

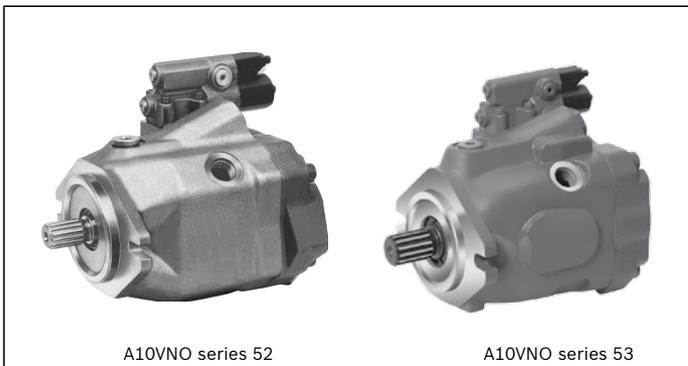
# Axial piston variable pump

## A10VNO series 52 and 53

**RE 92735**

Edition: 04.2015

Replaces: 03.2012



- ▶ Size 28 to 85
- ▶ Nominal pressure 210 bar
- ▶ Maximum pressure 250 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 the displacement.
- ▶ The flow can be infinitely varied by adjusting the swashplate angle.
- ▶ Stable storage for long service life
- ▶ High, permissible drive speed
- ▶ Favorable power-to-weight ratio – compact dimensions
- ▶ Low noise
- ▶ Excellent suction characteristics
- ▶ Electro-hydraulic pressure control
- ▶ Short response times

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## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12
<b>A10VN</b>	<b>O</b>		/	<b>5x</b>		<b>-</b>	<b>V</b>				

### Axial piston unit

01	Variable swashplate design, nominal pressure 210 bar, maximum pressure 250 bar	•	•	•	•	<b>A10VN</b>
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### Operating mode

02	Pump, open circuit					<b>O</b>
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### Size (NG)

03	Geometric displacement, see table of values on page 7	<b>28</b>	<b>45</b>	<b>63</b>	<b>85</b>
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### Control device

04	Pressure control	hydraulic					<b>DR</b>		
	with flow control	hydraulic	X-T open					<b>DRF</b>	
			X-T plugged	with flushing function					<b>DRS</b>
				without flushing function					<b>DRSC</b>
	pressure cut-off	hydraulic	remotely operated					<b>DRG</b>	
			electrical	negative control	$U = 12\text{ V}$				
$U = 24\text{ V}$									<b>ED72</b>

### Series

05	Series 5, index 2	-	•	•	-	<b>52</b>
	Series 5, index 3	•	-	-	•	<b>53</b>

### Direction of rotation

06	Viewed on drive shaft	clockwise					<b>R</b>
		counter-clockwise					<b>L</b>

### Sealing material

07	FKM (fluor-caoutchouc)					<b>V</b>
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### Drive shaft

08	Splined shaft	Standard shaft					<b>S</b>
	ANSI B92.1a	similar to shaft "S" however for higher input torque					<b>R</b>

### Mounting flanges

09	ISO 3019-1 (SAE)	2-hole	•	•	•	•	<b>C</b>
		4-hole	-	-	-	•	<b>D</b>

### Working port

10	SAE flange port fastening thread, metric	rear					<b>11</b>
		at side, opposite					<b>12</b>

01	02	03	04	05	06	07	08	09	10	11	12
<b>A10VN</b>	<b>O</b>			<b>/</b>	<b>5x</b>		<b>-</b>	<b>V</b>			

**Through drive** (for fitting options, see page 29)

11	Flange ISO 3019-1	Hub for splined shaft <sup>1)</sup>								
	diameter	diameter				<b>28</b>	<b>45</b>	<b>63</b>	<b>85</b>	
	without through drive					●	●	●	●	<b>N00</b>
	82-2 (A)	5/8 in	9T 16/32DP			●	●	●	●	<b>K01</b>
		3/4 in	11T 16/32DP			●	●	●	●	<b>K52</b>
101-2 (B)	7/8 in	13T 16/32DP			-	●	●	●	<b>K68</b>	
	1 in	15T 16/32DP			-	-	●	●	<b>K04</b>	

**Connector for solenoids**

12	DEUTSCH – molded connector, 2-pin – without suppressor diode (for electric controls)	●	●	●	●	<b>P</b>
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● = Available    ○ = On request    - = Not available

**Information**

- ▶ Note the project planning notes on page 36.
- ▶ Preservation:
  - Up to 12 months as standard
  - Up to 24 months long-term (state in plain text when ordering)

<sup>1)</sup> According to ANSI B92.1a

## Hydraulic fluids

The A10VNO variable pump is designed for operation with HLP mineral oil according to DIN 51524.

Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

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

### Details regarding the selection of hydraulic fluid

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

### Note

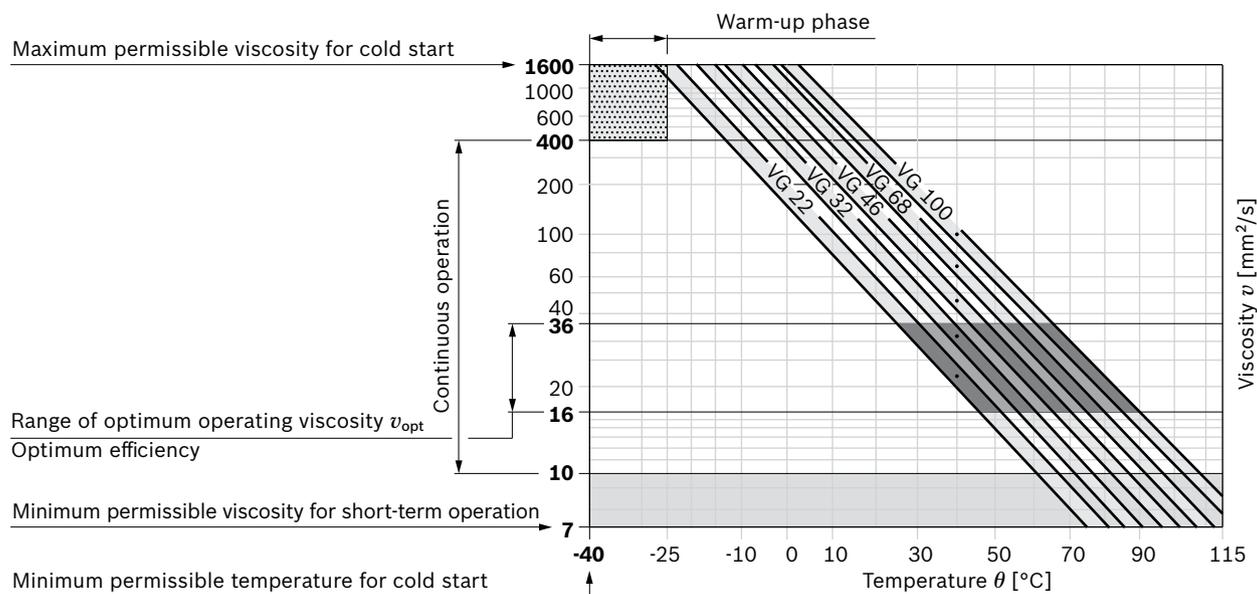
At no point of the component may the temperature be higher than 115 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.

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

### Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	$v_{max} \leq 1600 \text{ mm}^2/\text{s}$	$\theta_{St} \geq -40 \text{ °C}$	$t \leq 1 \text{ min}$ , without load ( $p \leq 30 \text{ bar}$ ), $n \leq 1000 \text{ rpm}$
	Permissible temperature difference	$\Delta T \leq 25 \text{ K}$	between axial piston unit and hydraulic fluid
Warm-up phase	$v < 1600 \text{ to } 400 \text{ mm}^2/\text{s}$	$\theta = -40 \text{ °C to } -25 \text{ °C}$	Note the detailed information on operation with low temperatures, see data sheet 90300-03-B.
Continuous operation	$v = 400 \text{ to } 10 \text{ mm}^2/\text{s}$	$\theta = -25 \text{ °C to } +110 \text{ °C}$	This corresponds, for example on the VG 46, to a temperature range of +5 °C to +85 °C (see selection diagram page 4)
			measured at port <b>L</b> observe permissible temperature range of the shaft seal ring ( $\Delta T = \text{approx. } 5 \text{ K}$ between bearing/shaft seal and port <b>L</b> )
	$v_{opt} = 36 \text{ to } 16 \text{ mm}^2/\text{s}$		Range of optimum operating viscosity and efficiency
Short-term operation	$v_{min} \geq 7 \text{ mm}^2/\text{s}$		$t < 1 \text{ min}$ , $p < 0.3 \cdot p_{nom}$

### ▼ Selection diagram



### **Filtration of the hydraulic fluid**

The finer the filtration, the better the hydraulic fluid cleanliness level, and the longer 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.

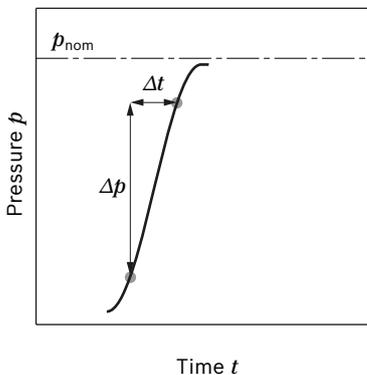
At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), at least cleanliness level 19/17/14 according to ISO 4406 is necessary.

Please contact us if the above classes cannot be observed.

## Operating pressure range

Pressure at working port B		Definition
Nominal pressure $p_{nom}$	210 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure $p_{max}$	250 bar absolute	The maximum pressure corresponds the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	2.5 ms	
Total operating period	300 h	
Minimum pressure $p_{B abs}$ (high pressure side)	10 bar absolute	Minimum pressure on the high-pressure side ( <b>B</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 $p_{S min}$	Standard 0.8 bar absolute	Minimum pressure at suction port <b>S</b> (inlet) that is required in order to avoid damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.
Maximum pressure $p_{S max}$	5 bar absolute	
Leakage pressure at port L <sub>1</sub> , L <sub>2</sub>		
Maximum pressure $p_{L max}$	2 bar absolute	Maximum 0.5 bar higher than inlet pressure at port <b>S</b> , but not higher than $p_{L max}$ . A case drain line to the reservoir is required.

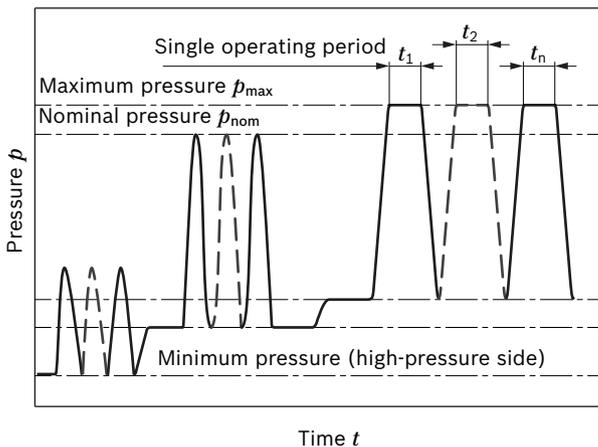
### ▼ Rate of pressure change $R_{A max}$



### Note

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

### ▼ Pressure definition



$$\text{Total operating period} = t_1 + t_2 + \dots + t_n$$

## Technical data

Size		NG	28	45	63	85
Displacement, geometric, per revolution		$V_{g \max}$ cm <sup>3</sup>	28	45	63	85
Maximum rotational speed <sup>1)</sup>	At $V_{g \max}$	$n_{\text{nom}}$ rpm	3200	2900	2700	2700
Flow	at $n_{\text{nom}}$ and $V_{g \max}$	$q_v$ l/min	90	131	170	230
Power	at $n_{\text{nom}}$ , $V_{g \max}$ and $\Delta p = 210$ bar	$P$ kW	31	46	59	80
Torque	at $V_{g \max}$ and $\Delta p = 210$ bar	$T$ Nm	94	150	210	284
Rotary stiffness drive shaft	S	$c$ Nm/rad	11000	22300	37500	65500
	R	$c$ Nm/rad	14800	26500	40500	69400
Moment of inertia for rotary group		$J_{GR}$ kgm <sup>2</sup>	0.00093	0.0017	0.0033	0.0056
Maximum angular acceleration <sup>2)</sup>		$\alpha$ rad/s <sup>2</sup>	6800	4900	3500	2500
Case volume		$V$ l	0.25	0.3	0.5	0.8
Weight <b>without</b> through drive (approx.)		$m$ kg	11.5	15	18	22
Weight <b>with</b> through drive (approx.)			13	18	24	28

### Determining the operating characteristics

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

$V_g$  = Displacement per revolution [cm<sup>3</sup>]

$\Delta p$  = Differential pressure [bar]

$n$  = Rotational speed [rpm]

$\eta_v$  = Volumetric efficiency

$\eta_{mh}$  = Mechanical-hydraulic efficiency

$\eta_t$  = Total efficiency ( $\eta_t = \eta_v \times \eta_{mh}$ )

#### Note

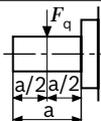
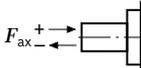
- ▶ Theoretical values, without efficiency and tolerances; values rounded.
- ▶ Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or the destruction of the axial piston unit. We recommend testing the loads by means of experiment or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

1) The values are valid:

- At absolute pressure  $p_{\text{abs}} = 1$  bar at suction port **S**
- For the optimal viscosity range of  $\nu_{\text{opt}} = 36$  to  $16$  mm<sup>2</sup>/s
- For hydraulic fluid based on mineral oils

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds. It applies for external stimuli (e. g. engine 2 to 8 times rotary frequency, Cardan shaft twice the rotary frequency). The limiting value is only valid for a single pump. The load capacity of the connection parts must be considered.

