Rexroth
Bosch Group

Axial Piston Variable Pump A10VSNO

RE 92741/03.11 1/16

Data sheet

Series 52
Size 15
Nominal pressure 210 bar
Maximum pressure 250 bar
Open circuit

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Features

- Variable pump in axial piston swashplate design
- The flow is proportional to the drive speed and displacement.
- Hydrostatically relieved swashplate bearing
- Low noise level
- Low pressure pulsation
- High efficiency
- Compact design
- Favorable power/weight ratio
- Proven A10 rotary group technology

Ordering code for standard program

A10VSN	O	15		/	52		–	V		A	14	N00
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swashplate design, variable, nominal pressure 210 bar, maximum pressure 250 bar		**A10VSN**

Operation mode

02	Pump, open circuit		**O**

Size (NG)

03	Geometric displacement $V_{g\,max}$ in cm^3		**15**

Control device

				015	
04	Pressure controller			●	**DR**
		hydraulic, remote controlled		●	**DRG**
		with hydraulic flow control	X-T open	●	**DFR**
			X-T plugged with flushing function	●	**DFR1**

Series

05	Series 5, index 2		**52**

Direction of rotation

			015	
06	Viewed on drive shaft	clockwise	●	**R**
		counter-clockwise	●	**L**

Seal

07	FKM (fluoride rubber)		**V**

Drive shaft

		015	
08	Splined shaft ANSI B92.1a–1976	●	**S**
	Parallel keyed shaft DIN 6885	●	**P**

Mounting flange

09	ISO 3019-2 – 2-hole		**A**

Service line ports

10	Metric thread connections, rear		**14**

Through drive

11	Without through drive		**N00**

● = Available ❍ = On request – = Not available

Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

If environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals must be observed. Please contact us.

When ordering, indicate the hydraulic fluid that is to be used.

Operating viscosity range

We recommend you to choose the operating viscosity (at operating temperature) in the optimum range for efficiency and useful life of

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

related to the reservoir temperature (open circuit).

Limits of viscosity range

The following values apply in case of borderline operating conditions:

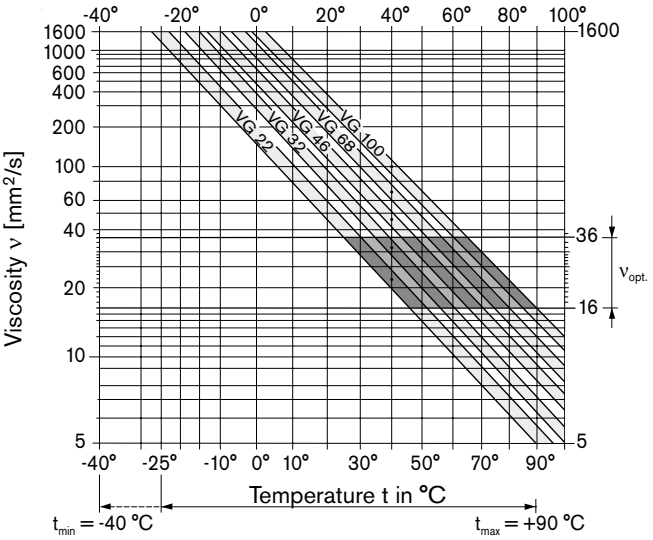
n_{min} = 10 mm²/s
short-term (t ≤ 1 min)
at max. perm. case drain temperature
of 90 °C.

Note that the max. case drain temperature of 90 °C may not be exceeded even locally (e.g. in the bearing area). The temperature in the area of the bearings is approx. 5 K higher than the average case drain temperature.

n_{max} = 1000 mm²/s
short-term (t ≤ 1 min)
on cold start
(p ≤ 30 bar, n ≤ 1000 rpm, t_{min} -25 °C)

Depending on the installation situation, special measures are necessary at temperatures between -40 °C and -25 °C. Please contact us.

For detailed information about use at low temperatures, , see RE 90300-03-B.



Hydraulic fluid temperature range

Selection diagram

Details regarding the choice 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 chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{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 (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68 (VG 68 should be selected).

Note
The case drain temperature, which is affected by pressure and speed, is always higher than the reservoir temperature. At no point of the component may the temperature be higher than 90 °C, however. The temperature difference specified on the left 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.

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 observed.
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 classes cannot be achieved, please contact us.

