Axial piston variable pump
A1VO series 10

RE 92650
Edition: 09.2013
Replaces: 02.2013

- Sizes 18, 35
- Nominal pressure 250 bar
- Maximum pressure 280 bar
- Open circuit

Features

- Variable axial piston pump of swashplate design for hydrostatic drives in open circuits.
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- A wide range of highly adaptable control devices with different control and regulation functions, for all important applications.
- Compact design
- High efficiency
- High power density
- Low noise level

Contents

Ordering code

01	02	03	04	05	06	07	08		09	10	11	12	13	14	15	16	17		18
A1V	**O**			**C**	**2**		**0**	**/**	**10**	**B**		**V**			**1**		**0**	**–**	**0**

Axial piston unit

01	Swashplate design, variable, nominal pressure 250 bar, maximum pressure 280 bar	**A1V**

Operating mode

02	Pump, open circuit	**O**

Sizes (NG)

03	Geometric displacement, see technical data on page 7		**018**	**035**

Control devices

			018	**035**	
04	Pressure controller		○	●	**DR**
	with override, electric-proportional, negative control	*U* = 12 V	○	○	**D3**
		U = 24 V	○	○	**D4**
	with load sensing		○	●	**DRS0**

Controller design and mounting

05	Cartridge	**C**

Setting

06	Adjustable	**2**

Connector for solenoids[1)] (see page 18)

		018	**035**	
07	Without connector (without solenoid, only with hydraulic controls)	○	●	**0**
	DEUTSCH – molded connector, 2-pin, without suppressor diode	○	○	**P**

Additional function

08	Without additional function	**0**

Series

09	Series 1, index 0	**10**

Configuration of ports and fastening threads

10	ANSI, port threads with O-ring seal according to ISO 11926, metric fastening thread on through drive version	**B**

Directions of rotation

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

Seals

12	FKM (fluor-caoutchouc)	**V**

Mounting flange

			018	**035**	
13	SAE J744	82-2	○	–	**A2**
		101-2	–	●	**B2**

Drive shafts (for permissible input torque, see page 8)

			018	**035**	
14	Splined shaft ANSI B92.1a	5/8 in 9T 16/32DP	○	–	**S2**
		3/4 in 11T 16/32DP	○	–	**S3**
		7/8 in 13T 16/32DP2DP	○	●	**S4**
		1 in 15T 16/32DP	–	●	**S5**

● = Available ○ = On request – = Not available

1) Connectors for other electric components can deviate
2) For size 35, not for through drive

01	02	03	04	05	06	07	08		09	10	11	12	13	14	15	16	17		18
A1V	**O**			**C**	**2**		**0**	**/**	**10**	**B**		**V**			**1**		**0**	**–**	**0**

Service line ports

15	Threaded ports B and S, at side, opposite	**1**

Through drives (for attachment options, see page 17)

	Flange SAE J744			Hub for splined shaft[3]					
16	Diameter	Attachment[4]	Designation	Diameter		Designation	**018**	**035**	
	82-2 (A)	⚯	A2	5/8 in	9T 16/32 DP	S2	○	●	**A2S2**
				3/4 in	11T 16/32 DP	S3	○	●	**A2S3**
				7/8 in	13T 16/32 DP	S4	○	●	**A2S4**
	101-2 (B)	⚯	B2	7/8 in	13T 16/32 DP	S4	**–**	●	**B2S4**
				1 in	15T 16/32 DP	S5	–	●	**B2S5**
	Without through drive						○	●	**0000**

Additional function

17	Without additional function	**0**

Standard / special version

18	Standard version	**0**

● = Available ○ = On request – = Not available

3) According to ANSI B92.1a

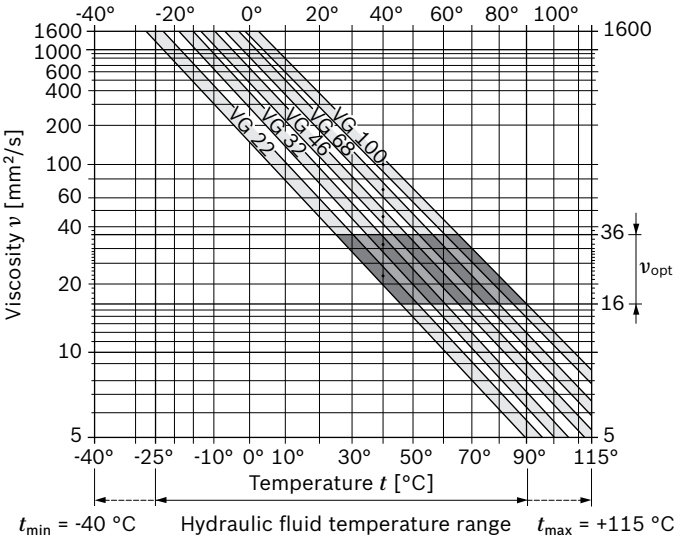
4) Mounting drillings pattern viewed on through drive, with service line port B on right.

Hydraulic fluid

Before starting project planning, please refer to our data sheet 90220 (mineral oil) for detailed information regarding the selection of hydraulic fluid and application conditions.

Further hydraulic fluids only after approval examination. Please contact us.