**Permissible radial and axial forces of the drive shaft**

Size		NG	28	45	63	85	
Maximum radial force at a/2		$F_{q \max}$	N	150	650	1000	1350
Maximum axial force		$\pm F_{ax \max}$	N	400	650	1000	1350

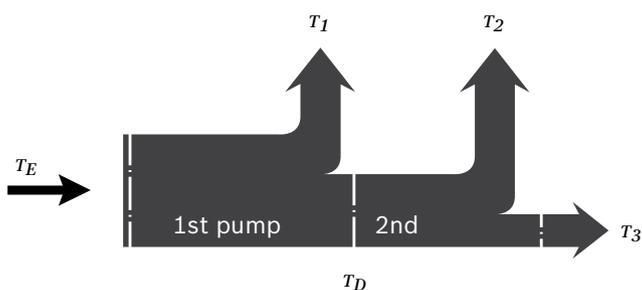
**Note**

- ▶ The values given are maximum values and do not apply to continuous operation. For drives with radial loading (pinion, V-belt drives), please contact us!

**Permissible input and through-drive torques**

Size			28	45	63	85	
Torque at $V_{g \max}$ and $\Delta p = 210 \text{ bar}^1$		$T_{\max}$	Nm	94	150	210	284
Input torque at drive shaft, maximum <sup>2)</sup>							
	S	$T_{E \max}$	Nm	124	198	319	630
		$\emptyset$	in	3/4	7/8	1	1 1/4
	R	$T_{E \max}$	Nm	160	250	400	650
		$\emptyset$	in	3/4	7/8	1	1 1/4
Maximum through-drive torque							
	S	$T_{D \max}$	Nm	108	160	319	484
	R	$T_{D \max}$	Nm	120	176	365	484

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

1) Efficiency not considered

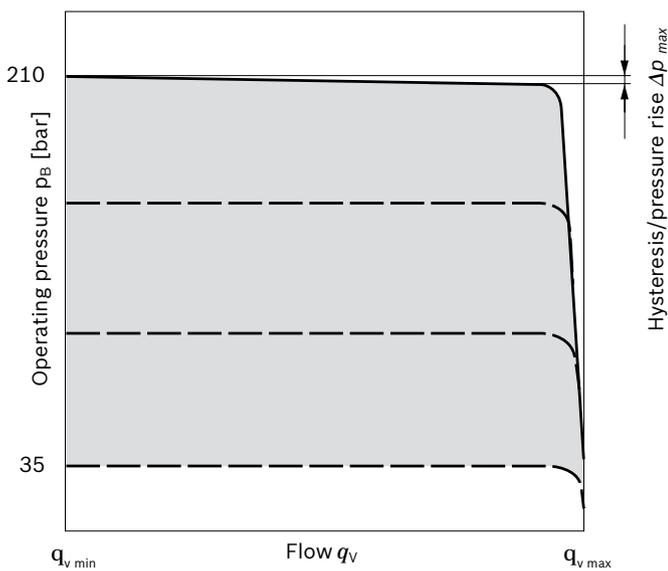
2) For drive shafts with no radial force

## DR – Pressure control

The pressure control 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 operating pressure exceeds the pressure setting at the pressure valve, the pump will regulate to a smaller displacement to reduce the control differential.

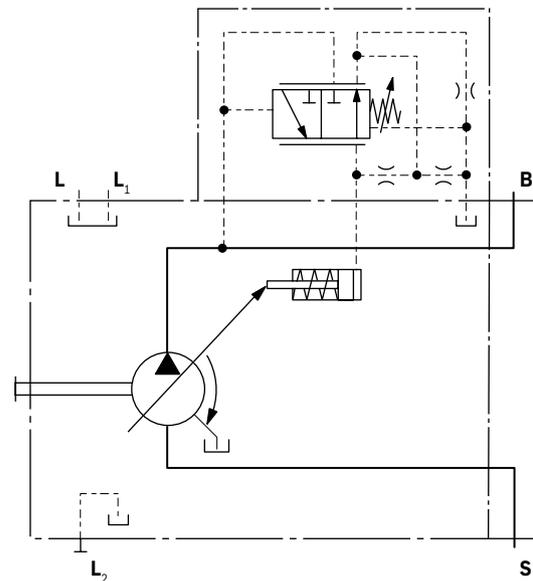
- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 35 to 210 bar. Standard is 210 bar.

### ▼ Characteristic curve DR



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

### ▼ Schematic DR



### Controller data

NG		28	45	63	85
Pressure increase	$\Delta p$ [bar]	6	6	6	8
Hysteresis and repeat precision	$\Delta p$ [bar]	maximum 4			
Pilot fluid consumption	[l/min]	maximum approx. 3			

<sup>1)</sup> 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.

## DRG – Pressure control remotely operated

For the remote-controlled pressure control, the target pressure can be set using a separately arranged pressure relief valve. Pressure control DR see page 9.

A pressure relief valve can be externally piped to port **X** for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the scope of supply of the pump.

The differential pressure at the DRG control valve is set as standard to 20 bar. At port **X** the amount of control fluid is about 1.5 l/min. If a different setting (range 10 to 22 bar) is required, please state in plain text.

As a separate pressure relief valve, we recommend:

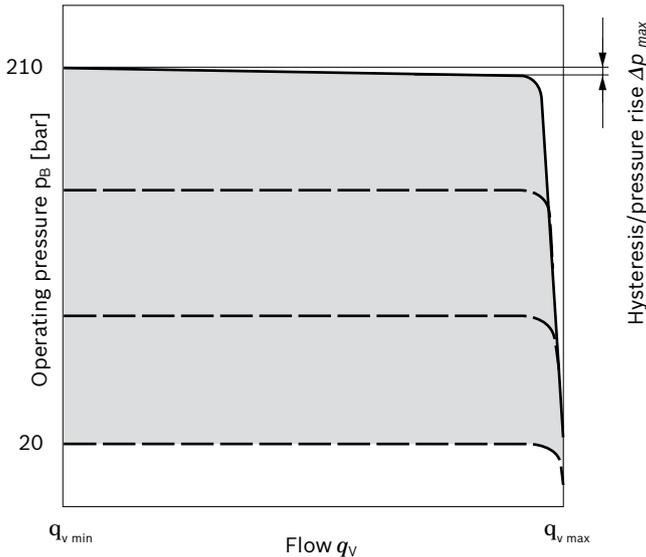
**DBDH 6** (hydraulic) to RE 25402 or

**DBETR-SO 381** with orifice  $\varnothing$  0.8 mm in P (electric) to RE 29166.

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

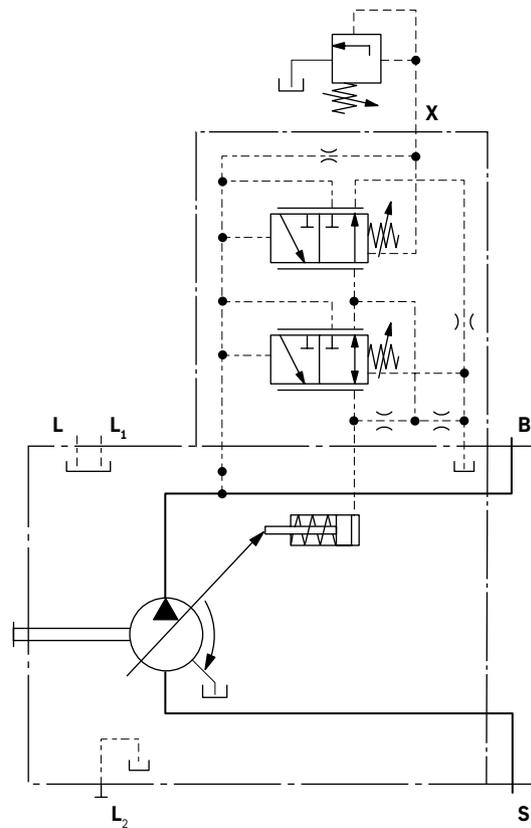
- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 20 to 210 bar.  
Standard is 210 bar.

### ▼ Characteristic curve DRG



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

### ▼ Schematic DRG



### Controller data

NG		28	45	63	85
Pressure increase	$\Delta p$ [bar]	6	6	6	8
Hysteresis and repeat precision	$\Delta p$ [bar]	maximum 4			
Pilot fluid consumption	l/min	maximum approx. 4.5			

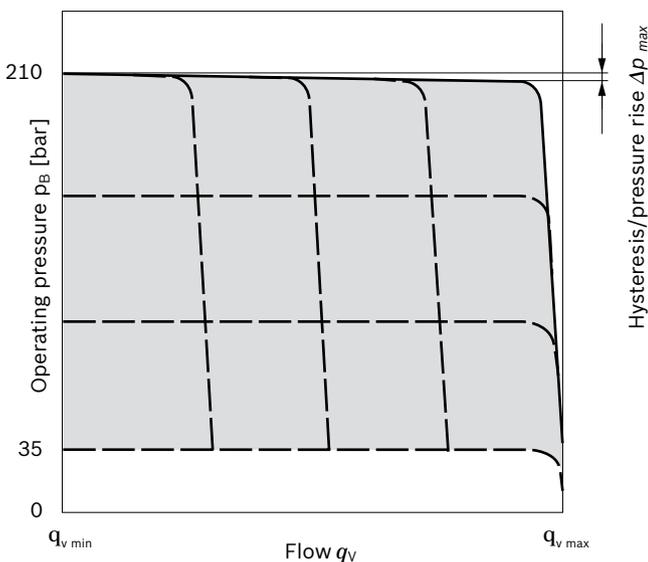
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.

## DRF/DRS/DRSC – Pressure and flow control

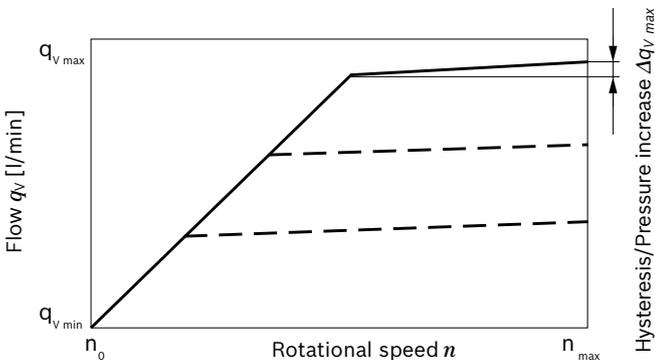
In addition to the pressure control function (see page 9), a variable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual required flow by the consumer, regardless of changing pressure levels. The pressure control overrides the flow control function.

- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 35 to 210 bar. Standard is 210 bar.

### ▼ Characteristic curve DRF/DRS/DRSC



### ▼ Characteristic curve at variable speed

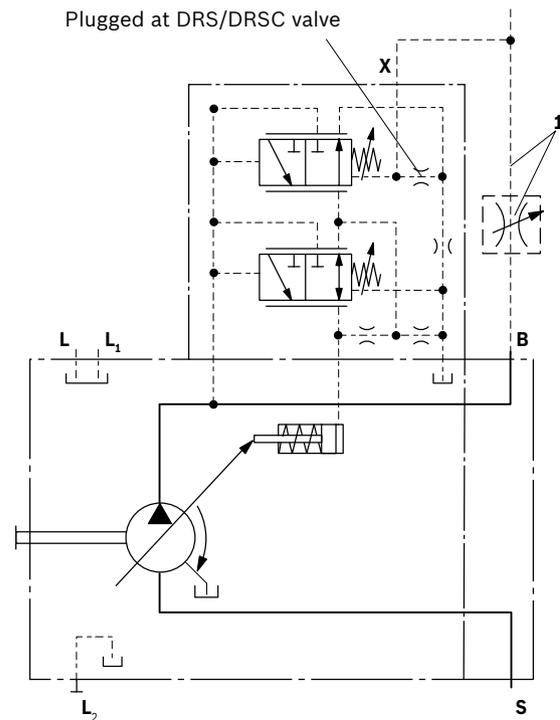


Characteristic curve valid at  $n_1 = 1500$  rpm and  $\theta_{fluid} = 50$  °C.

