

# Axial piston variable pump A10VSO series 32

## Americas

**RE-A 92714**

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- ▶ Sizes 45 to 180
- ▶ Nominal pressure 4100 psi (280 bar)
- ▶ Maximum pressure 5100 psi (350 bar)
- ▶ For industrial application areas
- ▶ Open circuit

### Characteristics

- ▶ Variable axial piston pump of swashplate design for hydrostatic drives in open circuit.
- ▶ The flow is proportional to the drive speed and displacement.
- ▶ The flow can be infinitely varied by adjusting the swashplate angle.
- ▶ Hydrostatic support of the cradle bearings
- ▶ Connection for measuring sensor on the high-pressure port
- ▶ Low noise level
- ▶ Low pressure pulsation
- ▶ High efficiency
- ▶ High resistance against cavitation, loss of suction pressure and case pressure peaks
- ▶ Universal through drive

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## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13
<b>A10VS</b>	<b>O</b>		/	<b>32</b>		<b>-</b>	<b>V</b>	<b>B</b>				

### Axial piston unit

01	Variable swashplate design, nominal pressure 4100 psi (280 bar), maximum pressure 5100 psi (350 bar)	<b>A10VS</b>
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### Operation mode

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

03	Geometric displacement, see "Technical data" on page 7	<b>045</b>	<b>071</b>	<b>100</b>	<b>140</b>	<b>180</b>
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### Control devices

04	Two-point control, directly operated				•	•	•	•	•	<b>DG</b>
	Pressure controller	hydraulic			•	•	•	•	•	<b>DR</b>
			with flow control	hydraulic	X-T open	•	•	•	•	•
	X-T plugged	•			•	•	•	•	<b>DRS</b>	
	pressure cut-off	hydraulic	remotely operated		•	•	•	•	•	<b>DRG</b>
			electric	negative control	$U = 12\text{ V}$	•	•	•	•	•
	$U = 24\text{ V}$	•			•	•	•	•	<b>ED72</b>	
	electric	positive control	$U = 12\text{ V}$	•	•	•	•	•	<b>ER71<sup>1)</sup></b>	
			$U = 24\text{ V}$	•	•	•	•	•	<b>ER72<sup>2)</sup></b>	
	Power control with pressure cut-off	hydraulic	control begin	to 725 psi (50 bar)	•	•	•	•	•	<b>LA5D</b>
				from 726 to 1300 psi (51 to 90 bar)	•	•	•	•	•	<b>LA6D</b>
				1301 to 2350 psi (91 to 160 bar)	•	•	•	•	•	<b>LA7D</b>
				2351 to 3500 psi (160 to 240 bar)	•	•	•	•	•	<b>LA8D</b>
				above 3501 psi (240 bar)	•	•	•	•	•	<b>LA9D</b>
	remotely operated	hydraulic	control begin	see LA.D	•	•	•	•	•	<b>LA.DG</b>
flow control, X-T plugged	hydraulic	control begin	see LA.D	•	•	•	•	•	<b>LA.DS</b>	
			electrically overridable (negative control)	see LA.D	•	•	•	•	•	<b>LA.S</b>

### Series

05	Series 3, index 2	<b>32</b>
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### Directions of rotation

06	With view on drive shaft	clockwise	<b>R</b>
		counter clockwise	<b>L</b>

### Seal

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

08	Parallel keyed shaft ISO 3019-1 (SAE J744) limited suitability for through drive				•	•	•	•	•	<b>K</b>
	Splined shaft	standard shaft		•	•	•	•	•	•	<b>S</b>
		ANSI B92.1a	similar to shaft "S" however for higher input torque		•	•	-	-	-	<b>R</b>

### Mounting flange

09	ISO 3019-1; 4-hole	<b>D</b>
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1) The following must be taken into account during project planning:  
Excessive current levels ( $I > 1200\text{ mA}$  at 12 V or  $I > 600\text{ mA}$  at 24 V) to the ER solenoid can result in undesired pressure increases which can lead to pump or system damage. Therefore:

- Use  $I_{\max}$  current limiter solenoids.
- A sandwich plate pressure reducing valve can be used to protect the pump in the event of overflow.  
An accessory kit with sandwich plate pressure reducing valve can be ordered from Rexroth under part number R902490825.

## Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13
<b>A10VS</b>	<b>O</b>			<b>/</b>	<b>32</b>	<b>-</b>	<b>V</b>		<b>B</b>			

### Working line ports

			045	071	100	140	180	
10	SAE flange ports at top, at bottom, on opposite side, metric fastening thread with universal through drive	<b>without</b> pulsation damping	●	●	●	●	○	<b>72U</b>
		<b>with</b> pulsation damping, not for high-speed	●	●	●	●	●	<b>82U</b>

### Through drives <sup>1</sup> (for fitting options, see page 41)

11	Flange ISO 3019-1 <sup>2)</sup>		Hub for splined shaft <sup>3)</sup>							
	Diameter	Attachment <sup>5)</sup>	Diameter	Diameter	045	071	100	140	180	
	Without through drive <sup>4)</sup>				●	●	●	●	●	<b>00</b>
	82-2 (A)	⌀, ⌀, ∞	5/8 in	9T 16/32DP	●	●	●	●	●	<b>01</b>
		⌀, ⌀, ∞	3/4 in	11T 16/32DP	●	●	●	●	●	<b>52</b>
	101-2 (B)	⌀, ⌀, ∞	7/8 in	13T 16/32DP	●	●	●	●	●	<b>68</b>
		⌀, ⌀, ∞	1 in	15T 16/32DP	●	●	●	●	●	<b>04</b>
	127-4 (C)	⌀	1 in	15T 16/32DP	●	●	●	●	●	<b>E2</b>
		⌀	1 1/4 in	14T 12/24DP	-	●	●	●	●	<b>15</b>
	127-2 (C)	⌀, ⌀, ∞	1 1/2 in	17T12/24DP	-	-	●	●	●	<b>24</b>
	152-4 (D)	⌀	1 1/2 in	17T 12/24DP	-	-	●	●	●	<b>96</b>
		⌀	1 3/4 in	13T 8/16DP	-	-	-	●	●	<b>17</b>

### Rotary group version

12	Standard rotary group (noise-optimized for n = 1500/1800 rpm)	●	●	●	●	●	●	<b>E</b>
	High-speed (with port plate version 72U only)	●	●	●	●	-	-	<b>S</b>

### Connector for solenoids

13	Without connector (without solenoid, with hydraulic control only, without code)	-	-	-	-	-	-	<b>H</b>
	HIRSCHMANN connector – without suppressor diode	-	-	-	-	-	-	<b>H</b>

● = Available    ○ = On request    - = Not available

### Information

- ▶ Note the project planning notes on page 44!
- ▶ Preservation:
  - Up to 12 months as standard
  - Up to 24 months long-term (state in plain text when ordering)

1) See data sheet 95581  
 2) 2-hole: Attachment pump series 31  
 4-hole: Attachment pump series 32  
 3) According to ANSI B92.1a (splined shafts according to SAE J744)  
 4) With through-drive shaft, without hub, without intermediate flange, closed on a functionally reliable basis with cover  
 5) Mounting through bores pattern viewed from through drive with control at top

## Hydraulic fluids

The A10VSO 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
- ▶ 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- ▶ 90223: HFA, HFB, HFC hydraulic fluids