▼ **Selection diagram**



Details regarding the selection of hydraulic fluid
The correct selection of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature, in an open circuit the reservoir temperature. The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.
Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (v_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and rotational speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below 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 us.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		T_{min} ≥ -50 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up	v_{max} = 1600	T_{St} ≥ -25 °C	t ≤ 1 min, without load (p ≤ 30 bar), n ≤ 1000 rpm
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	v < 1600 to 400		at p ≤ 0.7 • p_{nom}, n ≤ 0.5 • n_{nom} and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 5 K	between hydraulic fluid in the bearing and at port L
Maximum temperature		115 °C	in the bearing
		110 °C	measured at port L
Continuous operation	v = 400 to 10 v_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port L, no restriction within the permissible data
Short-term operation	v_{min} ≥ 10	T_{max} = +110 °C	measured at port L, t < 1 min, p < 0.3 • p_{nom}
FKM shaft seal		T ≤ +115 °C	see page 5

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.
To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.
At very high hydraulic fluid temperatures (90°C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.
If the above levels cannot be achieved, please contact us.

Shaft seal

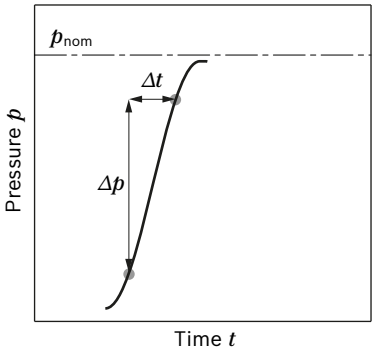
The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For the temperature range below -25 °C, the values in the table on page 4 are to be observed.

Operating pressure range

Pressure at service line port B		Definition
Nominal pressure p_{nom}	250 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	280 bar absolute	The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period (maximum number of cycles: approx. 1 million).
Single operating period	0.05 s	
Total operating period	14 h	
Minimum pressure $p_{B\,abs}$ (high-pressure side)	14 bar[1)] absolute	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 rate of pressure build-up and reduction during a pressure change over the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure $p_{S\,min}$	0.8 bar absolute	Minimum pressure at suction port **S** (inlet) which 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 $p_{S\,max}$	5 bar absolute	
Case drain pressure at port L_1, L_2		
Maximum pressure $p_{L\,max}$	2 bar absolute	Maximum 0.5 bar higher than inlet pressure at port **S**, but not higher than $p_{L\,max}$.

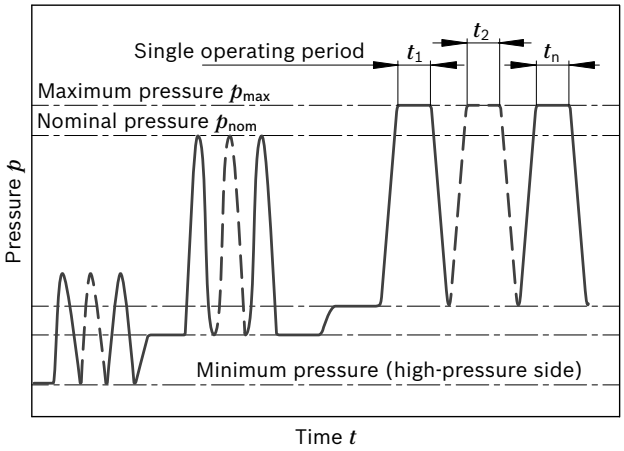
▼ **Rate of pressure change $R_{A\,max}$**



Note

Operating pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

▼ **Pressure definition**



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

1) Please contact us about lower pressures

Technical data

Size			NG		18	35
Displacemet geometric, per revolution			$V_{g\,max}$ $V_{g\,min}$	cm^3 cm^3	18 0	35 0
Maximum rotational speed [1)2)]	at $V_{g\,max}$ at $V_g \le V_{g\,max}$		n_{nom} n_{max}	rpm rpm	3300 3300	3000 3000
Flow	at n_{nom} and $V_{g\,max}$		q_v	L/min	59	105
Power	at n_{nom}, $V_{g\,max}$ and Δp = 250 bar		P	kW	25	44
Torque	at $V_{g\,max}$ and Δp = 250 bar		T	Nm	72	139
Rotary stiffness drive shaft	5/8 in 9T 16/32DP	S2	c	kNm/rad	6.2	–
	3/4 in 11T 16/32DP	S3	c	kNm/rad	9.9	–
	7/8 in 13T 16/32 DP	S4	c	kNm/rad	–	18.6
	1 in 15T 16/32DP	S5	c	kNm/rad	–	22.9
Moment of inertia for rotary group			J_{TW}	kgm^2	0.000505	0.00159
Maximum angular acceleration[5)]			α	rad/s^2	6800	5000
Case volume			V	L	0.5	0.6
Weight (without through drive) approx.			m	kg	11	16.9

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

Key

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

Note

- 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 valid:
   – for the optimum viscosity range from v_{opt} = 36 to 16 mm^2/s
   – with hydraulic fluid based on mineral oils
   – for a pressure $p_{suction} \ge 1$ bar absolute at suction port **S**.

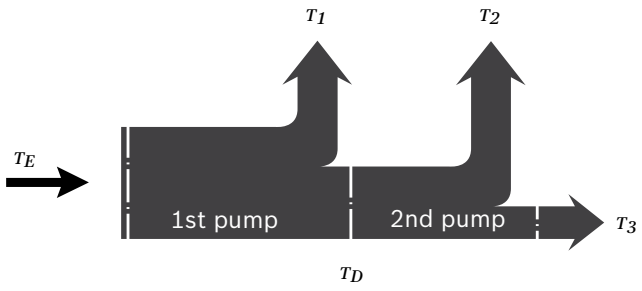
2) For a pressure $p_{suction} < 1$ bar at suction port **S** , please contact us.