Technical data

Operating pressure range

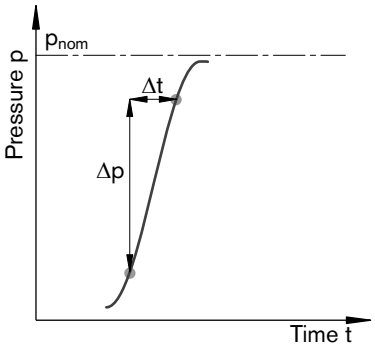
Pressure at service line port B

Nominal pressure p_{nom} _____ 210 bar absolute

Maximum pressure p_{max} _____ 250 bar absolute
Single operating period _____ 2.5 ms
Total operating period _____ 300 h

Minimum pressure (high-pressure side) _____ 10 bar[1)]

Rate of pressure change $R_{A\,max}$ _____ 16000 bar/s



Pressure at suction port S (inlet)

Minimum suction pressure $p_{S\,min}$ _____ 0.8 bar absolute

Maximum suction pressure $p_{S\,max}$ _____ 5 bar[2)] absolute

Case drain pressure

Maximum permissible case drain fluid pressure
(at port L, L_1):
Maximum 0.5 bar higher than inlet pressure at port S,
but not higher than 2 bar absolute.

$p_{L\,max}$ _____ 2 bar absolute

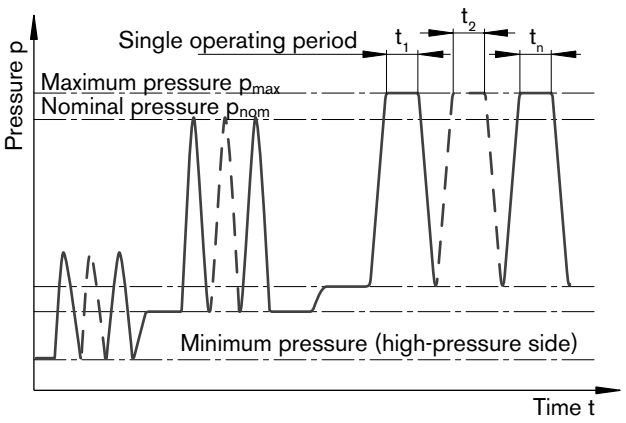
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
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.

Minimum pressure (high-pressure side)
Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



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

1) Lower pressure depending on time. Please contact us
2) Other values on request

Technical data

Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size			NG	15
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	15.2
Speed[1]				
maximum at $V_{g\,max}$		n_{nom}	rpm	3000
Flow				
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	45.6
at n_E = 1500 rpm and $V_{g\,max}$		$q_{vE\,max}$	l/min	22.8
Power at Δp = 210 bar				
at n_{nom} and $V_{g\,max}$		P_{max}	kW	16
at n_E = 1500 rpm and $V_{g\,max}$		P_{max}	kW	8
Torque				
at $V_{g\,max}$ and	Δp = 210 bar	T_{max}	Nm	51
	Δp = 100 bar	T	Nm	24
Rotary stiffness	Drive shaft P	c	Nm/rad	10700
	Drive shaft S	c	Nm/rad	9200
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0006
Maximum angular acceleration[2]		α	rad/s^2	8000
Filling capacity		V	L	0.2
Mass (without filllng); approx.		m	kg	8

1) The values are valid:
- for absolute pressure p_{abs} = 1 bar at suction opening "S"
- for optimum viscosity range of ν_{opt} = 16 to 36 mm^2/s
- for mineral operating fluid with a specific mass of 0.88 kg/l.

2) The data are valid for values between the minimum required and maximum permissible speed.
Valid for external excitation (e.g. 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.

Note

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.

Determining the size

Flow $q_v = \frac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

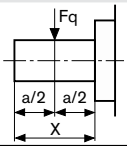
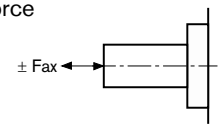
Torque $T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data

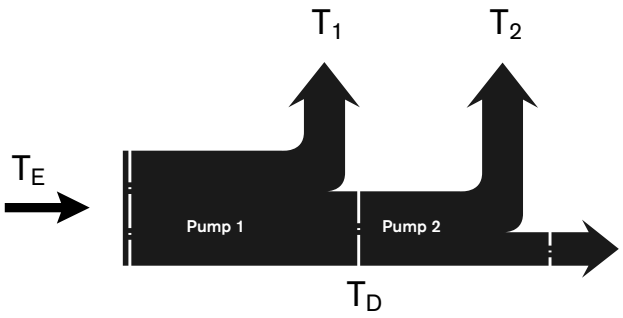
Permissible radial and axial forces of the drive shaft