### Notes on 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 ( $\nu_{opt}$ : see selection diagram).

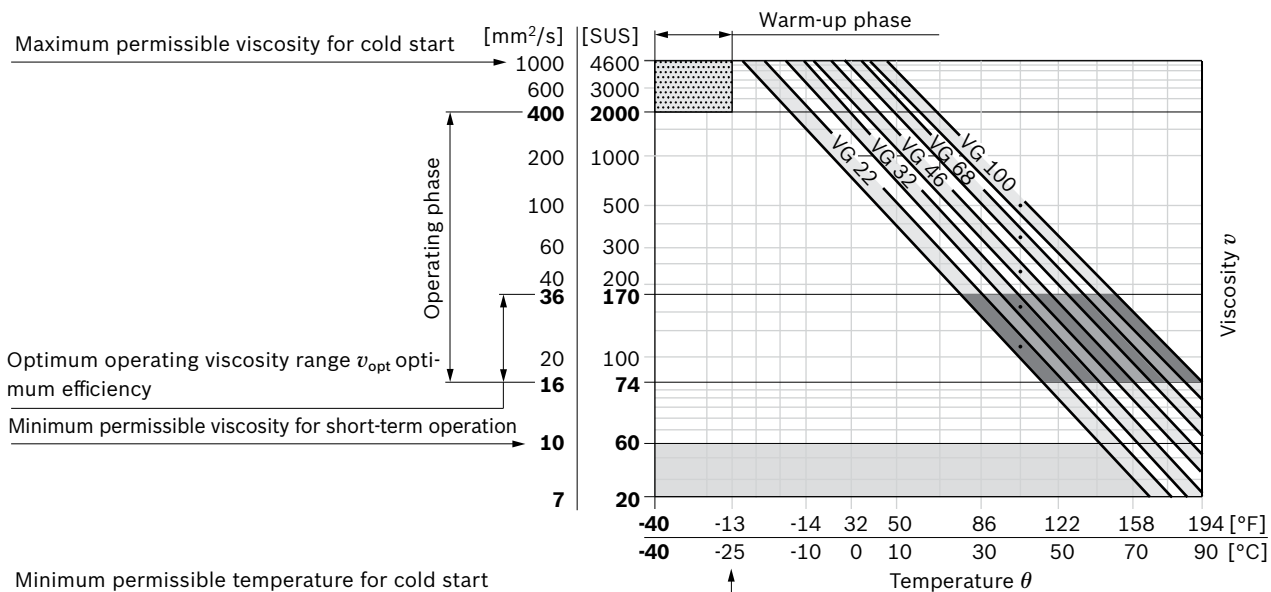
#### Note

At no point of the component may the temperature be higher than 194 °F (90 °C). The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing. If the above conditions cannot be maintained due to extreme operating parameters, please contact the responsible member of staff at Bosch Rexroth.

### Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	$\nu_{max} \leq 4600$ SUS $\nu_{max} \leq (1000 \text{ mm}^2/\text{s})$	$\theta_{St} \geq -13$ °F (-25 °C) <sup>1)</sup>	$t \leq 3$ min, without load ( $p \leq 435$ psi (30 bar))
Permissible temperature difference		$\Delta T \leq 23$ °F (13 K)	between axial piston unit and hydraulic fluid
Warm-up phase	$\nu < 4600$ to 1850 SUS $\nu < (1000$ to 400 $\text{mm}^2/\text{s})$	$\theta =$ at -13 °F (-25 °C)	For detailed information on operation at low temperatures, see data sheet 90300-03-B.
Operating phase	$\nu = 1850$ to 80 SUS $\nu = (400$ to 16 $\text{mm}^2/\text{s})$		This corresponds, for example on the VG 46, to a temperature range of 41 °F (+5 °C) to 158 °F (+70 °C) (see selection diagram)
		$\theta = -13$ °F (-25 °C) to $\theta = 185$ °F (+85 °C)	measured at port <b>L</b> Note the permissible temperature range of the shaft seal ( $\Delta T =$ approx. 9 °F (5 K) between the bearing/shaft seal and port <b>L</b> )
		$\nu_{opt} = 170$ to 80 SUS $\nu_{opt} = (36$ to 16 $\text{mm}^2/\text{s})$	Range of optimum operating viscosity and efficiency
Short-term operation	$\nu_{min} \geq 60$ SUS (10 $\text{mm}^2/\text{s})$		$t < 3$ min, $p < 0.3 \cdot p_{nom}$

### ▼ Selection diagram



1) Special measures are necessary at temperatures between -40 °F (-40 °C) and -13 °F (-25 °C). Please contact us.

For detailed information on operation at low temperatures, see data sheet 90300-03-B.