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

Permissible input and through-drive torques

Size			NG		18	35
Torque at $V_{g\,max}$ and Δp = 250 bar[1)]			T_{max}	Nm	72	139
Input torque at drive shaft, maximum[2)]						
	S2	5/8 in	$T_{E\,max}$	Nm	59	–
	S3	3/4 in	$T_{E\,max}$	Nm	143	–
	S4	7/8 in	$T_{E\,max}$	Nm	–	–
	S5	1 in	$T_{E\,max}$	Nm	–	319
Maximum through-drive torque			$T_{D\,max}$	Nm	72	139

▼ **Torque distribution**



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	<	$T_{D\,max}$

Note
For axial and/or radial forces (pinion, v-belt), please contact us!

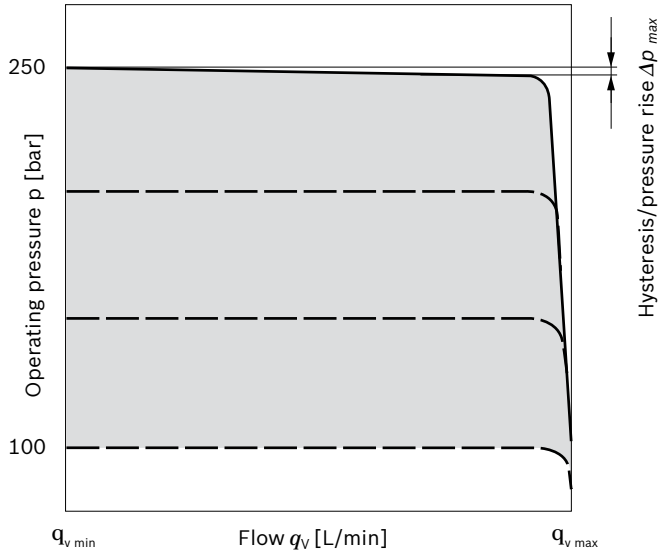
1) Efficiency not considered
2) For drive shafts without radial force

DR – Pressure controller

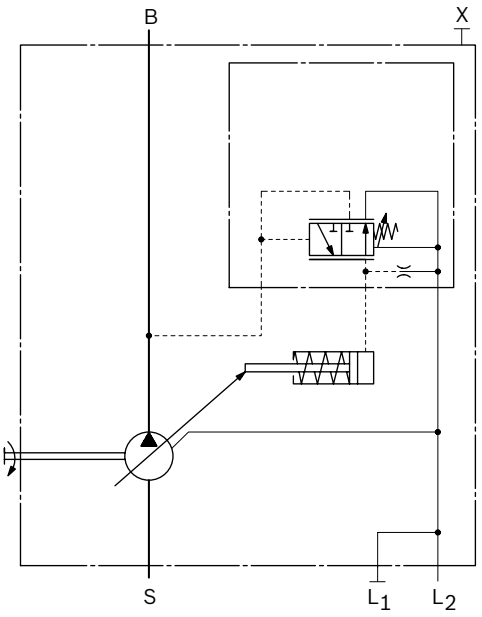
The pressure controller limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only delivers as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the setpoint value set at the pressure valve, the pump will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

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1)] for pressure control: 100 to 250 bar. Standard is 250 bar.

▼ **Characteristic DR**



▼ **Schematic DR**



Controller data

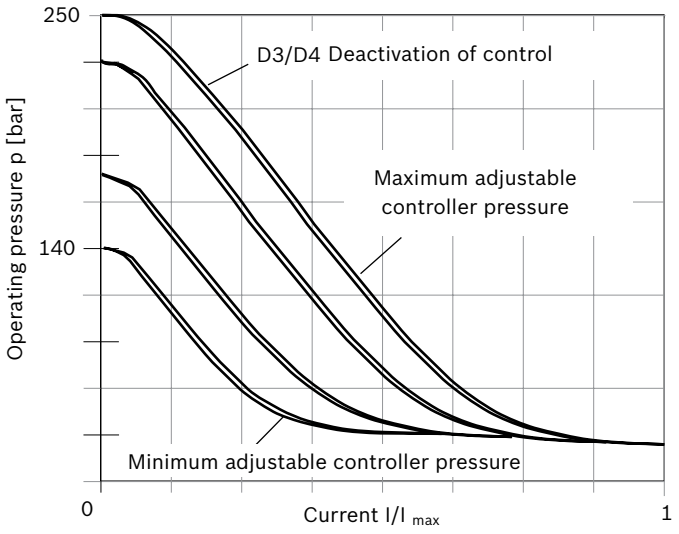
NG	18	35
Hysteresis and repeat precision Δp	Maximum 5 bar	
Pilot fluid consumption	Maximum approx. 3 L/min	

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
Lower values on request

D3/D4 – Pressure controller with override

With electric pressure adjustment using a proportional solenoid, the high pressure can be infinitely adjusted depending on the solenoid current. When the load pressure is changed at the consumer, the pump flow volume is adjusted so that the specified pressure is achieved again. If the solenoid current drops below the beginning of control, the unit will go to the set maximum pressure. The same thing applies if the pilot signal is lost.

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



Characteristic measured with pump in zero stroke.
Further information on request.