Size		NG		15
Maximum radial force at a/2		$F_{q\ max}$	N	250
Maximum axial force		+ $F_{ax\ max}$	N	400

Permissible input torque

Size			15
Torque at $V_{g\ max}$ and $\Delta p = 210$ bar[1)]	T_{max}	Nm	51
Maximum input torque[2)]			
at drive shaft P	$T_{E\ max}$	Nm	90
DIN 6885		mm	18
at drive shaft S	$T_{E\ max}$	Nm	126
SAE J744 (ANSI B92.1a-1996)		in	3/4

1) Efficiency not taken into account
2) for radial-force-free drive shafts

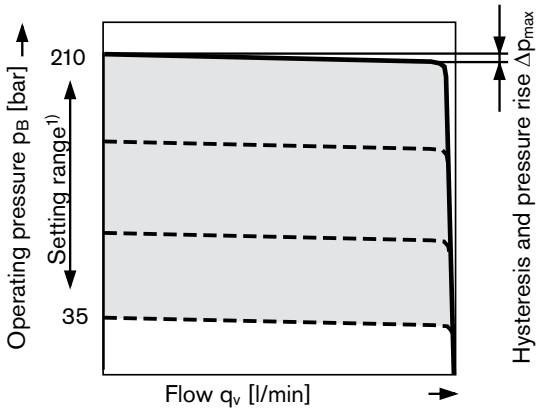


DR - Pressure controller

The pressure controller limits the maximum pressure at the pump output within the control range of the pump. The variable pump only moves as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure setpoint set at the pressure valve, the pump adjusts towards a smaller displacement volume and the control deviation is reduced. The pressure can be freely set on the control valve.

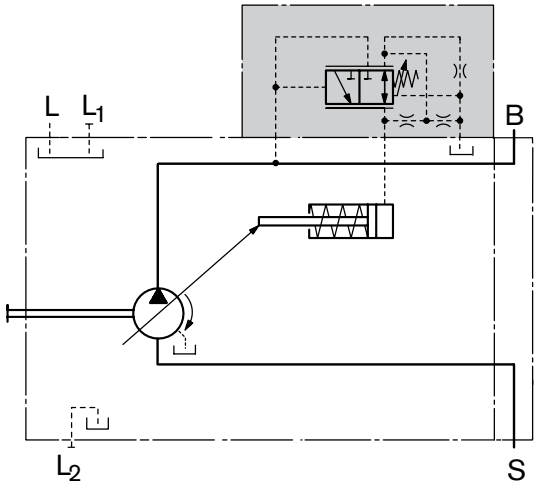
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50 °C)



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

Circuit diagram



	Port for
B	Service line
S	Suction line
L, L1	Case drain fluid (L_1 plugged)

Controller data

Hysteresis and repeat precision Δp _____ maximum 3 bar

Pressure rise, maximum

NG		**15**
Δp	bar	4

Control fluid consumption _____ maximum approx. 3 l/min

DRG – Pressure controller, remotely controlled

The DRG control valve overrides the function of the DR pressure controller, see page 7.

A pressure relief valve, which is not part of the delivery contents of the DRG control, can be externally connected to port X as a remote control.

The differential pressure at the control valve is set to 20 bar as standard. The volume of control fluid at port X is approx. 1.5 l/min. If another setting (range 10 to 22 bar) is required, please state so in plain language.

We recommend the following as a separate pressure relief valve:

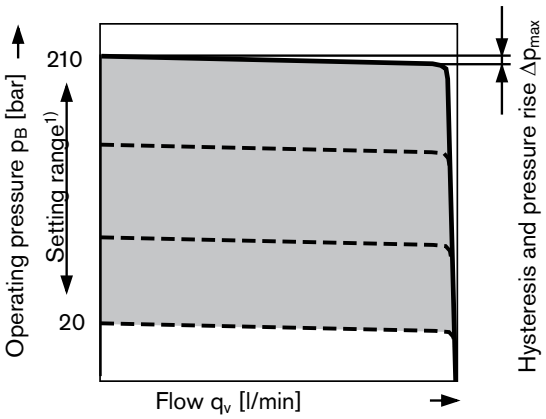
DBDH 6 (hydraulic) according to RE 25402, or

DBETR-SO 381 with orifice Ø 0.8 mm in P (electric) as per RE 29166.