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

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

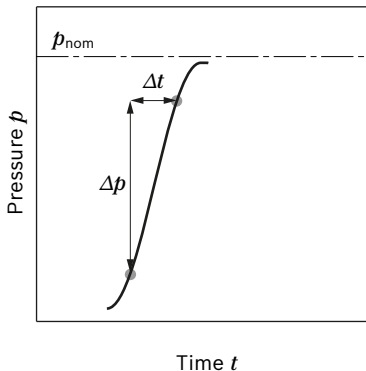
A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

Please contact us if the above classes cannot be observed.

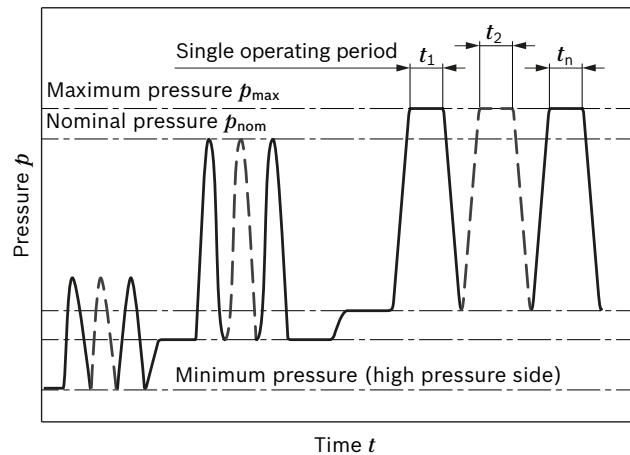
## Operating pressure range

Pressure at working line port B		Definition	
Nominal pressure $p_{nom}$	4100 psi (280 bar) absolute	The nominal pressure corresponds to the maximum design pressure.	
Maximum pressure $p_{max}$	5100 psi (350 bar) absolute	The maximum pressure corresponds the maximum operating 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 (high pressure side)	145 psi (10 bar) <sup>1)</sup> 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 $R_{A\ max}$	232000 psi/s (16000 bar/s)	Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.	
Pressure at suction port S (Inlet)			
Minimum pressure $p_{S\ min}$	Standard	12 psi (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.
	High-speed	15 psi (1.0 bar) absolute	
Maximum pressure $p_{S\ max}$		145 psi (10 bar) <sup>2)</sup> absolute	
Case drain pressure at port L <sub>1</sub> , L <sub>2</sub>			
Maximum pressure $p_{L\ max}$	30 psi (2 bar) absolute	Maximum 0.5 bar higher than inlet pressure at port <b>S</b> , but not higher than $p_{L\ max}$ . A separate case drain line to the reservoir is required.	

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



### ▼ Pressure definition



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

#### Note

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

1) Lower pressure is time-dependent, please contact us  
2) Other values on request

## Technical data

### Standard rotary group, version E

Size		NG	45	71	100	140	180	
Displacement, geometric, per revolution		$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	2.75 (45)	4.34 (71)	6.10 (100)	8.54 (140)	10.98 (180)
Maximum rotational speed <sup>1)</sup>	At $V_{g \max}$	$n_{\text{nom}}$	rpm	1800 <sup>2)</sup>	1800 <sup>2)</sup>	1800 <sup>2)</sup>	1800 <sup>3)</sup>	1800 <sup>3)</sup>
Flow	At $n_{\text{nom}}$ and $V_{g \max}$	$q_v$	gpm (l/min)	21.4 (81)	34 (128)	47.6 (180)	67 (252)	85.6 (324)
Power	At $n_{\text{nom}}$ , $V_{g \max}$ and $\Delta p = 4100$ psi (280 bar)	$P$	HP (kW)	50 (38)	80 (59.7)	112 (84)	158 (118)	202.5 (151)
Torque	at $V_{g \max}$ and $\Delta p = 4100$ psi (280 bar)	$T$	lb-ft (Nm)	145 (200)	231 (317)	325 (446)	454 (624)	589 (802)
	at $V_{g \max}$ and $\Delta p = 1450$ psi (100 bar)	$T$	lb-ft (Nm)	51 (72)	83 (113)	117 (159)	164 (223)	208 (286)
Rotary stiffness of drive shaft	K	$c$	lb-ft/rad (Nm/rad)	25509 (34587)	59446 (80627)	97603 (132335)	138958 (188406)	157113 (213022)
	S	$c$	lb-ft/rad (Nm/rad)	21755 (29497)	53017 (71884)	89348 (121142)	125042 (169537)	126199 (171107)
	R	$c$	lb-ft/rad (Nm/rad)	30256 (41025)	56455 (76545)	–	–	–
Moment of inertia rotary group		$J_{GR}$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.0830 (0.0035)	0.2065 (0.0087)	0.4390 (0.0185)	0.6549 (0.0276)	0.7831 (0.033)
Maximum angular acceleration <sup>4)</sup>		$\alpha$	rad/s <sup>2</sup>	4000	3300	2700	2700	2000
Case volume		$V$	gal (L)	0.3 (1.0)	0.4 (1.6)	0.6 (2.2)	0.8 (3.0)	0.7 (2.7)
Mass (approx.)		$m$	lbs (kg)	66 (30)	103 (47)	152 (69)	161 (73)	171 (78)