Possible connections at port **B** (not included in the delivery contents)

LS mobile control blocks	Data sheets
M4-12	64276
M4-15	64283
LUDV mobile control blocks	
M6-15	64284
M7-22	64295

### ▼ Schematic DG



**1** The sensing orifice (control block) and the line is not included in the delivery contents.

#### Note

The DRS and DRSC valve versions have no pilot line between **X** and the reservoir. Unloading the LS-pilot line must be possible in the valve system. Because of the flushing function sufficient unloading of the flow control in DRS control valve **X**-line must also be provided. If this pilot line of the **X** line does not have to be guaranteed, the DRSC control valve must be used.

For further information see page 12

<sup>1)</sup> 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.

**Differential pressure  $\Delta p$ :**

- ▶ Standard setting: 14 to 22 bar.

If another setting is required, please state in clear text.

Relieving the load on port **X** to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar higher than the differential pressure  $\Delta p$ .

No account is taken of system influences.

**Controller data**

- ▶ DR Pressure control data see page 9.
- ▶ Maximum flow deviation measured at drive speed  
n = 1500 rpm.

<b>NG</b>		<b>28</b>	<b>45</b>	<b>63</b>	<b>85</b>
Flow deviation	$\Delta q_{vmax}$ [l/min]	0.9	1.0	1.8	2.5
Hysteresis; repeat precision	$\Delta p$ [bar]	maximum 4			
Pilot fluid consumption	[l/min]	maximum approx. 3 to 4.5 (DRF) maximum approx. 3 (DRS / DRSC)			

## ED – Electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

When a change is made at the consumer (load pressure), the position of the control piston will shift.

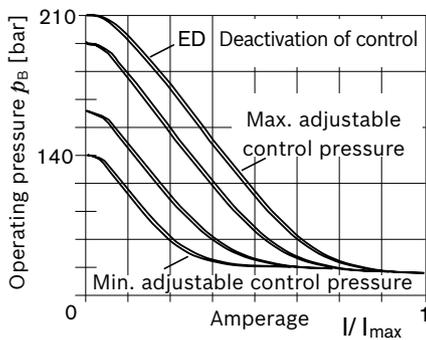
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to  $p_{max}$  by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power, e.g. for fan drives). The response time characteristic curve of the ED-control was optimized for the use as a fan drive system.

When ordering, specify the type of application in clear text.

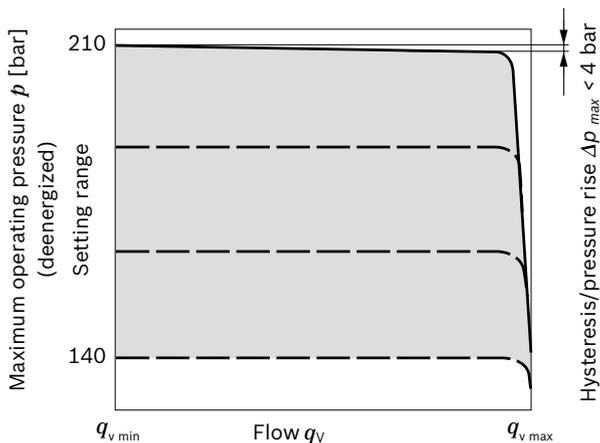
### ▼ Static current-pressure characteristic curve ED

(negative characteristic curve measured with pump in zero stroke)



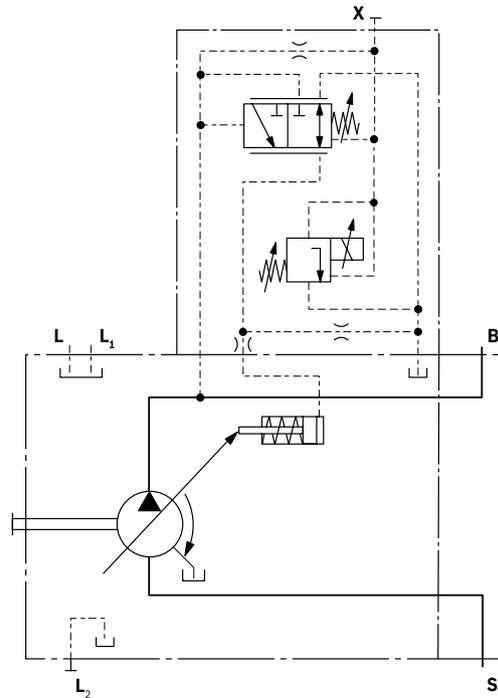
► Hysteresis static < 3 bar.

### ▼ Flow-pressure characteristic curve



- Characteristic curve valid at  $n_1 = 1500$  rpm and  $\theta_{fluid} = 50$  °C.
- Pilot fluid consumption: 3 to 4.5 l/min.
- Standby standard setting 23 bar. Other values on request.

### ▼ Schematic ED71/ED72



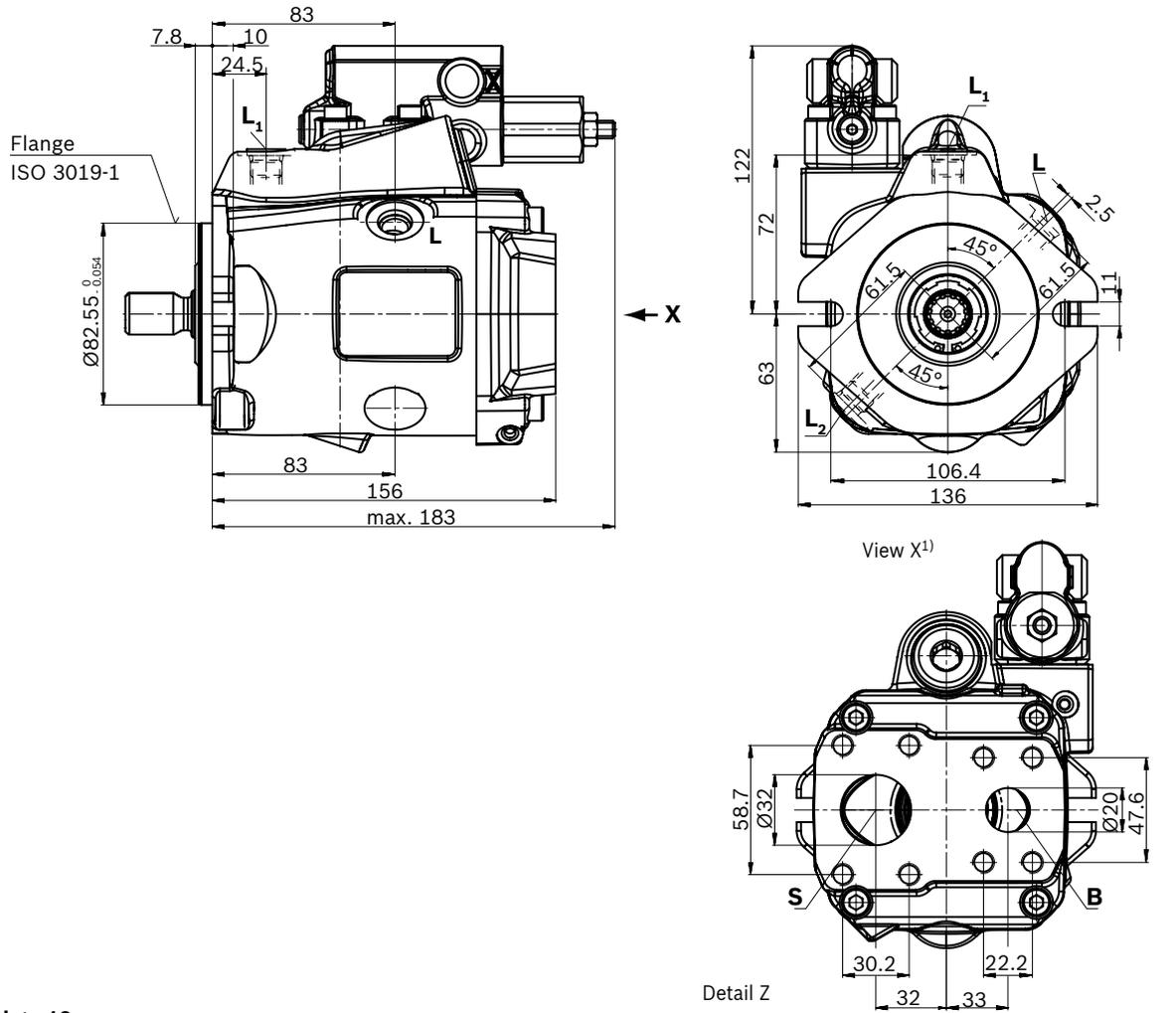
Technical data, solenoid	ED71	ED72
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $p_{min}$	100 mA	50 mA
End of control at $p_{max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100%	100%
Type of protection: see connector version page 31		
Operating temperature range at valve -20 °C to +115 °C		

210 bar is the standard nominal pressure, higher pressures for fan drive application on request. You will also find more information about fan systems in application brochure 98065.