The maximum line length should not exceed 2 m.

Static characteristic

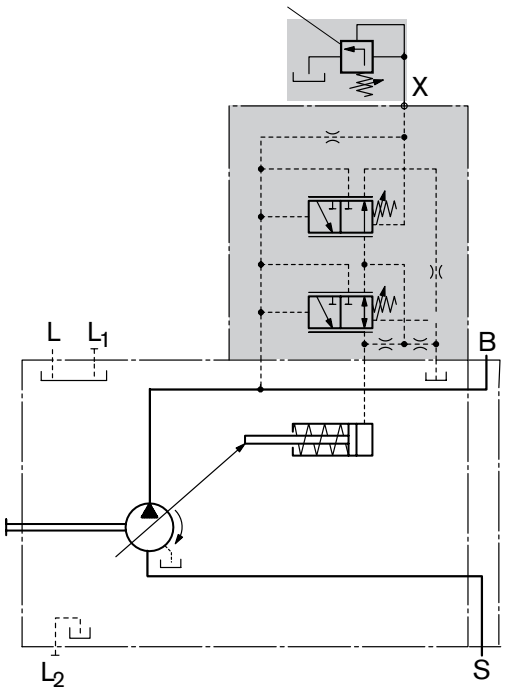
(at $n_1 = 1500$ rpm ; $t_{fluid} = 50$ °C)



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

Circuit diagram

Not included in the delivery contents



	Port for
B	Service line
S	Suction line
L, L1	Case drain fluid (L_1 plugged)
X	Pilot pressure

Controller data

Hysteresis and repeat precision Δp _____ maximum 3 bar

Pressure rise, maximum

NG		15
Δp	bar	4

Control fluid consumption _____ maximum approx. 4.5 l/min

DFR/DFR1 – Pressure flow control

In addition to the function of the pressure controller (see page 7), an adjustable orifice (e.g. directional valve) is used to take off a differential pressure in front of and behind the orifice to control the flow of the pump. The pump supplies the amount of hydraulic fluid actually required by the consumer.

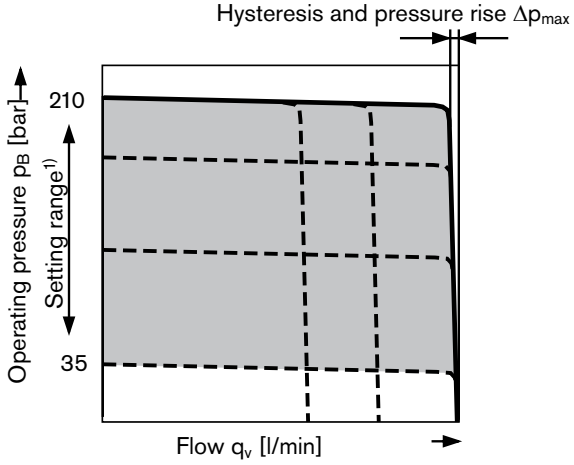
The pressure controller is overriding.

Note

The version DFR1 has no connection from X to the reservoir. The LS relief therefore has to be performed in the system. Moreover, the flushing function means that sufficient relief must be guaranteed on the X line.

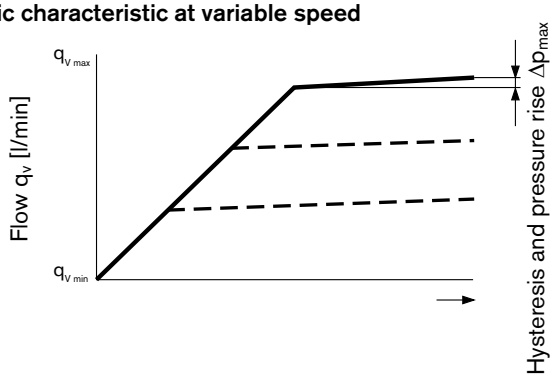
Static characteristic

Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)