DRS0 – Pressure controller with load sensing

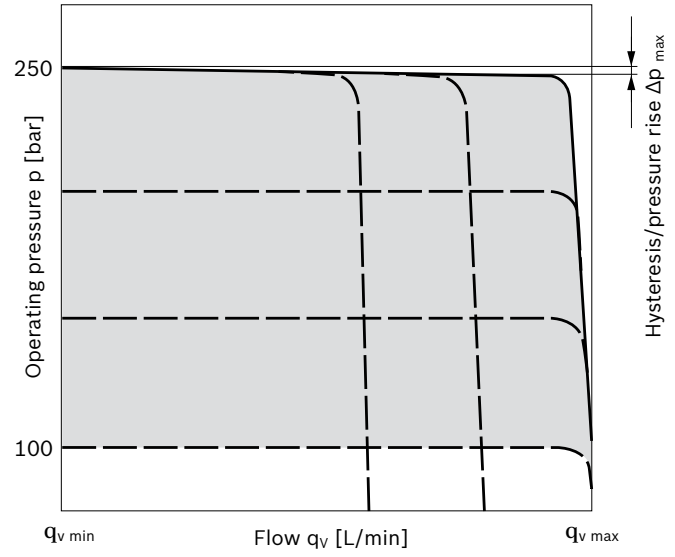
In addition to the pressure controller function (DR), the load sensing controller works as a load-pressure controlled flow controller and adjusts the displacement of the pump to the volume required by the consumer. The load-sensing controller compares pressure before and after the measuring orifice and keeps the pressure drop (differential pressure Δp) across the orifice – and therefore the flow – constant. The swiveling in due to the pressure or flow controller will always take priority.

▶ Setting range[1)] for pressure control: 100 to 250 bar.

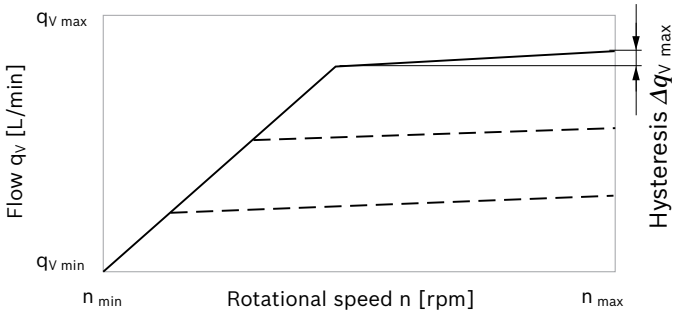
Note

The DRS0 version has no connection from **X** to the reservoir so the LS relief has to be incorporated into the system.

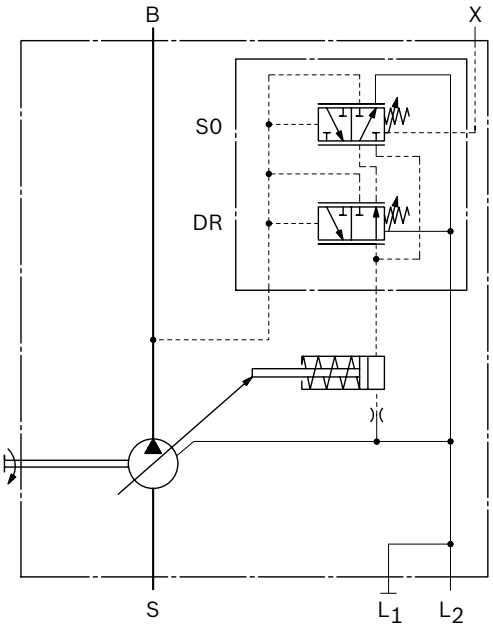
▼ **Characteristic DRS0**



▼ **Characteristic at variable rotational speed**



▼ **Schematic DRS0**



Differential pressure Δp

Standard setting: 14 bar. If another setting is required, please state in plain text.