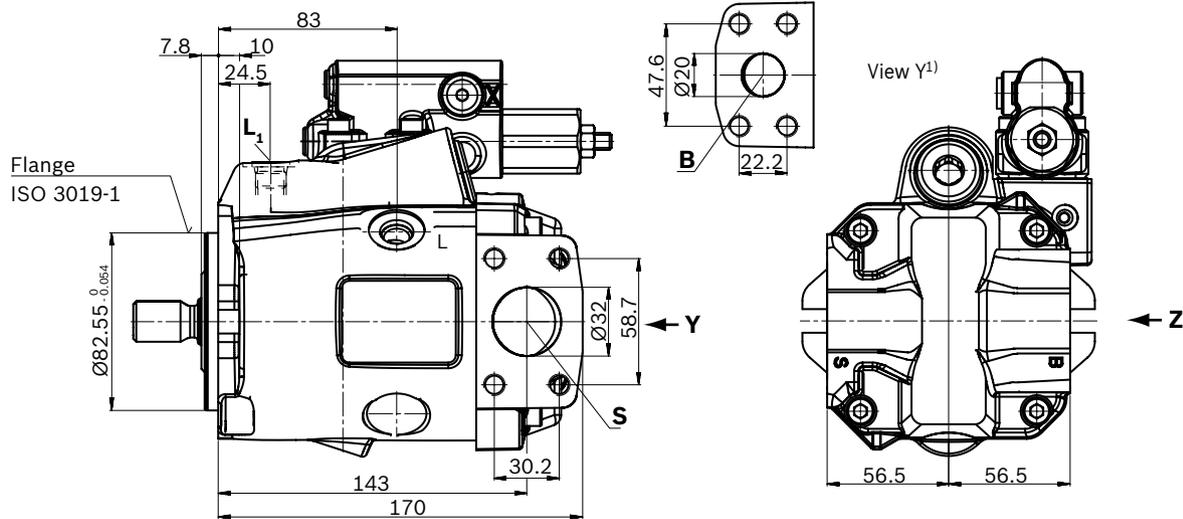
**Dimensions, Size 28**

**DR – Hydraulic pressure controller; clockwise rotation, series 53**

▼ **Port plate 11**

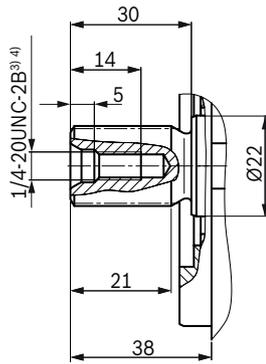


▼ **Port plate 12**

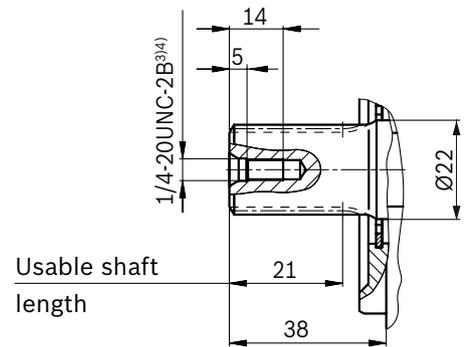


1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

## ▼ Splined shaft 3/4 in (SAE J744)

S – 11T 16/32DP<sup>1)</sup>

## ▼ Splined shaft 3/4 in (SAE J744)

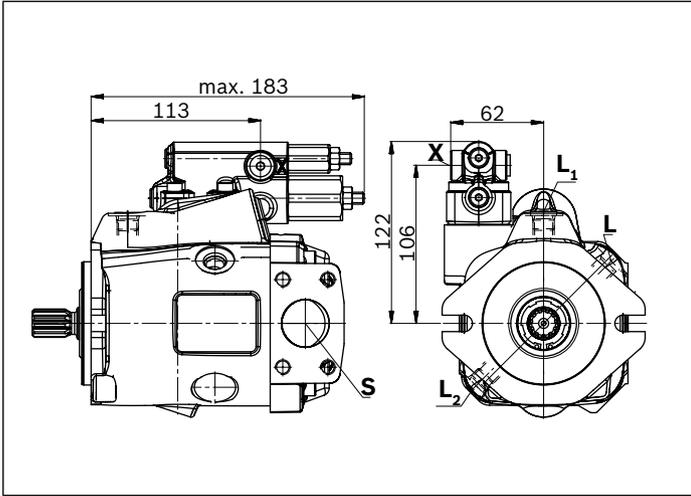
R – 11T 16/32DP<sup>1)2)</sup>

Ports		Standard	Size <sup>4)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>5)</sup>	Condition <sup>9)</sup>
<b>B</b>	Working line port (Standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	3/4 in M10 × 1.5; 17 deep	250	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	1 1/4 in M10 × 1.5; 17 deep	5	O
<b>L</b>	Case drain port	DIN 11926 <sup>7)</sup>	3/4-16UNF-2B; 12 deep	2	O <sup>8)</sup>
<b>L<sub>1</sub>, L<sub>2</sub></b>	Case drain port	DIN 11926 <sup>7)</sup>	3/4-16UNF-2B; 12 deep	2	X <sup>8)</sup>
<b>X</b>	Control pressure	DIN 11926	7/16-20UNF-2A; 11.5 deep	250	O

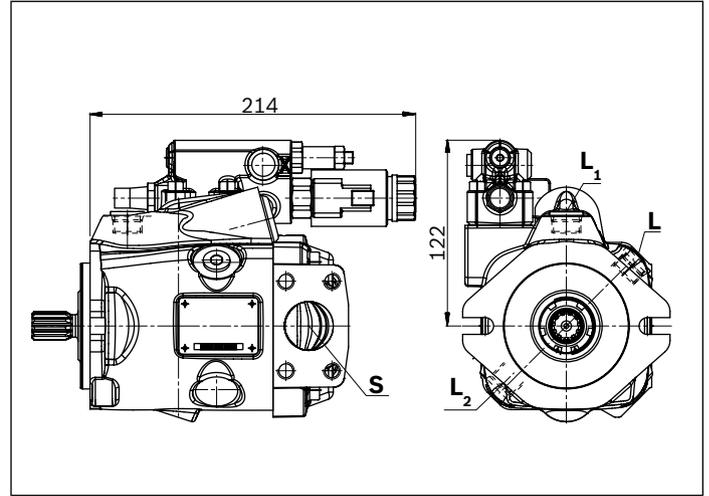
- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
- 3) Thread according to ASME B1.1
- 4) Observe the general instructions on page 36 concerning the maximum tightening torques.

- 5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 6) Metric fixing thread differing from standard
- 7) The spot face can be deeper than as specified in the standard.
- 8) Depending on the installation position, L, L<sub>1</sub> or L<sub>2</sub> must be connected (also see installation instructions starting on page 32).
- 9) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)

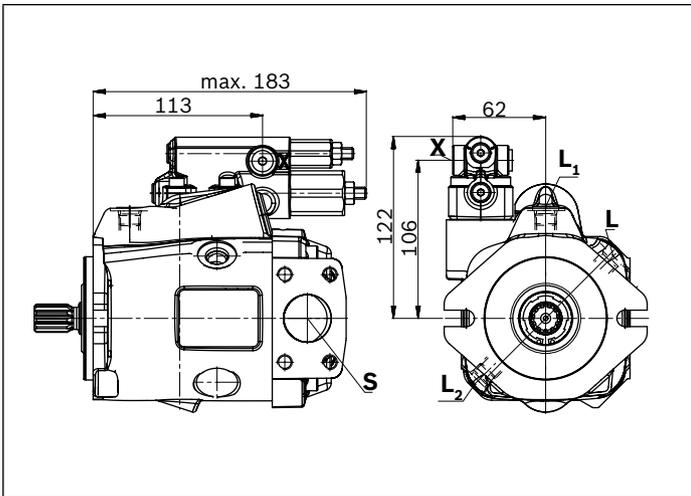
▼ **DRG – Pressure controller, remote controlled, series 53**



▼ **ED7. – Electro-prop. Pressure control, series 53**



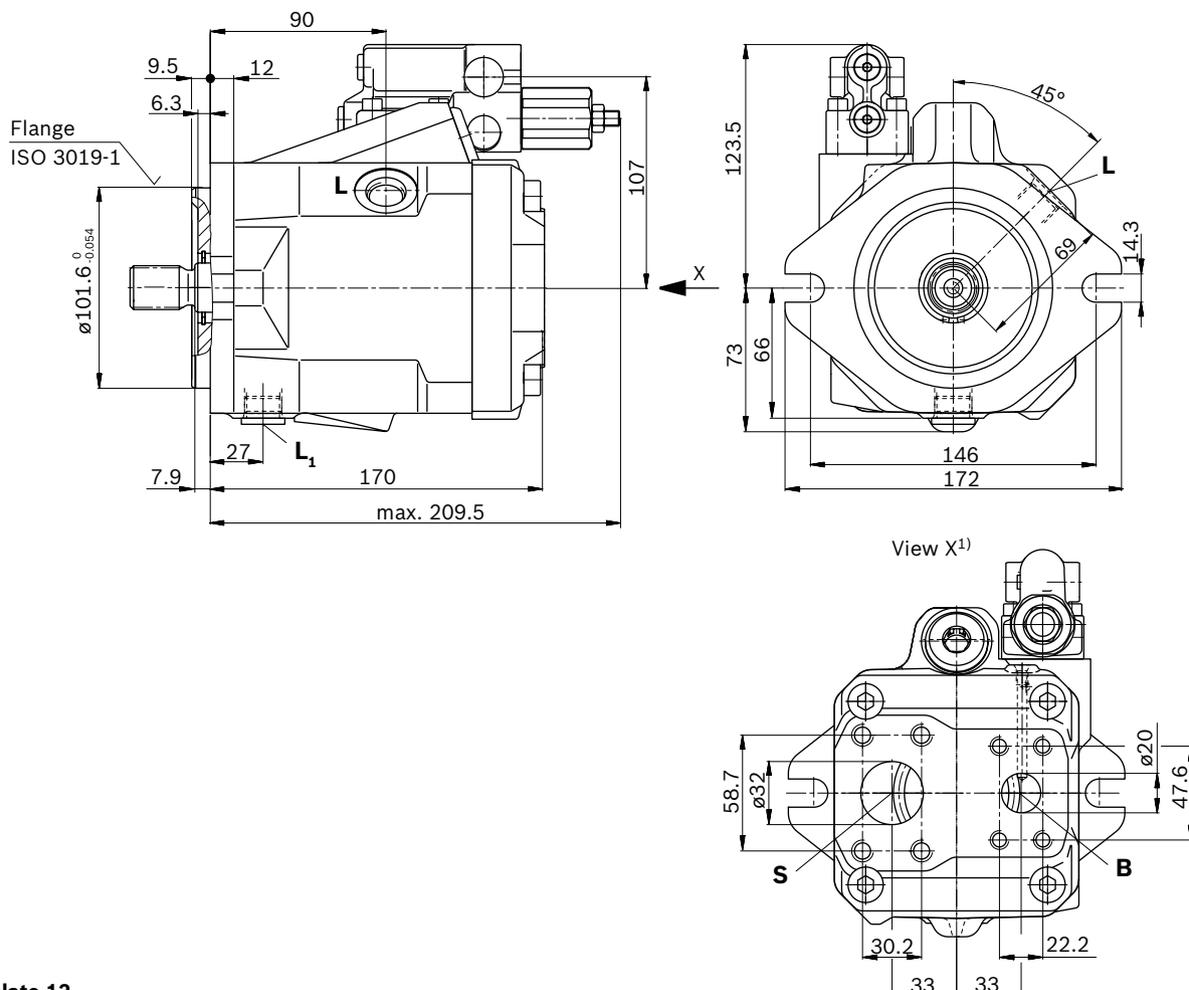
▼ **DRF/DRS/DRSC – Pressure and flow control, series 53**