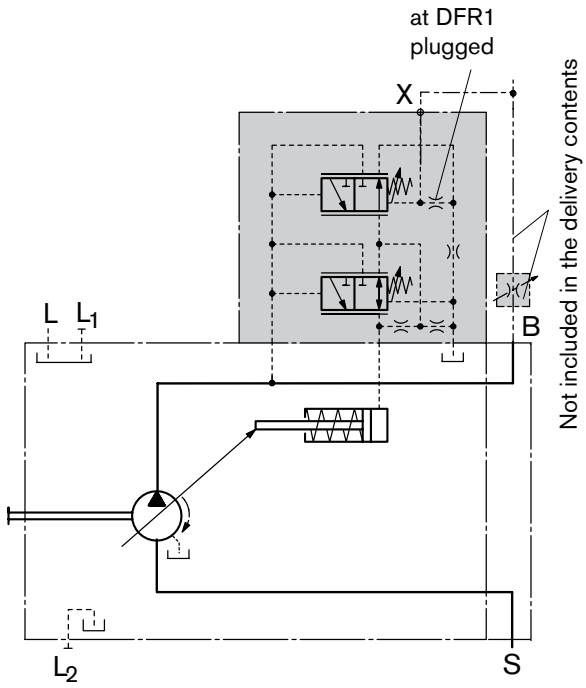


1) To prevent damage to the pump and to the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve is greater.

Static characteristic at variable speed



Circuit diagram



	Port for
B	Service line
S	Suction line
L, L1	Case drain fluid (L_1 plugged)
X	Pilot pressure

Differential pressure Δp:

Standard setting: 14 to 22 bar.
If another setting is required, please state so in plain language.
If port X to the reservoir is relieved, a zero stroke pressure ("stand by") is set. This is approx. 1 to 2 bar above the defined differential pressure Δp. System influences are not taken into account.

Controller data

For DR pressure controller data, see page 7.
Maximum discrepancy in displacement measured at drive speed n = 1500 rpm.