Controller data

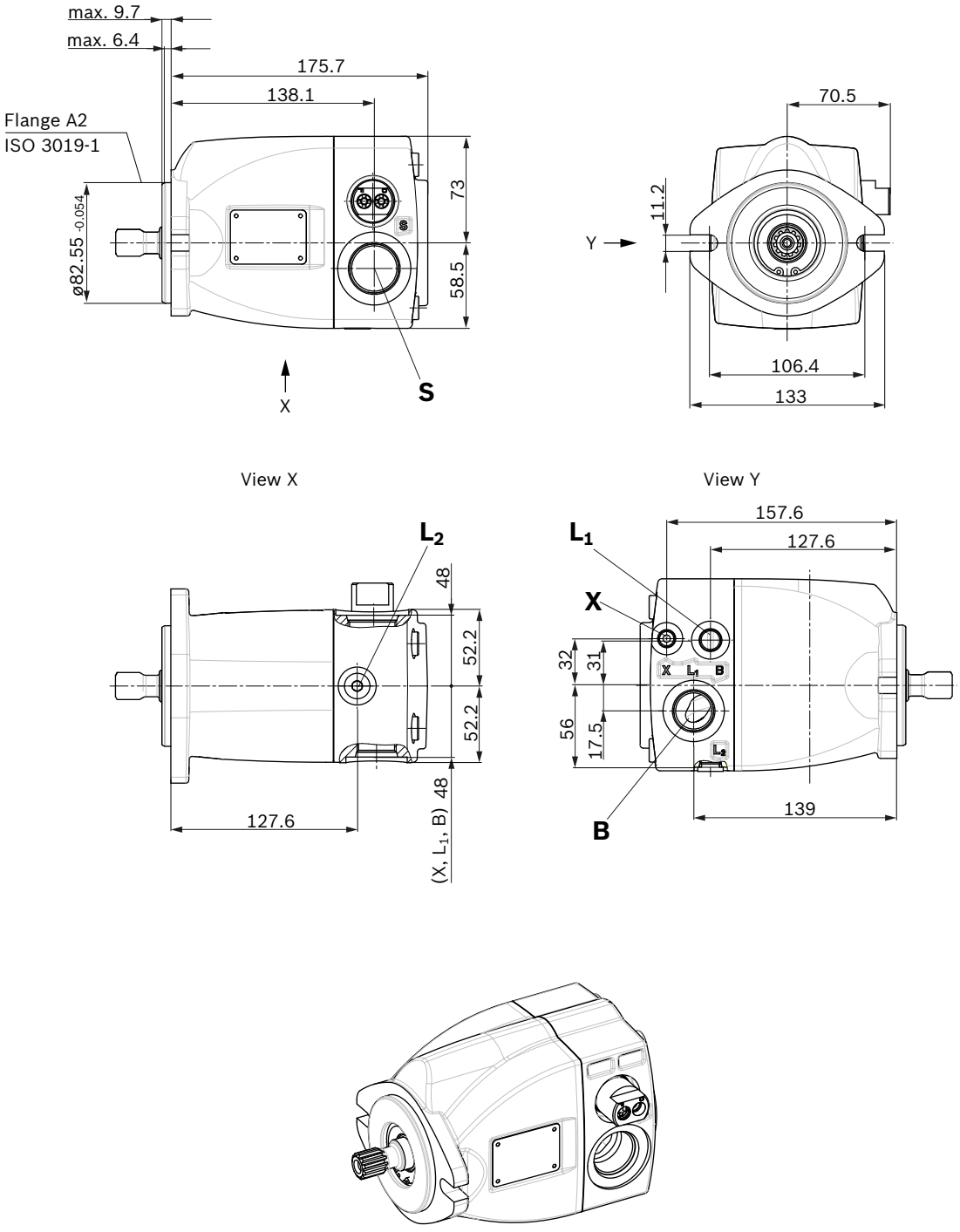
For data for the pressure controller DR, please refer to page 9. Maximum flow differential (hysteresis and increase) measured at drive speed n = 1500 rpm and t_{fluid} = 50 °C

NG	18	35
Flow difference $\Delta q_{V\,max}$	3 L/min	
Maximum control fluid consumption, approx.	4 L/min	

1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded.
Lower values on request

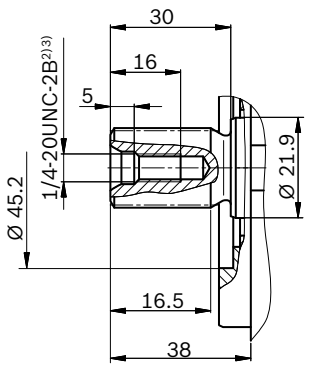
Dimensions size 18

DR – Pressure controller / DRS0 – Pressure controller with load sensing
clockwise rotation



▼ **Splined shaft SAE J744**

S3 – 3/4 in 11T 16/32DP[1)]

