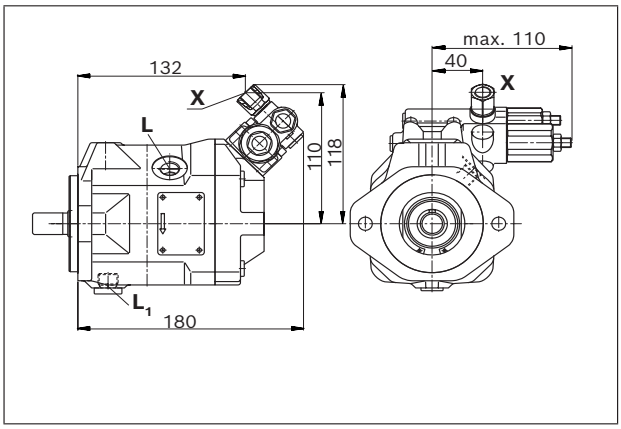
Ports flange A (metric); port plate 7, 14		**Standard**	**Size**	p_{max} **[bar (psi)]**[4)]	**State**[7)]
B	Working port	DIN 3852	M27 × 2; 16 (0.63) deep	315 (4550)	O
S	Suction port	DIN 3852	M27 × 2; 16 (0.63) deep	5 (75)	O
L	Drain port	DIN 3852[5)]	M16 × 1.5; 12 (0.47) deep	2 (30)	O[6)]
L_1	Drain port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

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (also see installation instructions starting on page 16).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

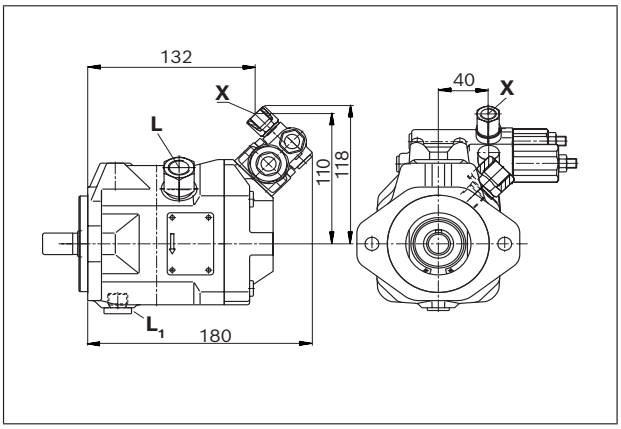
▼ **DRG – Pressure controller, remotely controlled (mounting flange A)[1)]**



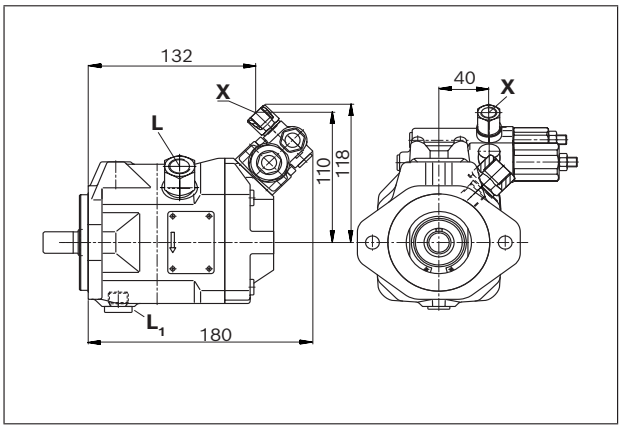
▼ **DFR/DFR1 - Pressure, flow controller (mounting flange A)[1)]**