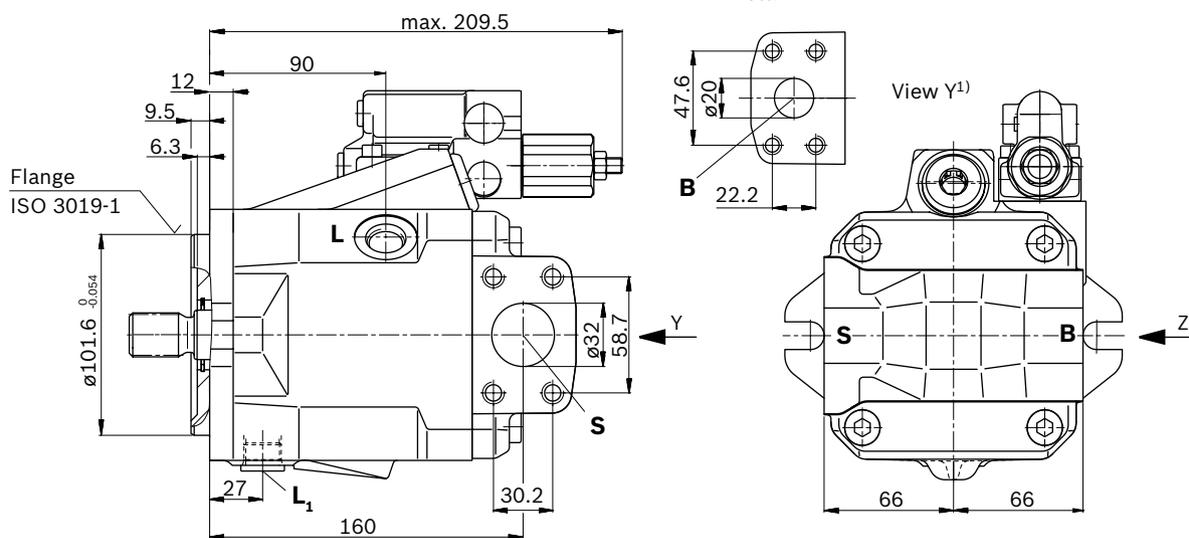
### Dimensions, Size 45

#### DR – Hydraulic pressure controller; clockwise rotation, series 52

##### ▼ Port plate 11

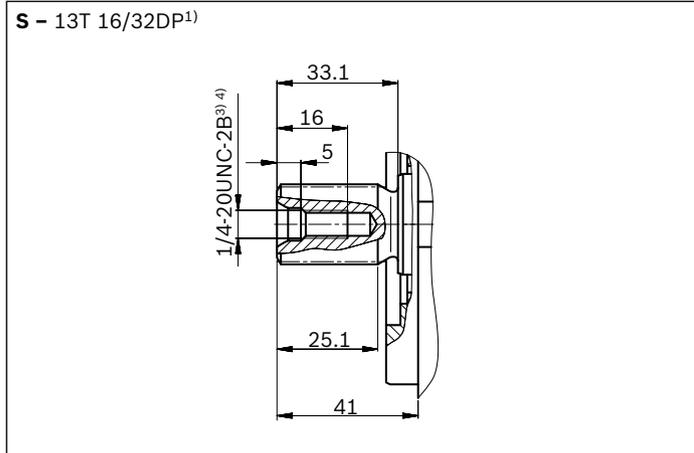


##### ▼ Port plate 12

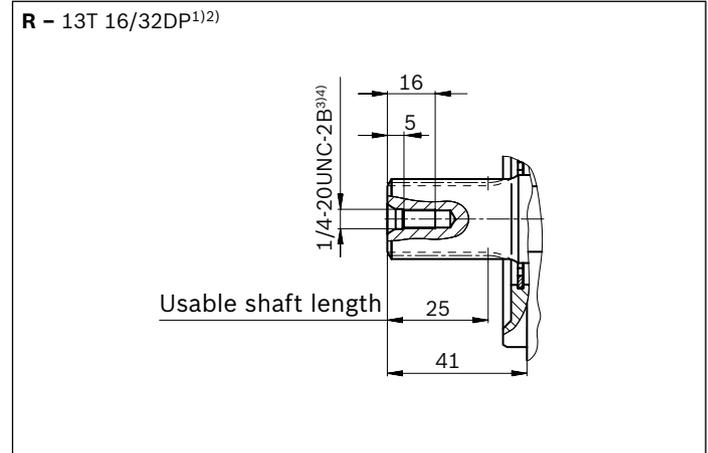


1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

▼ **Splined shaft 7/8 in (SAE J744)**



▼ **Splined shaft 7/8 in (SAE J744)**

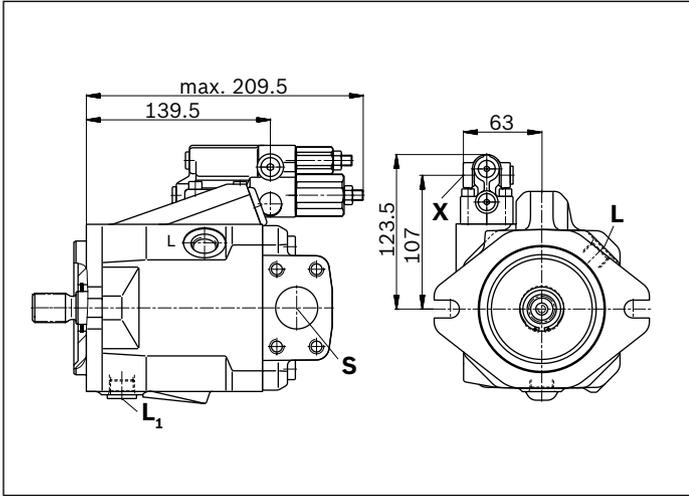


Ports		Standard	Size <sup>4)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>5)</sup>	Condition <sup>9)</sup>
<b>B</b>	Service line port (Standard pressure series) Fixing thread	SAE J518 <sup>6)</sup> DIN 13	3/4 in M10 × 1.5; 17 deep	250	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	1 1/4 in M10 × 1.5; 17 deep	5	O
<b>L</b>	Case drain port	ISO 11926 <sup>7)</sup>	3/4-16UNF-2B; 12 deep	2	O <sup>8)</sup>
<b>L<sub>1</sub></b>	Case drain port	ISO 11926 <sup>7)</sup>	3/4-16UNF-2B; 12 deep	2	X <sup>8)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20UNF-2B; 11.5 deep	250	O

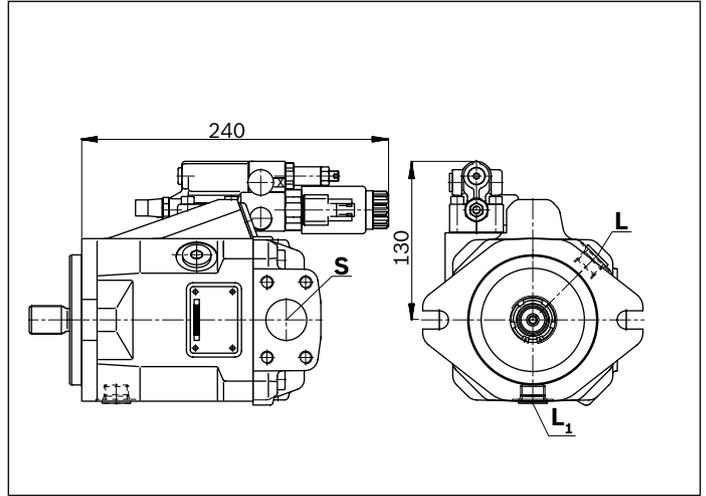
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.  
 3) Thread according to ASME B1.1  
 4) Observe the general instructions on page 36 concerning the maximum tightening torques.  
 5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

6) Metric fixing thread differing from standard  
 7) The spot face can be deeper than as specified in the standard.  
 8) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 32).  
 9) O = Must be connected (plugged on delivery)  
 X = Plugged (in normal operation)

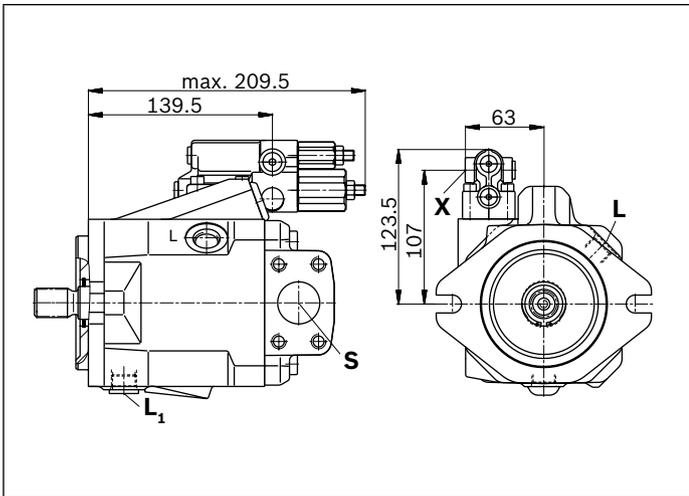
▼ **DRG – Pressure controller, remote controlled, series 52**



▼ **ED7. – Electro-prop. Pressure control, series 52**



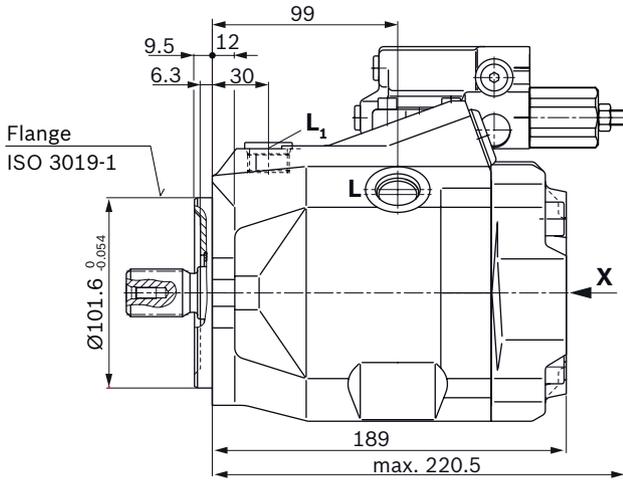
▼ **DRF/DRS/DRSC – Pressure and flow control, series 52**



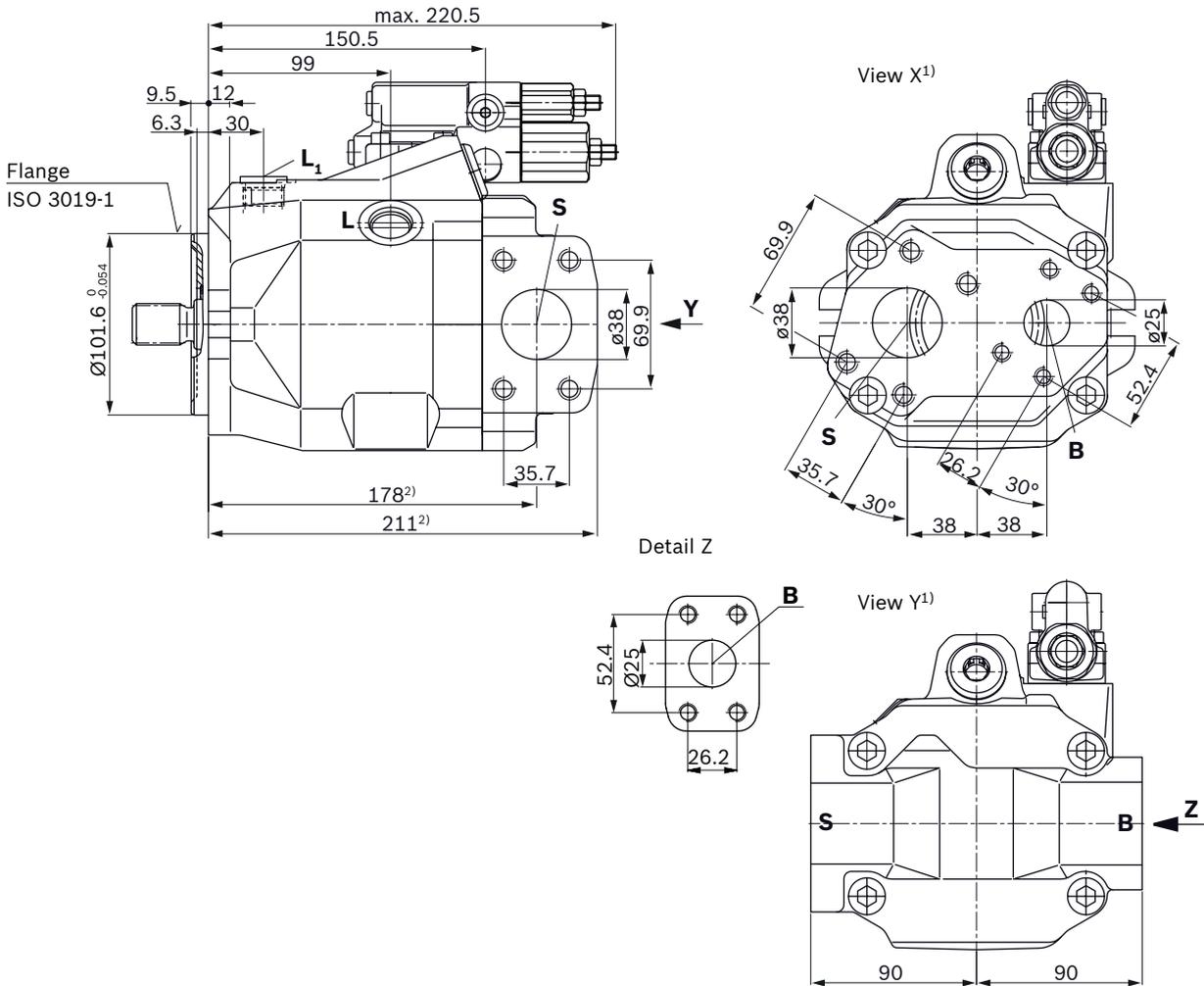
**Dimensions, Size 63**

**DR – Hydraulic pressure controller; clockwise rotation, series 52**

▼ **Port plate 11**

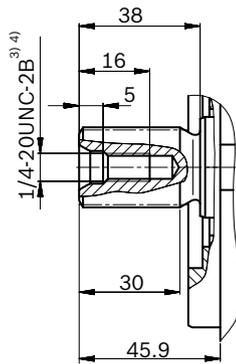


▼ **Port plate 12**

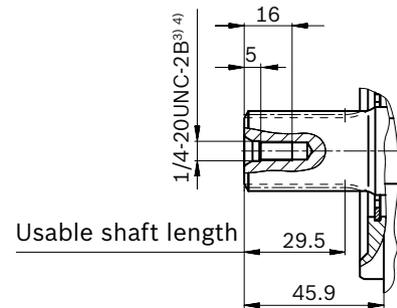


1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

## ▼ Splined shaft 1 in SAE J744

S – 15T 16/32DP<sup>1)</sup>

## ▼ Splined shaft 1 in SAE J744

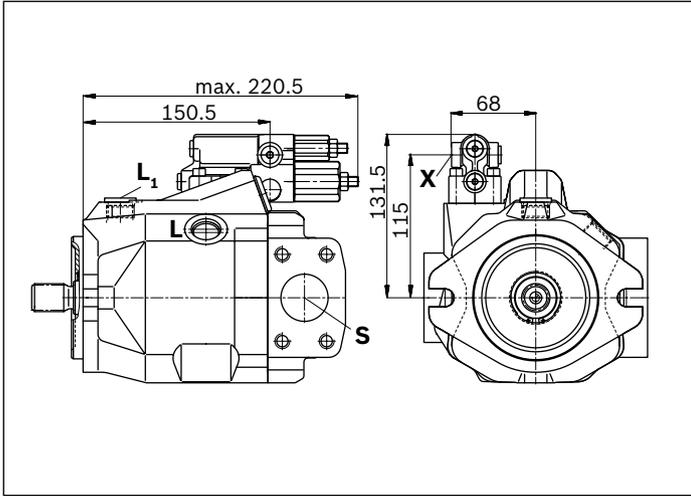
R – 15T 16/32DP<sup>1)2)</sup>

Ports		Standard	Size <sup>4)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>5)</sup>	Condition <sup>9)</sup>
<b>B</b>	Working line port (Standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	1 in M10 × 1.5; 17 deep	250	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	1 1/2 in M12 × 1.75; 20 deep	5	O
<b>L</b>	Case drain port	ISO 11926 <sup>7)</sup>	7/8-14UNF-2B; 13 deep	2	O <sup>8)</sup>
<b>L<sub>1</sub></b>	Case drain port	ISO 11926 <sup>7)</sup>	7/8-14UNF-2B; 13 deep	2	X <sup>8)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20UNF-2A; 11.5 deep	250	O