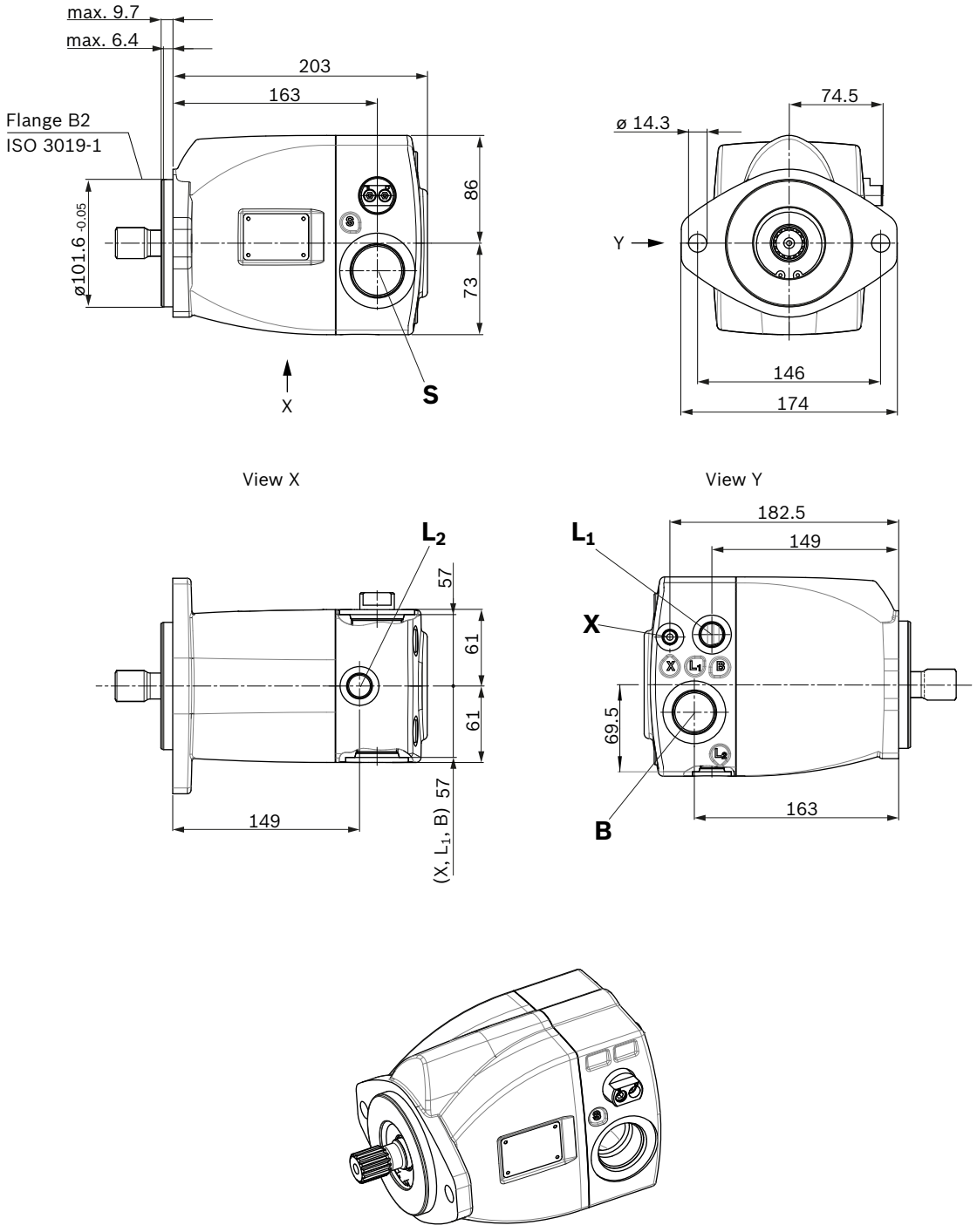


Ports		Standard[4)]	Size[3)]	$p_{max\ abs}$ [bar][5)]	State[8)]
B	Service line port	ISO 11926	1 1/16-12UN-2B; 20 deep	280	O
S	Suction port	ISO 11926	1 5/16-12UN-2B; 20 deep	5	O
L_1	Case drain fluid	ISO 11926	9/16-18UNF-2B; 13 deep	10	O[6)]
L_2	Case drain fluid	ISO 11926	9/16-18UNF-2B; 13 deep	10	X[6)]
X	Pilot signal	ISO 11926	7/16-20UNF-2B; 12 deep	280	O[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) Observe the general instructions on page 22 for the maximum tightening torques.
4) The spot face can be deeper than specified in the appropriate standard.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on installation position, L or L1 L2 must be connected (see also installation instructions on page 19).
7) Only if an S0 controller is present.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

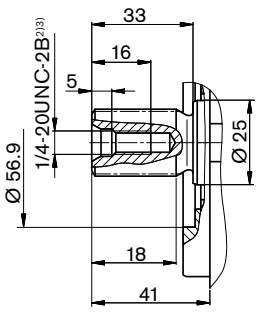
Dimensions size 35

DR – Pressure controller / DRS0 – Pressure controller with load sensing
clockwise rotation

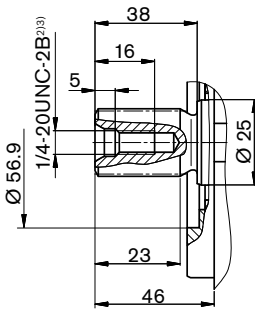


▼ **Splined shaft SAE J744**

S4 – 7/8 in 13T 16/32DP[1)]



S5 – 1 in 15T 16/32DP[1)]



Ports		Standard[4)]	Size[3)]	p_{max} [bar][5)]	State[8)]
B	Service line port	ISO 11926	1 5/16-12UN-2B; 20 deep	280	O
S	Suction port	ISO 11926	1 5/8-12UN-2B; 20 deep	5	O
L_1	Case drain fluid	ISO 11926	3/4-16UNF-2B; 15 deep	10	O[6)]
L_2	Case drain fluid	ISO 11926	3/4-16UNF-2B; 15 deep	10	X[6)]
X	Pilot signal	ISO 11926	7/16-20UNF-2B; 12 deep	280	O[7)]

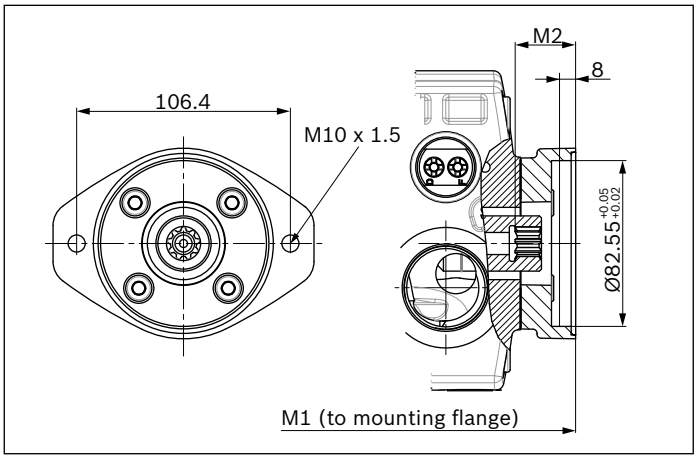
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Observe the general instructions on page 22 for the maximum tightening torques.
4) The spot face can be deeper than specified in the appropriate standard.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on installation position, L or L1 L2 must be connected (see also installation instructions on page 19).
7) Only if an S0 controller is present.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Through drive dimensions

Flange SAE J744			Hub for splined shaft[1]			Availability NG		Short code
Diameter	Attachment[2]	Designation	Diameter		Designation	018	035	
82-2 (A)	⚯	A2	5/8 in	9T 16/32 DP	S2	○	●	A2S2
			3/4 in	11T 16/32 DP	S3	○	●	A2S3
			7/8 in	13T 16/32 DP	S4	○	●	A2S4
101-2 (B)	⚯	B2	7/8 in	13T 16/32 DP	S4	–	●	B2S4
			1 in	15T 16/32 DP	S5	–	●	B2S5