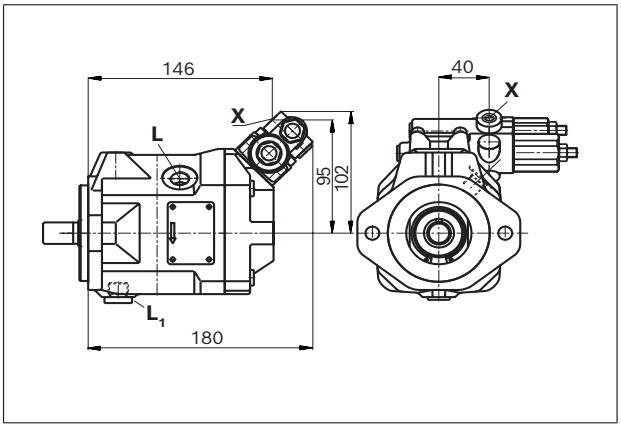
▼ **DRG – Pressure controller, remotely controlled (mounting flange C)[1)2)]**



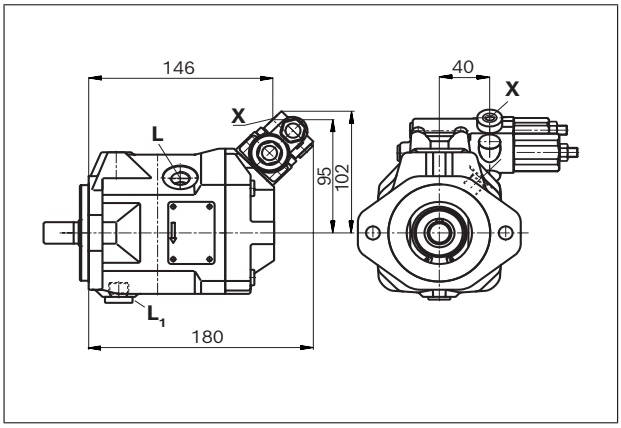
▼ **DFR/DFR1 - Pressure, flow controller (mounting flange C)[1)2)]**



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



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



1) Valve mounting for clockwise or counter-clockwise rotation
see page 12 bis 13
2) With metric adapter
3) Version complete SAE without adapter

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation.
This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines. Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest positioned drain port (**L**, **L_1**).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g., reservoir, frame parts).
Under all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the total pressure loss. However, it must not be higher than $h_{S\ max}$ = 800 mm (31.5 inch). The minimum suction pressure at port **S** must not fall below 0.8 bar (12 psi) absolute during operation and during cold start.
When designing the reservoir, ensure that there is adequate distance between the suction line and the drain line. We recommend using a baffle (baffle plate) between suction line and drain line.
A baffle improves the air separation ability as it gives the hydraulic fluid more time for desorption. Apart from that, this prevents the heated return flow from being drawn directly back into the suction line. The suction port must be supplied with air-free, calmed and cooled hydraulic fluid.

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

Installation position

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

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

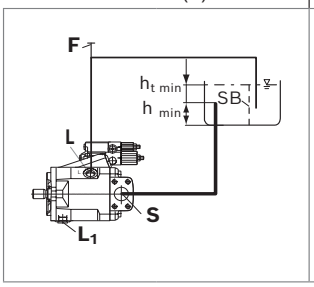
Notice
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Below-reservoir installation (standard)

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

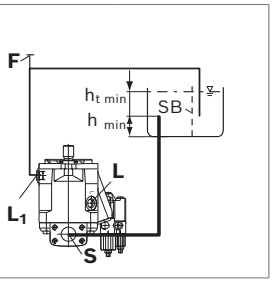
▼ **Installation position 1**

Air bleed	Filling
F	L (F)



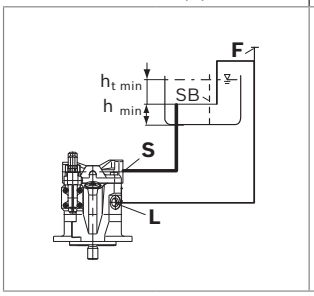
▼ **Installation position 2**[1)]

Air bleed	Filling
F	L_1 (F)



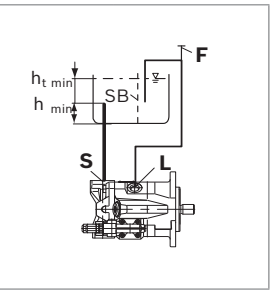
▼ **Installation position 3**[1)]

Air bleed	Filling
F	L (F)



▼ **Installation position 4**

Air bleed	Filling
F	L (F)



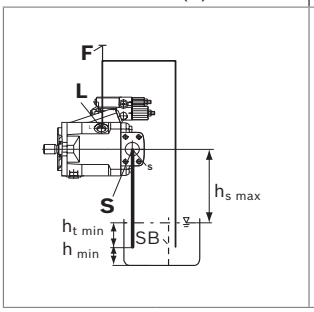
For key, see page 16.