#### Calculation of characteristics

Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{231 (1000)}$	[gpm (l/min)]
Torque	$T = \frac{V_g \cdot \Delta p}{24 (20) \cdot \pi \cdot \eta_{mh}}$	[lb-ft (Nm)]
Power	$P = \frac{2 \pi \cdot T \cdot n}{33000 (60000)} = \frac{q_v \cdot \Delta p}{1714 (600) \cdot \eta_t}$	[HP (kW)]
Key		
$V_g$	= Displacement per revolution [in <sup>3</sup> (cm <sup>3</sup> )]	
$\Delta p$	= Differential pressure [psi (bar)]	
$n$	= Rotational speed [rpm]	
$\eta_v$	= Volumetric efficiency	
$\eta_{mh}$	= Mechanical-hydraulic efficiency	
$\eta_t$	= Total efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )	

#### Note

- ▶ Theoretical values, without efficiency and tolerances; values rounded.
- ▶ Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.
- ▶ Transport and storage
  - $\theta_{\text{min}} \geq -50$  °C
  - $\theta_{\text{opt}} = +5$  °C to  $+20$  °C

- 1) The values are applicable:
  - to the optimum viscosity range from  $v_{\text{opt}} = 170$  to  $80$  SUS ( $36$  to  $16$  mm<sup>2</sup>/s)
  - to hydraulic fluid based on mineral oils
- 2) The values apply at absolute pressure  $p_{\text{abs}} = 12$  psi (0.8 bar) at suction port S

- 3) The values apply at absolute pressure  $p_{\text{abs}} = 15$  psi (1.0 bar) at suction port S
- 4) The data are valid for values between the minimum required and maximum permissible speed. Valid for external excitation (e.g., diesel 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.

## Technical data

### High-speed rotary group, version S

Size		NG	45	71	100	140	
Displacement, geometric, per revolution		$V_{g \max}$	in <sup>3</sup> (cm <sup>3</sup> )	2.75 (45)	4.34 (71)	6.10 (100)	8.54 (140)
Maximum rotational speed <sup>1)</sup>	At $V_{g \max}$	$n_{\text{nom}}$	rpm	3000 <sup>2)</sup>	2550 <sup>2)</sup>	2300 <sup>2)</sup>	2200 <sup>3)</sup>
Flow	At $n_{\text{nom}}$ and $V_{g \max}$	$q_v$	gpm (l/min)	35.6 (135)	47.8 (181)	61 (230)	81.3 (308)
Power	At $n_{\text{nom}}$ , $V_{g \max}$ and $\Delta p = 4100$ psi (280 bar)	$P$	HP (kW)	84 (62.8)	113 (85)	143 (107)	193 (144)
Torque	at $V_{g \max}$ and $\Delta p = 4100$ psi (280 bar)	$T$	lb-ft (Nm)	145 (200)	230 (317)	325 (446)	457 (624)
	at $V_{g \max}$ and $\Delta p = 1450$ psi (100 bar)	$T$	lb-ft (Nm)	50 (72)	80 (113)	115 (159)	162 (223)
Rotary stiffness	Drive shaft K	$c$	lb-ft/rad (Nm/rad)	25509 (34587)	59446 (80627)	97603 (132335)	138958 (188406)
	Drive shaft S	$c$	lb-ft/rad (Nm/rad)	21755 (29497)	53017 (71884)	89348 (121142)	125042 (169537)
	Drive shaft R	$c$	lb-ft/rad (Nm/rad)	30256 (41025)	56455 (76545)	–	–
Moment of inertia rotary group		$J_{GR}$	lb-ft <sup>2</sup> (kgm <sup>2</sup> )	0.0830 (0.0035)	0.2065 (0.0087)	0.4390 (0.0185)	0.6549 (0.0276)
Maximum angular acceleration <sup>3)</sup>		$\alpha$	rad/s <sup>2</sup>	4000	3300	2700	2700
Case volume		$V$	gal (L)	0.3 (1.0)	0.4 (1.6)	0.6 (2.2)	0.8 (3.0)
Mass (approx.)		$m$	lbs (kg)	66 (30)	103 (47)	152 (69)	161 (73)