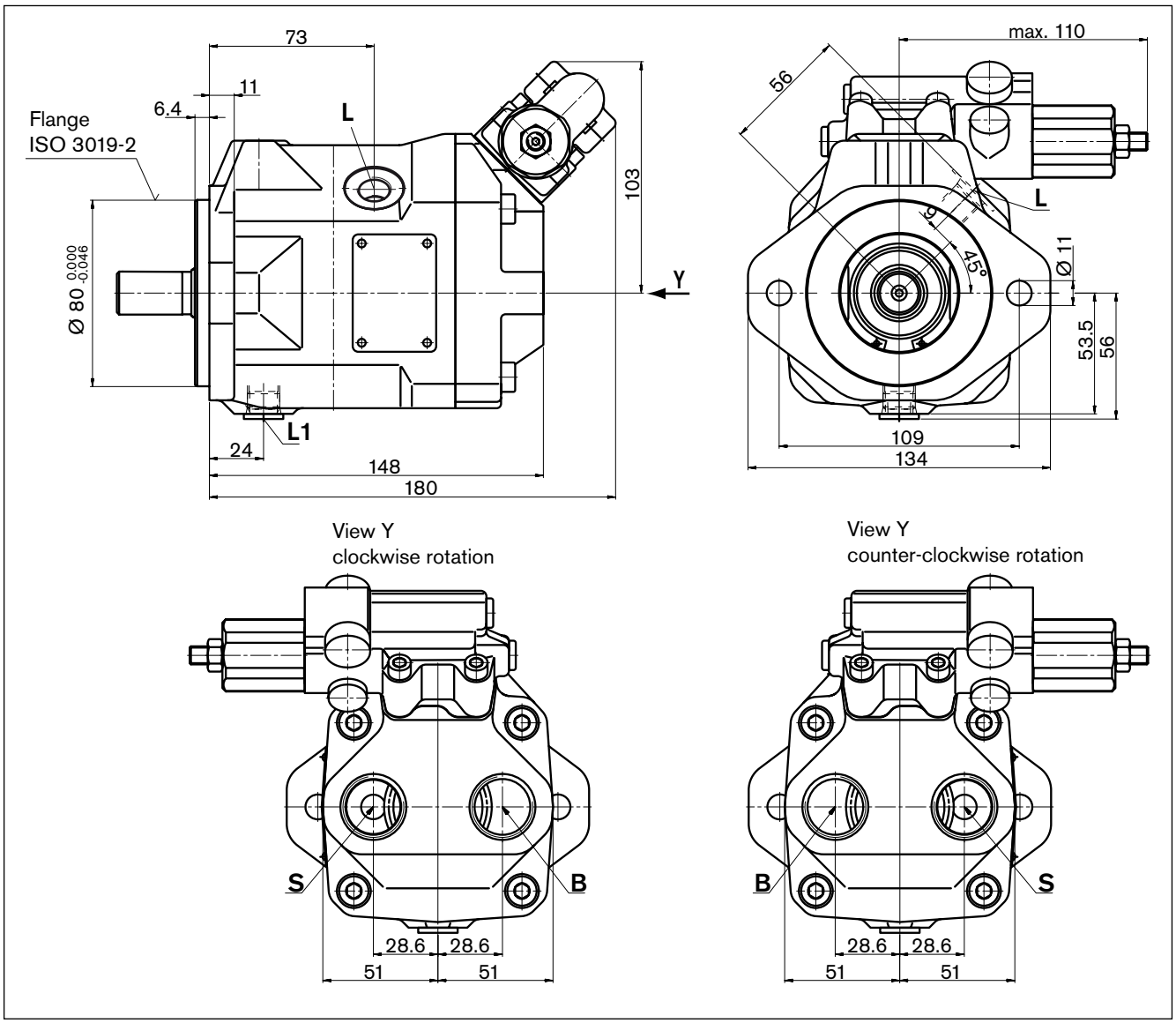
NG	**15**
$\Delta q_{v\,max}$ l/min	0.5

Control fluid consumption
DFR/DFR1 _____ maximum approx. 3 to 4.5 l/min

Dimensions size 15

Before finalizing your design, request a binding installation drawing. Dimensions in mm

DR – Pressure controller, hydraulic



Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line (standard pressure series)	DIN 3852	M27 x 2; 16 deep	250	O
S	Suction line (standard pressure series)	DIN 3852	M27 x 2; 16 deep	5	O
L	Case drain fluid	DIN 3852 [4]	M16 x 1.5; 12 deep	2	O [3]
L_1	Case drain fluid	DIN 3852 [4]	M16 x 1.5; 12 deep	2	X [3]
X with adapter	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	250	O

1) Observe the general instructions on page 16 for the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring equipment and fittings.
3) Depending on the installation position L or L1 must be connected.
4) The spot face can be deeper than specified in the appropriate standard.

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 15

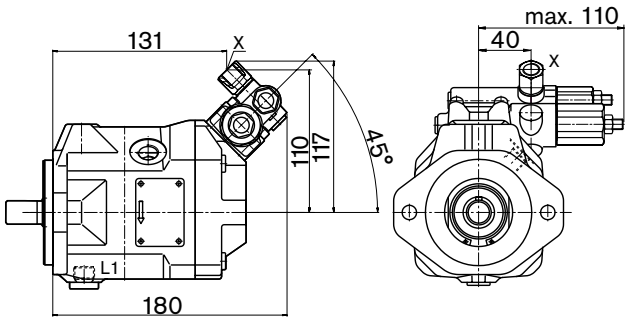
Before finalizing your design, request a binding installation drawing. Dimensions in mm

DG – Two-point control, directly operated

in preparation

DFR/DFR1 – Pressure flow control

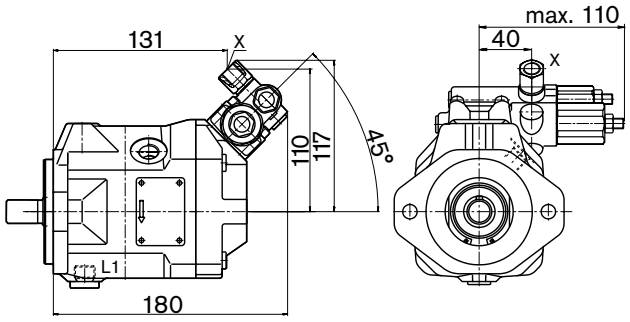
Display
clockwise rotation



For dimensions of port X with adapter, see DFR/DFR1

DRG – Pressure controller, remotely controlled

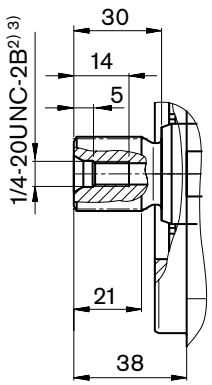
Display
clockwise rotation



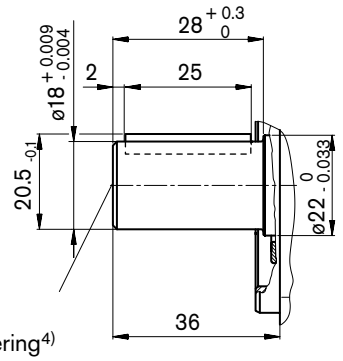
For dimensions of port X without adapter, see DFR/DFR1

Drive shaft

S Splined shaft 3/4 in 11T 16/32DP[1] (SAE J744)



P Cyl. shaft with key DIN 6885, A6x6x25



Centering[4]
R3 15x6.7 DIN 332

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 16 for the maximum tightening torques.
3) Thread according to ASME B1.1
4) Axial securing of coupling, e.g. via clamping coupling or radially fitted clamping screw

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also ensured following a relatively long standstill as fluid in the axial piston unit may drain back to the reservoir 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 case drain fluid in the case interior must be directed to the reservoir via the highest case drain port (L_1, L_2).