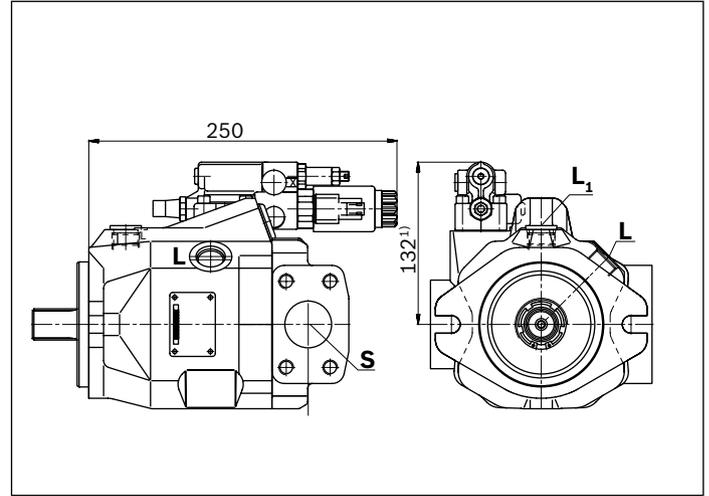
- 1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
- 3) Thread according to ASME B1.1
- 4) Observe the general instructions on page 36 concerning the maximum tightening torques.
- 5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

- 6) Metric fixing thread differing from standard
- 7) The spot face can be deeper than as specified in the standard.
- 8) Depending on the installation position, L, L<sub>1</sub> or L<sub>2</sub> must be connected (also see installation instructions starting on page 32).
- 9) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)

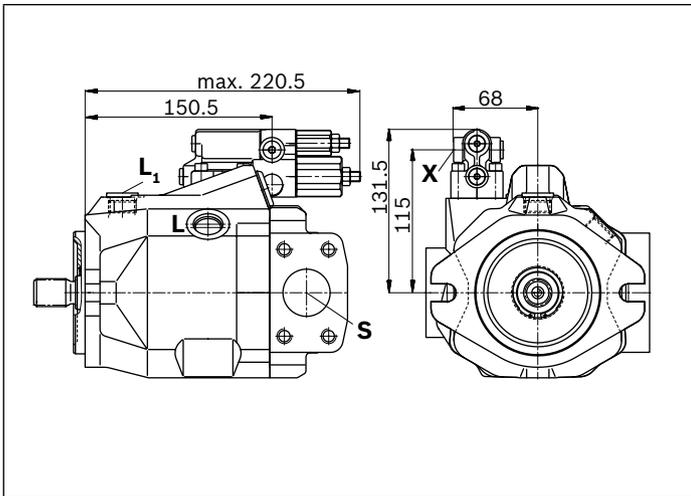
▼ **DRG – Pressure controller, remote controlled, series 52**



▼ **ED7. / ER7. – Electro-prop. Pressure control, series 52**



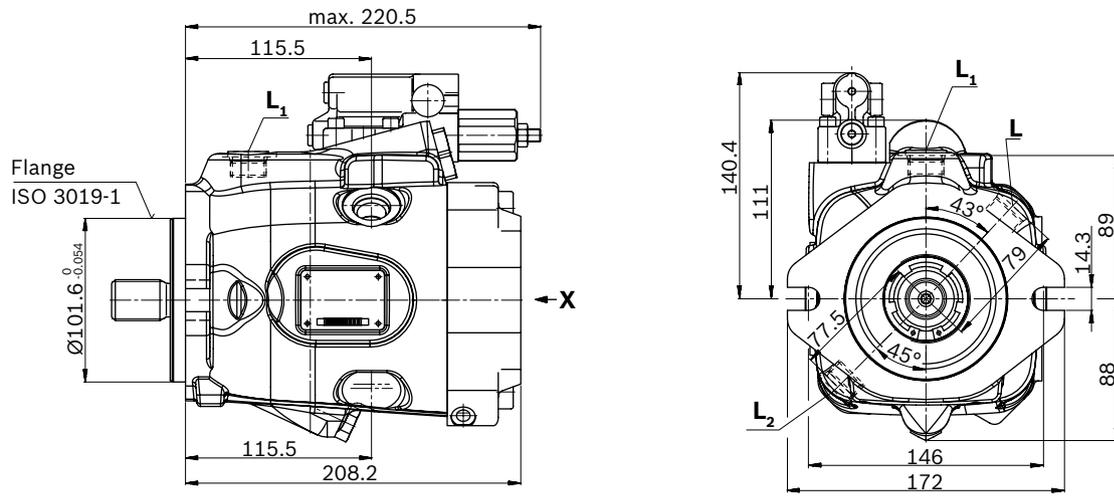
▼ **DRF/DRS/DRSC – Pressure and flow control, series 52**