Above-reservoir installation

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

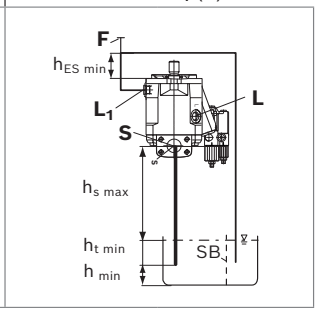
▼ **Installation position 5**

Air bleed	Filling
F	L (F)



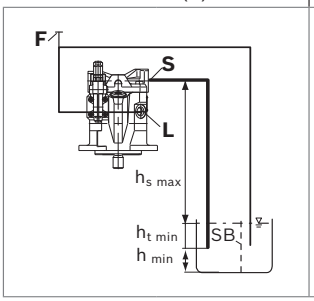
▼ **Installation position 6**[1)]

Air bleed	Filling
F	L_1 (F)



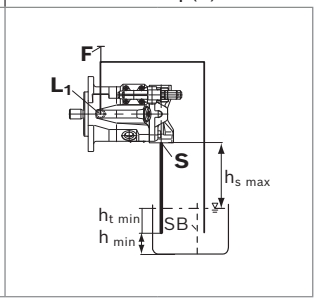
▼ **Installation position 7**[1)]

Air bleed	Filling
F	L (F)



▼ **Installation position 8**

Air bleed	Filling
F	L_1 (F)



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

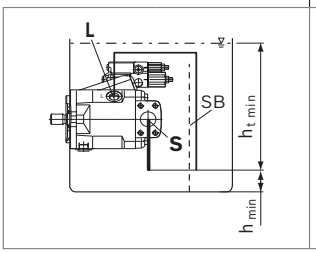
1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation". Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.

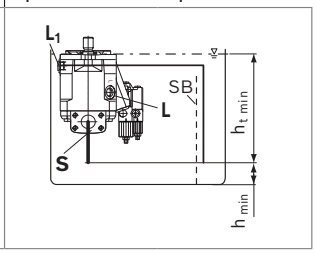
▼ **Installation position 9**

Air bleed	Filling
L	L



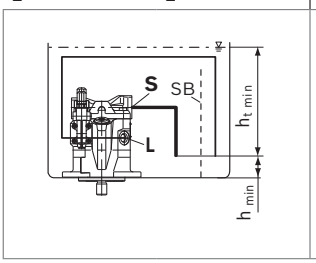
▼ **Installation position 10**[1)]

Air bleed	Filling
L_1	L_1



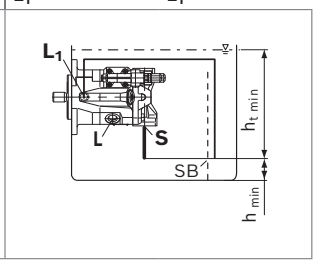
▼ **Installation position 11**[1)]

Air bleed	Filling
L	L



▼ **Installation position 12**

Air bleed	Filling
L_1	L_1



For key, see page 16.

Notice

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

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 A10VSO axial piston variable pump is designed to be used in open circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift. The characteristic curve may also shift due to the dither frequency or control electronics.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all configuration variants of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g., $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal) Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- The pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. Therefore, a pressure relief valve must be provided in the hydraulic system (integrated into the pump or externally in the system). In this connection, observe the technical limits of the pressure relief valve.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The excitation frequency of the pump is 9 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. 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 service ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

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