If several units are combined, make sure that the respective case pressure is not exceeded. For pressure differentials at case drain port L, each pump is to be fitted with a separate case drain line.

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

In all operating conditions, the intake and case 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. Pressure must not drop below the minimum suction pressure at port S ($p_{S\ min} = 0.8$ bar absolute) during operation.

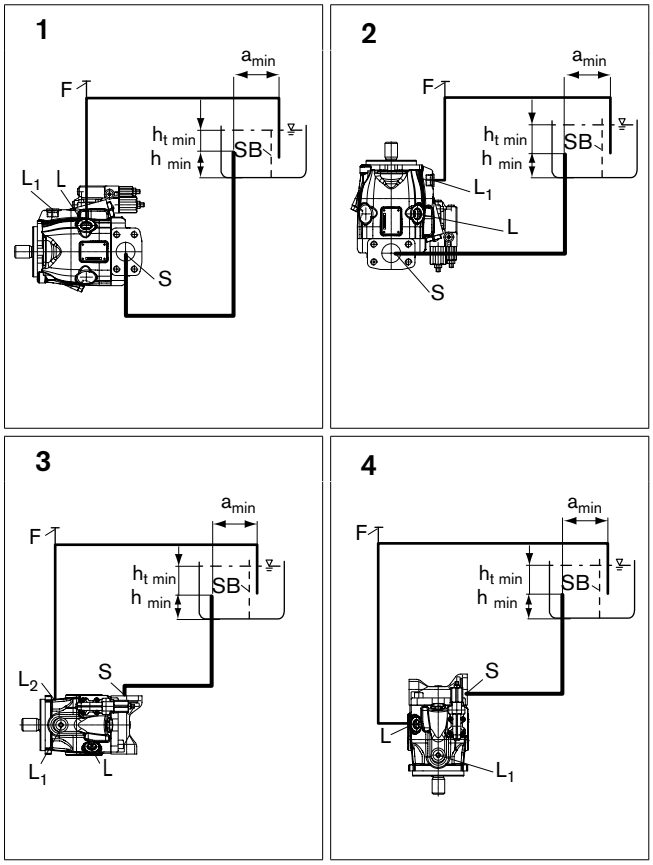
Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

Below-reservoir installation (standard)

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



Installation position	Air bleed	Filling
1, 3	F	S + L, L_1 (F)
2, 4	F	S + L, L_1 (F)

Key, see page 51

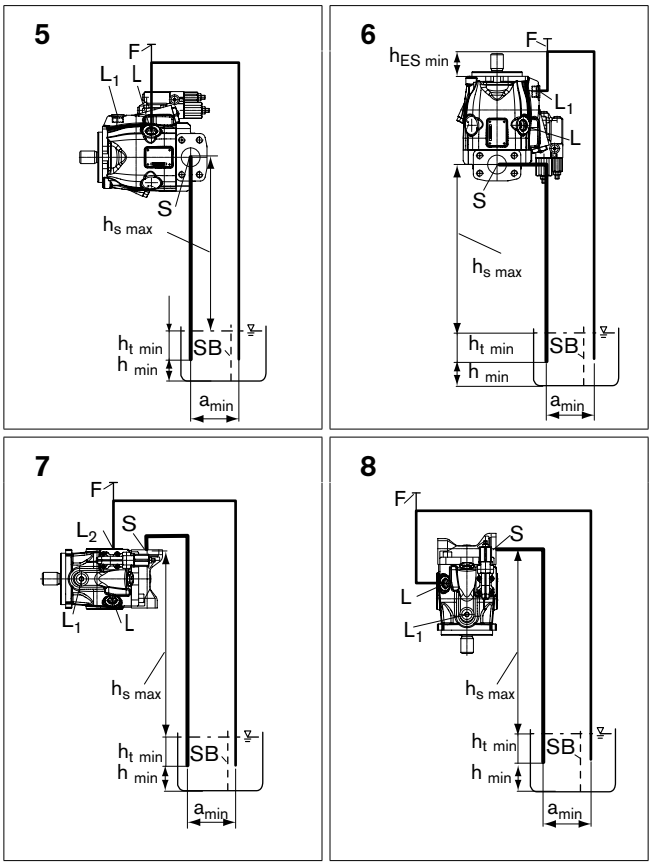
Installation instructions

Above-reservoir installation

Above-reservoir installation is when the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining dry, a height difference $h_{ES\ min}$ of at least 25 mm to port L_1 is to be observed in installation position 6.

Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

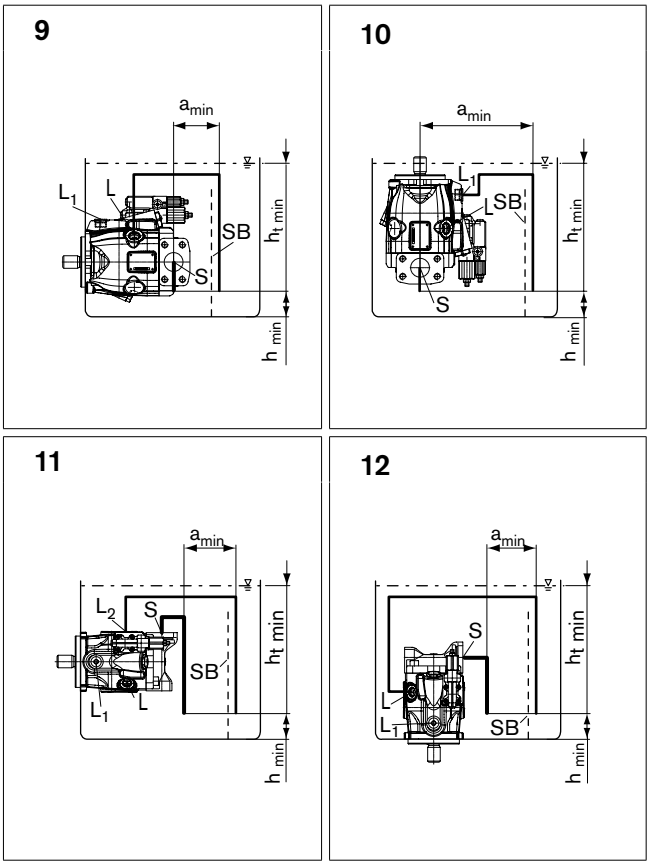
A check valve in the reservoir line is only permissible in isolated cases upon request.



Installation position	Air bleeding	Filling
5, 7	F	L, L_1 (F)
6, 8	F	S + L, L_1 (F)

Inside-reservoir installation

Inside-reservoir installation is when the pump is installed within the minimum reservoir fluid level.



Installation position	Air bleeding	Filling
9, 11	L, L1	L, L1
10, 12	L, L1	S + L, L_1

S	Filling / air bleed
F	Air bleed port
S	Suction port
L, L1	Case drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum necessary spacing to reservoir base (100 mm)
$h_{ES\ min}$	Minimum necessary height to protect the axial piston unit from draining dry (25 mm).
$h_{S\ max}$	Maximum permissible suction height (800 mm)
a_{min}	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.

General instructions

– The A10VSNO pump is designed to be used in open circuits.

– The project planning, installation and commissioning of the axial piston unit must be carried out by trained and qualified personnel.

– Please read the accompanying instruction manual carefully and fully before using the axial piston unit. If necessary, these can be requested from Rexroth.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take suitable safety precautions (e.g. wear protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.

– Pressure ports:
The ports and fixing 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 operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

– Pressure cut-off and pressure controller do not provide protection against pressure overload. A separate pressure relief valve is to be fitted in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The following tightening torques apply:

- Threaded hole of the axial piston unit:
The maximum permissible tightening torques M_{GMax} are maximum values of the female threads and must not be exceeded. For values, see the following table.

- Fittings:
Observe the manufacturer's instruction regarding the tightening torques of the used fittings.

- Fixing screws:
For fixing screws according to DIN 13, we recommend checking the tightening torque individually according to VDI 2230.

- 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.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

Threaded port sizes		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
7/16-14 UNF-2B	ISO 11926	40 Nm	15 Nm	3/16 in
M14x1.5	DIN 3852	80 Nm	35 Nm	6 mm
M16x1.5	DIN 3852	100 Nm	50 Nm	8 mm
M27x2	DIN 3852	330 Nm	135 Nm	12 mm

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The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.