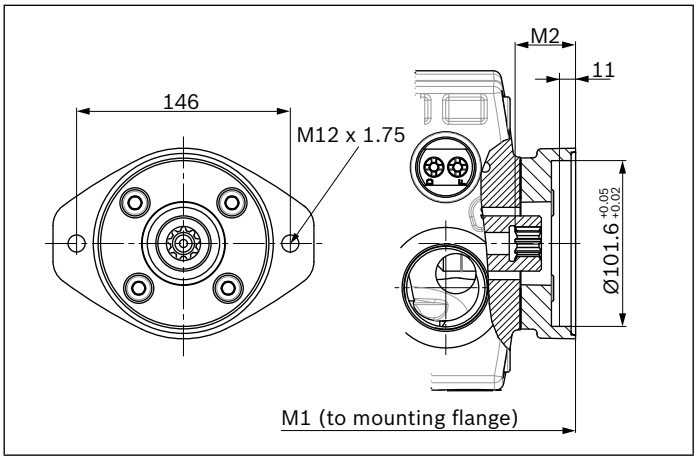
● = Available ○ = On request – = Not available

▼ **82-2 (A)**



Short code	NG	M1	M2
A2S2	18	199.2	32
	35	227.6	32
A2S3	18	199.2	38
	35	227.6	38
A2S4	18	199.2	41
	35	227.6	41

▼ **101-2 (B)**



Short code	NG	M1	M3
B2S4	35	227.6	41
B2S5	35	227.6	46

1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting drilling pattern viewed on through drive with service line port B on right.
3) Continuous thread according to DIN 13; observe the general instructions on page 22 for the maximum tightening torques.

Overview of attachment options

Through drive[1]			Attachment options – 2nd pump						
Flange	**Hub for splined shaft**	**Short code**	**A1VO/10 NG (shaft)**	**A4VG/32 NG (shaft)**	**A10VG/10 NG (shaft)**	**A10VO/52/53 NG (shaft)**	**A10VNO/52/53 NG (shaft)**	**A10V(S)O/31 NG (shaft)**	**External gear pump[2]**
82-2 (A)	5/8 in	A2S2	18 (S2)	–	–	10 (U), 18 (U)	–	18 (U)	Series F
	3/4 in	A2S3	18 (S3)	–	–	10 (S), 18 (S, R)	28 (R)	18 (S, R)	–
101-2 (B)	7/8 in	B2S4	35 (S4)	–	18 (S)	28 (S, R)	–	28 (S, R)	Series N Series G
	1 in	B2S5	35 (S5)	28 (S)	28 (S)	–	–	–	–

Combination pumps A1VO + A1VO

Total length A

A1VO (1st pump)	A1VO (2nd pump)	
	NG18	**NG35**
NG18	375	–
NG35	403.3	431

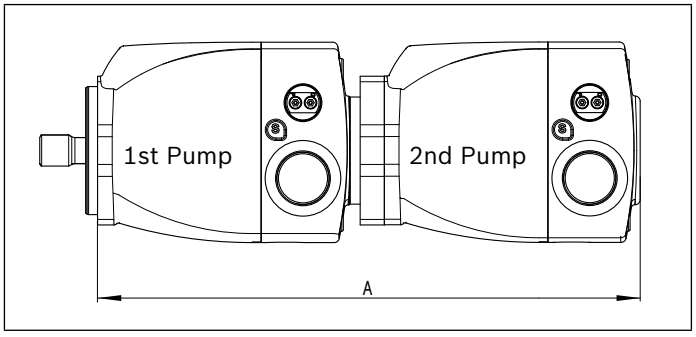
By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of the 1st and 2nd pump must be linked by a "**+**".

Order example:

A1VO035DRS0C100/10BRVB2S51B2S500+
A1VO035DRS0C100/10BRVB2S51000000

A tandem pump consisting of two equal sizes is permissible without additional supports assuming that the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s2).

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



1) Additional through drives are available on request
2) Bosch Rexroth recommends special versions of the external gear pumps. Please contact us.

Connector for solenoids

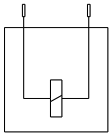
DEUTSCH DT04-2P-EP04

Molded connector, 2-pin, without bidirectional suppressor diode.

There is the following type of protection with mounted mating connector:

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

▼ **Circuit symbol**

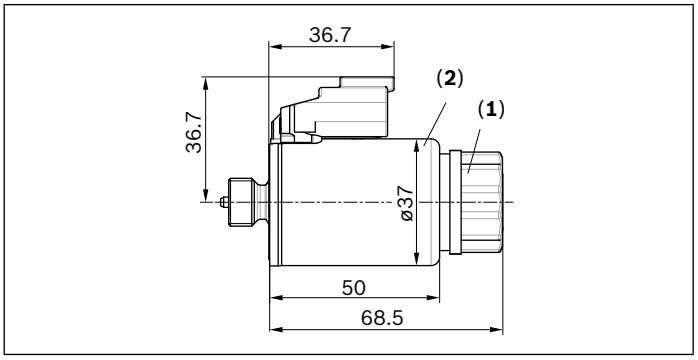


▼ **Mating connector DEUTSCH DT06-2S-EP04**

Consisting of	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

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

This can be supplied by Bosch Rexroth on request (material number R902601804).