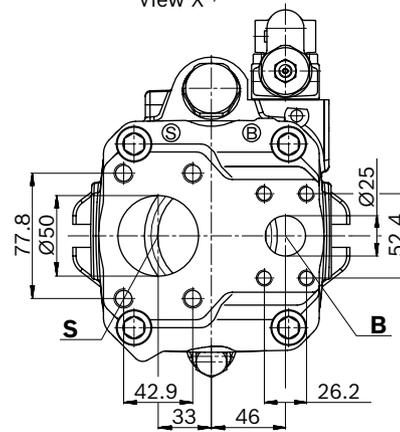
**Dimensions, Size 85**

**DR – Hydraulic pressure controller; clockwise rotation, mounting flange C series 53**

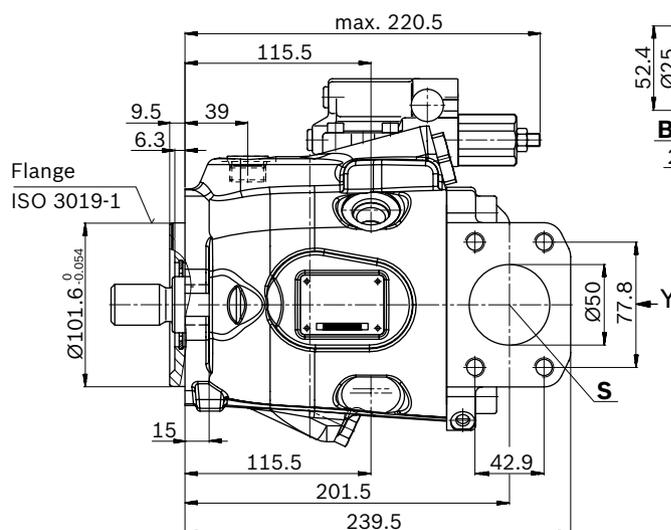
▼ **Port plate 11**



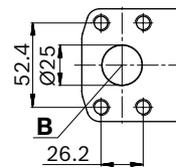
View X<sup>1)</sup>



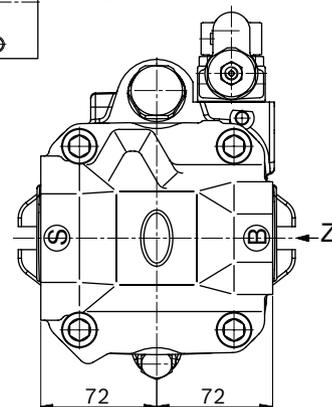
▼ **Port plate 12**



Detail Z



View Y<sup>1)</sup>

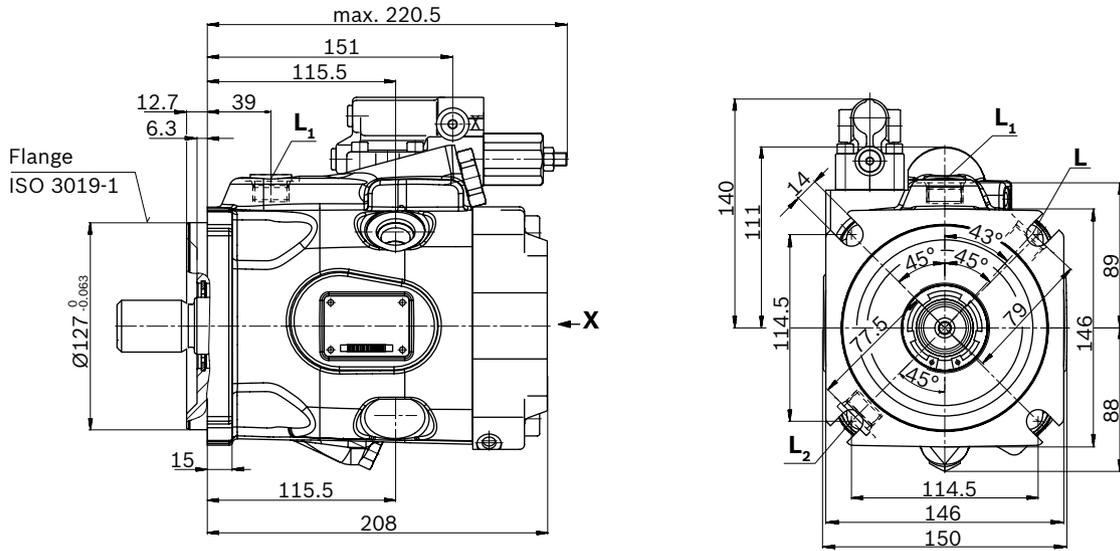


1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

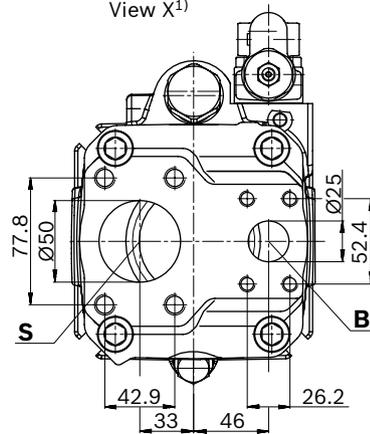
**Dimensions, Size 85**

**DR – Hydraulic pressure controller; clockwise rotation, mounting flange D series 53**

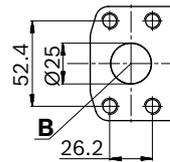
▼ **Port plate 11**



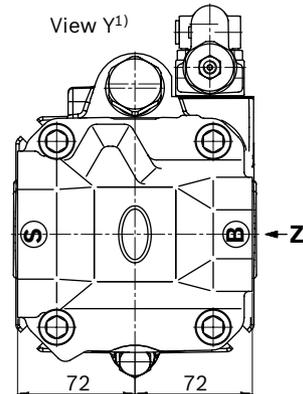
View X<sup>1)</sup>



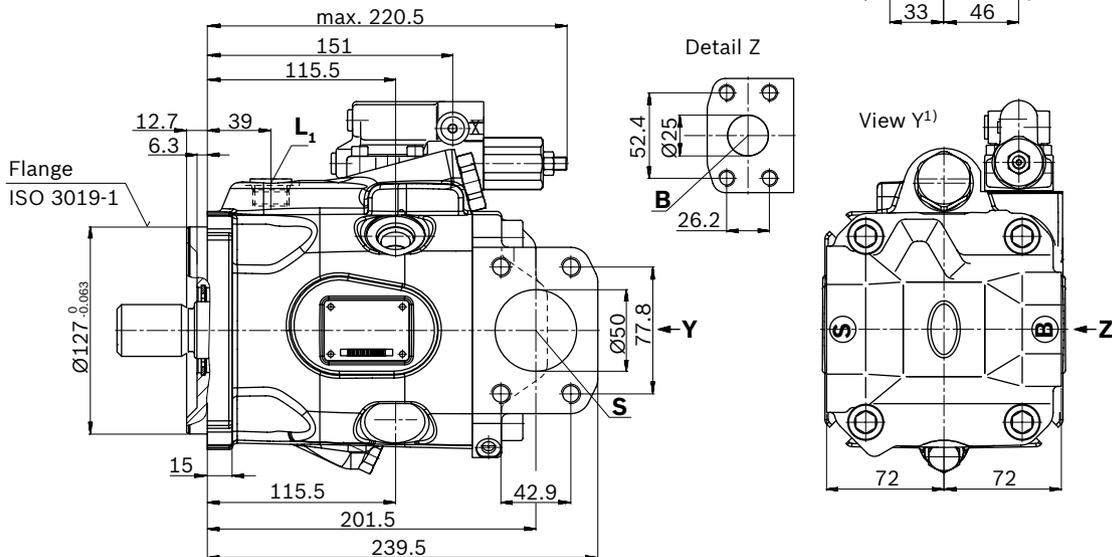
Detail Z



View Y<sup>1)</sup>

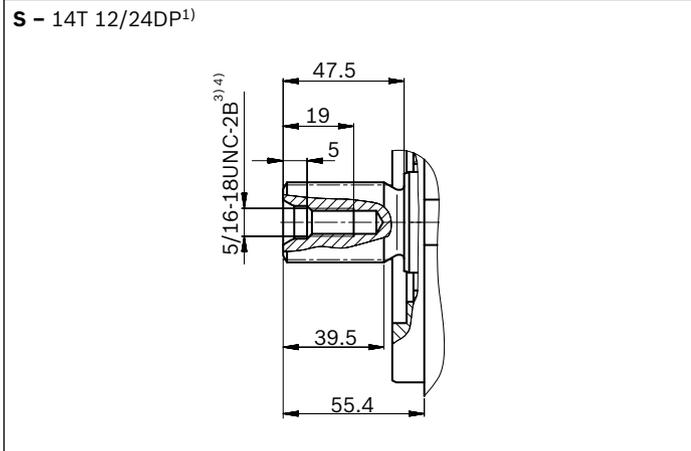


▼ **Port plate 12**

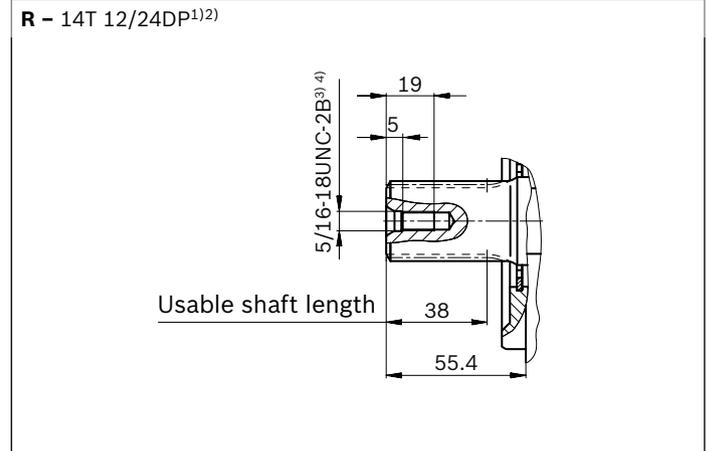


1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

▼ **Splined shaft 1 1/4 in SAE J744**



▼ **Splined shaft 1 1/4 in SAE J744**

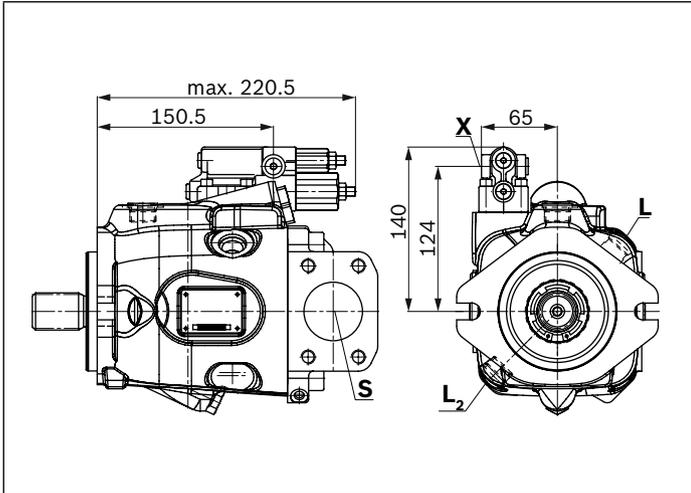


Ports		Standard	Size <sup>4)</sup>	$p_{\max \text{ abs}}$ [bar] <sup>5)</sup>	Condition <sup>9)</sup>
<b>B</b>	Working line port (Standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	1 in M10 × 1.5; 17 deep	250	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 <sup>6)</sup> DIN 13	2 in M12 × 1.75; 20 deep	5	O
<b>L</b>	Case drain port	ISO 11926 <sup>7)</sup>	7/8-14UNF-2B; 13 deep	2	O <sup>8)</sup>
<b>L<sub>1</sub>, L<sub>2</sub></b>	Case drain port	ISO 11926 <sup>7)</sup>	7/8-14UNF-2B; 13 deep	2	X <sup>8)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20UNF-2A; 11.5 deep	250	O

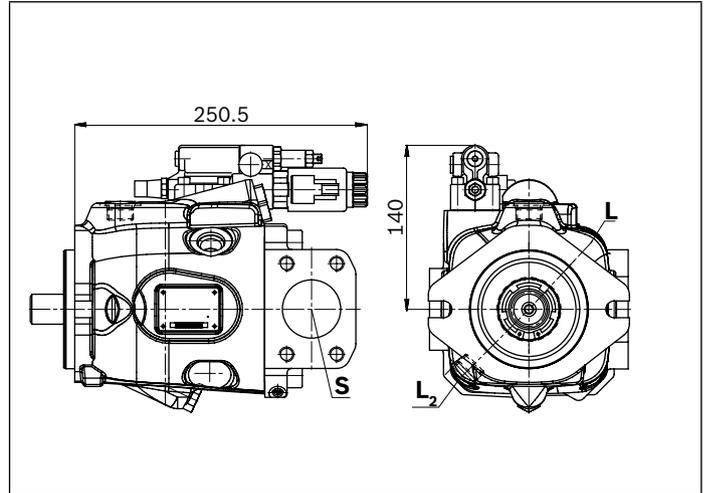
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.  
 3) Thread according to ASME B1.1  
 4) Observe the general instructions on page 36 concerning the maximum tightening torques.  
 5) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

6) Metric fixing thread differing from standard  
 7) The spot face can be deeper than as specified in the standard.  
 8) Depending on the installation position, L, L<sub>1</sub> or L<sub>2</sub> must be connected (also see installation instructions starting on page 32).  
 9) O = Must be connected (plugged on delivery)  
 X = Plugged (in normal operation)

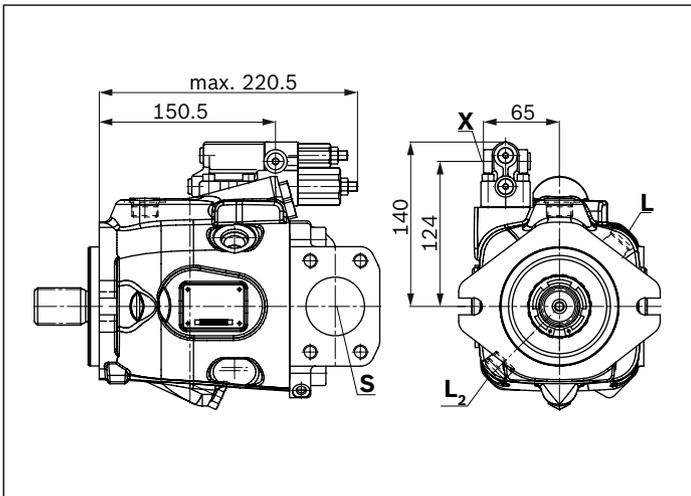
▼ **DRG – Pressure controller, remote controlled, series 53**



▼ **ED7. – Electro-prop. Pressure control, series 53**



▼ **DRF/DRS/DRSC – Pressure and flow control, series 53**

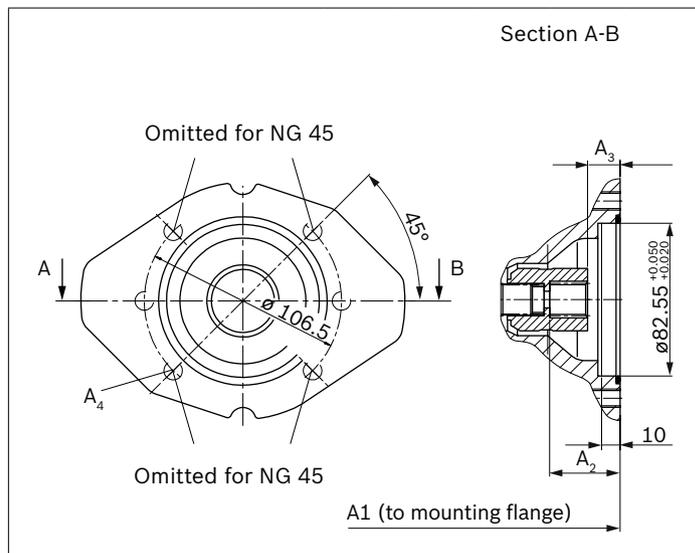
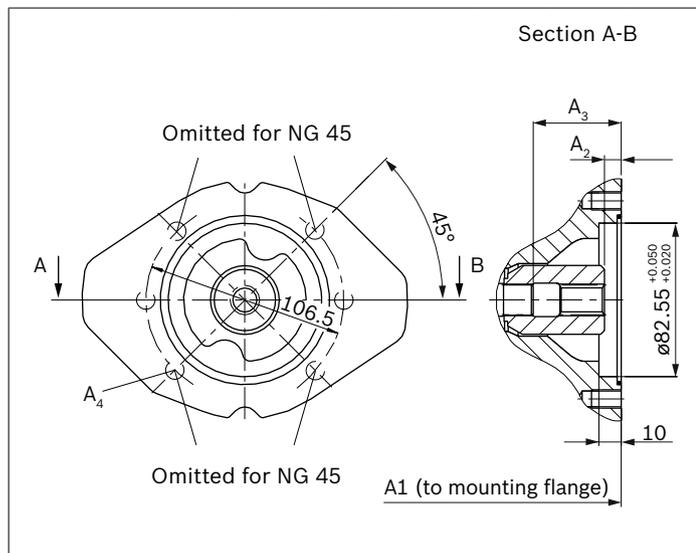


### Dimensions through drive

Flange ISO 3019-1 (SAE)		Hub for splined shaft <sup>1)</sup>		Availability over sizes				Code
diameter	Symbol <sup>2)</sup>	diameter		28	45	63	85	
82-2 (A)	♂, ∞	5/8 in	9T 16/32DP	●	●	●	●	K01
		3/4 in	11T 16/32DP	●	●	●	●	K52

● = Available    ○ = On request

▼ 82-2



K01 (SAE J744 16-4 (A))	NG	A1	A2	A3	A4 <sup>3)</sup>
	28	182	9.3	43.3	M10×1.5; 14.5 deep
	45	204	9.9	47	M10×1.5; 16 deep
	63	229	10.7	53	M10×1.5; 16 deep
	85	255	9.5	59	M10×1.5; 16 deep

K52 (SAE J744 19-4 (A-B))	NG	A1	A2	A3	A4 <sup>3)</sup>
	28	182	39	18.8	M10×1.5; 14.5 deep
	45	204	39.3	18.8	M10×1.5; 16 deep
	63	229	39.4	18.9	M10×1.5; 16 deep
	85	255	39.4	18.9	M10×1.5; 16 deep

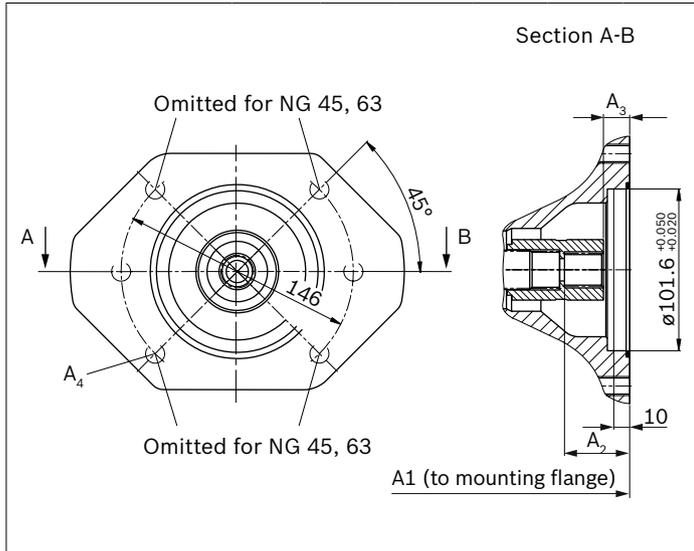
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
 2) Mounting bores pattern viewed from through drive with control at top

3) Thread according to DIN 13, observe the general instructions on page 54 for the maximum tightening torques.

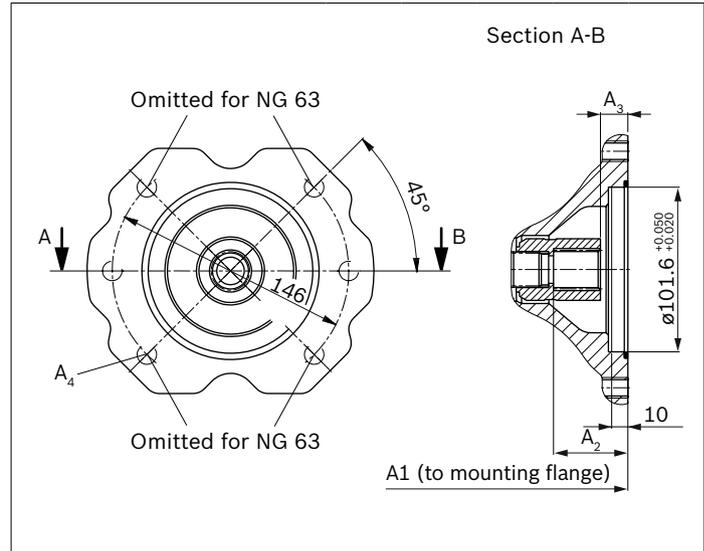
Flange ISO 3019-1 (SAE)		Hub for splined shaft <sup>1)</sup>		Availability over sizes				Code
diameter	Symbol <sup>2)</sup>	diameter		28	45	63	85	
101-2 (B)	♂, ∞	7/8 in	13T 16/32DP	-	●	●	●	K68
		1 in	15T 16/32DP	-	-	●	●	K04

● = Available    ∞ = On request

▼ **101-2**



<b>K68</b> (SAE J744 22-4 (B))	NG	A1	A2	A3	A4 <sup>3)</sup>
	45	204	42.3	17.8	M12×1.75; 18 deep
	63	229	42.4	17.9	M12×1.75; 18 deep
	85	255	42.4	17.9	M12×1.75; 18 deep



<b>K04</b> (SAE J744 25-4 (B-B))	NG	A1	A2	A3	A4 <sup>3)</sup>
	63	229	47.9	18.9	M12×1.75; 18 deep
	85	255	47.4	18.4	M12×1.75; 18 deep

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

2) Mounting bores pattern viewed from through drive with control at top

3) Thread according to DIN 13, observe the general instructions on page 54 for the maximum tightening torques.

**Overview of attachment options**

Through drive		Attachment of 2nd pump				
Flange ISO 3019-1	Hub for splined shaft	Short code	A10VNO/5x NG (shaft)	A10V(S)O/5x NG (shaft)	A1VO/10 NG (shaft)	External gear
82-2 (A)	5/8 in	K01	–	10 (U), 18 (U)	18 (S2)	Series F
	3/4 in	K52	28 (S, R)	10 (S) 18 (S, R)	18 (S3)	
101-2 (B)	7/8 in	K68	45 (S, R)	28 (S, R) 45 (U, W) <sup>1)</sup>	35 (S4)	Series N/G
	1 in	K04	63 (S, R)	45 (S, R) 60, 63 (U, W) <sup>2)</sup> 72 (U, W) <sup>2)</sup>	35 (S5)	

1) Not for NG28 with K68

2) Not for NG63 with K04

## Combination pumps A10VNO + A10VNO

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 "+".

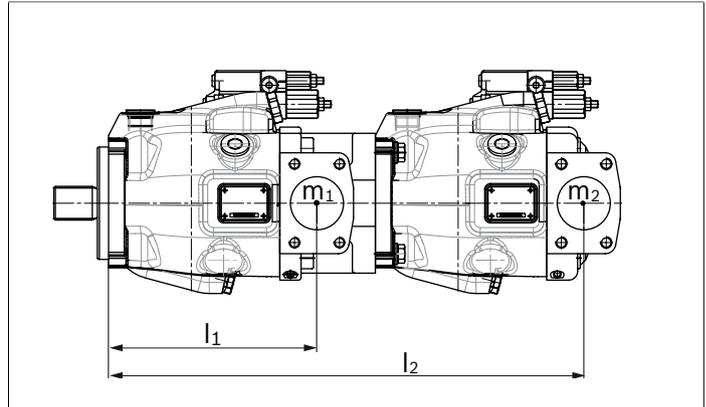
**Order example:**

**A10VNO63DRS/53R-VSC12K04+**

**A10VNO45DRF/53R-VSC11N00**

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

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



$m_1, m_2, m_3$	Weight of pump	[kg]
$l_1, l_2, l_3$	Distance, center of gravity	[mm]
$T_m = (m_1 \times l_1 + m_2 \times l_2 + m_3 \times l_3) \times \frac{1}{102} \text{ [Nm]}$		

### Permissible mass moment of inertia

Size				28	45	63	85
static	$T_m$	Nm	-		890	900	1370
dynamic at 10 g (98.1 m/s <sup>2</sup> )	$T_m$	Nm	-		89	90	137
Weight with through-drive plate	$m$	kg		13	18	24	28
Weight without through-drive plate (e.g. 2nd pump)				11.5	15	18	22
Distance, center of gravity <b>without</b> through drive	$l_1$	mm		78	85	96	105
Distance, center of gravity <b>with</b> through drive	$l_1$	mm		87	99	115	127

## Connector for solenoids

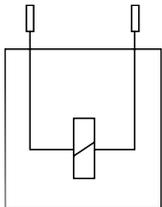
### DEUTSCH DT04-2P-EP04

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



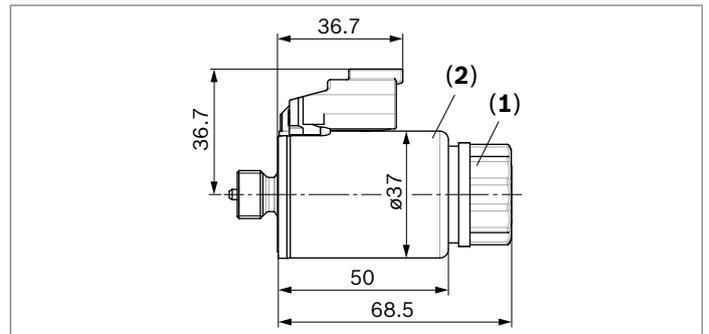
#### ▼ Mating connector DEUTSCH DT06-2S-EP04

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

## Electronic controls

Control	Electronics function	electronics	Further information
Electric pressure control	Controlled power outlet	RA	analog 95230
		RC4-5/30 <sup>1)</sup>	Digital 95205



### Changing plug position

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<sup>+1</sup> Nm.  
(WAF 26, 12-sided DIN 3124)

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

## 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 case drain in the case interior must be directed to the reservoir via the highest available drain port (**L**, **L<sub>1</sub><sup>2)</sup>**, **L<sub>2</sub><sup>3)</sup>**). If a shared drain line is used for several units, make sure that the relevant case pressure is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operational circumstances, particularly at cold start. If this is not possible, separate reservoir lines must be laid as required.

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

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

When designing the reservoir, ensure that there is sufficient distance

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 conditions, an influence on the control characteristic curves can be expected. Gravity, dead weight and case pressure can cause minor shifts in characteristics and changes in response time.

For key, see page 34.

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.

2) For NG45 and NG63 series 52, **L<sub>1</sub>** is opposite, **L** must then be connected if necessary.

3) Only series 53

### Installation position

See the following examples **1** to **12**.

Additional installation positions are available upon request.

Recommended installation position: **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.

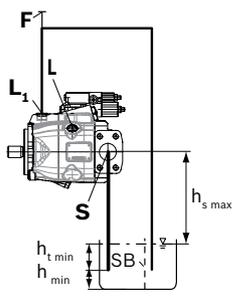
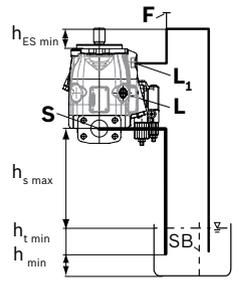
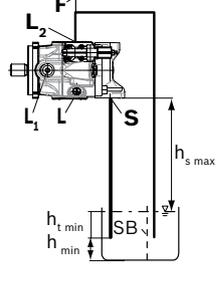
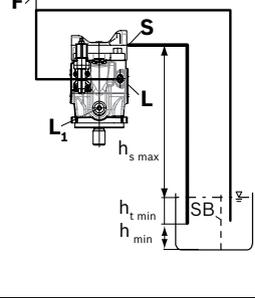
Installation position	Air bleeding	Filling
1 <sup>2)</sup>	F	S + L or L <sub>1</sub>
2 <sup>1)</sup>	F	S + L <sub>1</sub>
3 <sup>3)</sup>	F	S + L or L <sub>1</sub>
4	F	S + L or L <sub>1</sub>

**Above-reservoir installation**

Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining in position 6, the height difference  $h_{ES\ min}$  must be at least 25 mm. Observe the maximum permissible suction height  $h_{s\ max} = 800\ mm$ .

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

For key, see page 34.

Installation position	Air bleeding	Filling
<p>5<sup>2)</sup></p> 	F	L <sub>1</sub> or L
<p>6<sup>1)2)</sup></p> 	F	L <sub>1</sub>
<p>7<sup>3)</sup></p> 	F	L <sub>2</sub>
<p>8<sup>1)</sup></p> 	F	S or L

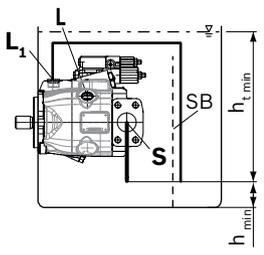
- 1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.
- 2) For NG45 and NG63 series 52, L<sub>1</sub> is opposite, L must then be connected if necessary.
- 3) Only series 53

### Tank 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.

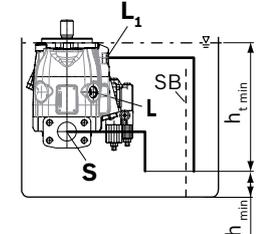
Installation position	Air bleeding	Filling
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**g<sup>2)</sup>**



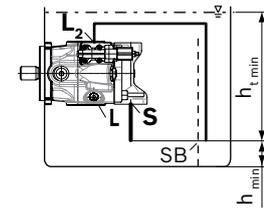
Via the highest available port <b>L</b>	Automatically via the open port <b>L</b> or <b>L<sub>1</sub></b> due to the position under the hydraulic fluid level
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**10**

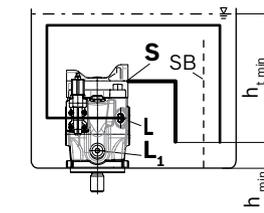


Via the highest available port <b>L<sub>1</sub></b>	Automatically via the open port <b>L</b> , <b>L<sub>1</sub></b> or <b>S</b> due to the position under the hydraulic fluid level
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**11<sup>3)</sup>**



**12**



Via the highest available port <b>L</b>	Automatically via the open port <b>L</b> , <b>L<sub>1</sub></b> or <b>S</b> due to the position under the hydraulic fluid level
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### Key and assembly note

Key	
<b>F</b>	Filling / air bleeding
<b>S</b>	Suction port
<b>L; L<sub>1</sub>, L<sub>2</sub></b>	Tank port
<b>SB</b>	Baffle (baffle plate)
<b>h<sub>t min</sub></b>	Minimum required immersion depth (200 mm)
<b>h<sub>min</sub></b>	Minimum required distance to tank base (100 mm)
<b>h<sub>ES min</sub></b>	Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
<b>h<sub>S max</sub></b>	Maximum permissible suction height (800 mm)

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

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.  
2) For NG45 and NG63 series 52, **L<sub>1</sub>** is opposite, **L** must then be connected if necessary.  
3) Only series 53



## Project planning notes

- ▶ The A10VNO pump is designed to be used in open circuits.
- ▶ Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual thoroughly and completely. If necessary, request them from Bosch Rexroth.
- ▶ Before finalizing your design, request a binding installation drawing.
- ▶ The specified data and notes must be observed.
- ▶ Pressure controllers are not backups against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.
- ▶ Depending on the operating condition of the axial piston unit (operating pressure, fluid temperature), the characteristic curve may shift.
- ▶ Not all versions of the product are approved for use in a safety function pursuant to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. MTTF<sub>d</sub>) for functional safety.
- ▶ Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports can only be used to accommodate hydraulic lines.

## Safety instructions

- ▶ 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).
- ▶ Moving parts in control and regulation systems (e.g. valve spools) may in certain circumstances become stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow or build-up of torque of the axial piston unit will no longer respond correctly to the operator's commands. Even the use of different filter cartridges (external or internal inlet filter) will not rule out a fault but merely minimize the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to set the consumer being driven to a safe position (e.g. safe stop) and if necessary to ensure it is properly implemented.