Changing connector orientation

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

- Loosen the mounting nut (**1**) of the solenoid. To do this, turn the mounting nut (**1**) one turn counter-clockwise.
- Turn the solenoid body (**2**) to the desired orientation.
- Retighten the mounting nut.
  Tightening torque: 5+1 Nm.
  (size WAF 26, 12-sided DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position “drive shaft up/down” filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (**L_1**, **L_2**).

For combinations of multiple units, the case drain fluid must be drained off at each pump. If a shared reservoir line is used for this purpose, make sure that the case pressure in each pump is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

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

In all operating conditions, the suction and drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\,max}$ = 800 mm. The minimum suction pressure at port **S** must also not fall below 0.8 bar absolute during operation and during a cold start.

When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Note

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

Installation position

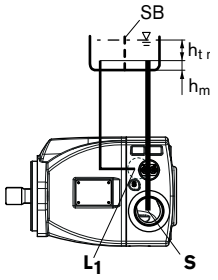
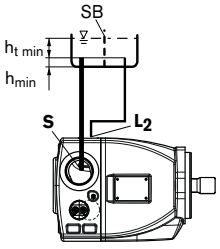
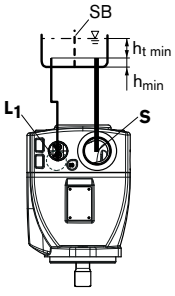
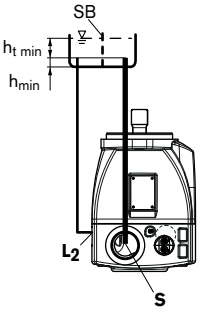
See examples **1** to **11** below.

Additional installation positions are available upon request.

Recommended installation positions: **1** and **2**

Below-reservoir installation (standard)

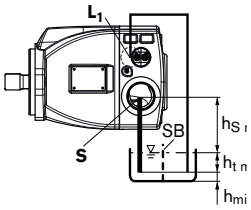
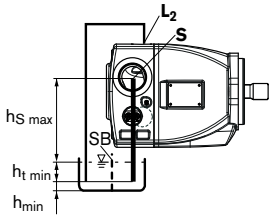
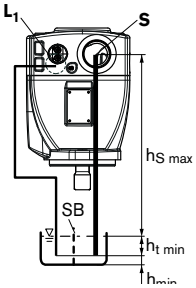
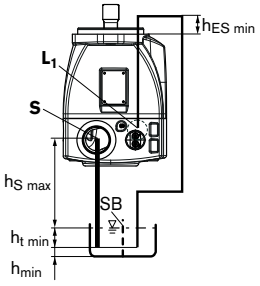
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Installation position	Air bleed	Filling
1 	**L_1**	**S** + **L_1**
2 	**L_2**	**S** + **L_2**
3 	**L_1** or **L_2**	**S** + **L_1** or **L_2**
4[1] 	**L_1** or **L_2**	**S** + **L_1** or **L_2**

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

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining in position 8, the height difference $h_{ES\ min}$ must be at least 25 mm. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm.

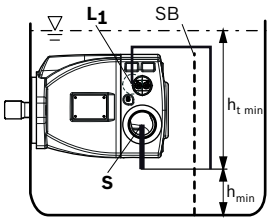
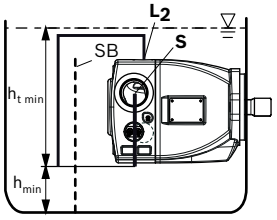
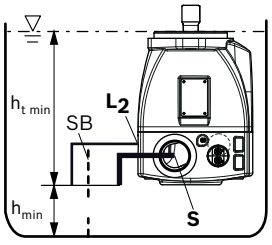
Installation position	Air bleed	Filling
5 	**L_1**	**L_1**
6 	**L_2**	**L_2**
7 	**L_1** or **S**	**L_1** or **S**
8[1] 	**L_1**	**L_1**

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) may not be installed in a reservoir below the fluid level.

Installation position	Air bleed	Filling
9 	Via the highest available port **L_1**	Automatically via the open port **L_1** due to the position under the hydraulic fluid level
10 	Via the highest available port **L_2**	Automatically via the open port **L_2** due to the position under the hydraulic fluid level
11[1] 		

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

General instructions

- The A1VO 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 person.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g., by wearing protective clothing).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line 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 service line ports and function ports can only be used to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- Before finalizing your design, request a binding installation drawing.
- Not all variants of the product are approved for use in safety functions 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.
- Pressure controllers are not backups against pressure overload. A separate pressure-relief valve is to be provided in the hydraulic system.
- The following tightening torques apply:
  - Fittings:
    Observe the manufacturer's specifications regarding the tightening torques of the fittings used.
  - Mounting bolts:
    For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - Female threads of the axial piston unit:
    The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.
  - Threaded plugs:
    For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports **Standard**	**Thread size**	**Maximum permissible tightening torque of the female threads $M_{G\ max}$**	**Required tightening torque of the threaded plugs M_V**	**WAF** **Hexagon socket of the threaded plugs**
ISO 11926	7/16-20UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18 UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16 UNF-2B	160 Nm	70 Nm	5/16 in
	1 1/16-12 UNF-2B	360 Nm	170 Nm	9/16 in
	1 5/16-12 UN-2B	540 Nm	270 Nm	5/8 in
	1 5/8-12 UN-2B	960 Nm	320 Nm	3/4 in

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