Calculation of characteristics		
Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{231 (1000)}$	[gpm (l/min)]
Torque	$T = \frac{V_g \cdot \Delta p}{24 (20) \cdot \pi \cdot \eta_{mh}}$	[lb-ft (Nm)]
Power	$P = \frac{2 \pi \cdot T \cdot n}{33000 (60000)} = \frac{q_v \cdot \Delta p}{1714 (600) \cdot \eta_t}$	[HP (kW)]
Key		
$V_g$	= Displacement per revolution [in <sup>3</sup> (cm <sup>3</sup> )]	
$\Delta p$	= Differential pressure [psi (bar)]	
$n$	= Rotational speed [rpm]	
$\eta_v$	= Volumetric efficiency	
$\eta_{mh}$	= Mechanical-hydraulic efficiency	
$\eta_t$	= Total efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )	

#### Note

- ▶ Theoretical values, without efficiency and tolerances; values rounded.
- ▶ Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

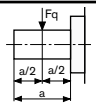
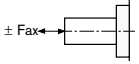
1) The values are applicable:  
– to the optimum viscosity range from  $v_{\text{opt}} = 170$  to 80 SUS (36 to 16 mm<sup>2</sup>/s)  
– to hydraulic fluid based on mineral oils

2) The values apply at absolute pressure  $p_{\text{abs}} = 12$  psi (0.8 bar) at suction port S

3) The values apply at absolute pressure  $p_{\text{abs}} = 15$  psi (1.0 bar) at suction port S

4) The data are valid for values between the minimum required and maximum permissible speed. Valid for external excitation (e.g., diesel 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 loading on the drive shaft**

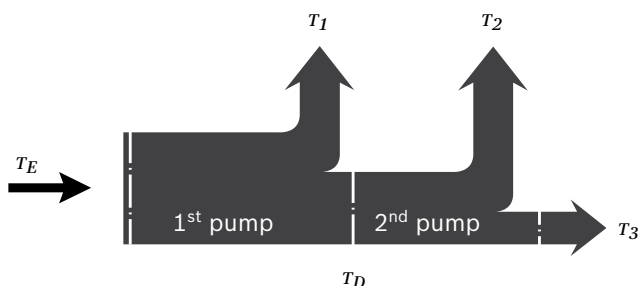
Size		NG	45	71	100	140	180
Maximum radial force at a/2		$\pm F_{q \max}$	lb 337 (N) (1500)	427 (1900)	517 (2300)	630 (2800)	517 (2300)
Maximum axial force		$+ F_{ax \max}$	lb 337 (N) (1500)	540 (2400)	900 (4000)	1080 (4800)	180 (800)

**Note**

- For drives with radial loading (pinion, V-belt drives), please contact us!

**Permissible input and through-drive torques**

Size			45	71	100	140	180
Torque at $V_{g \max}$ and $\Delta p = 4000 \text{ psi (280 bar)}^1$		$T_{max}$ lb-ft (Nm)	145 (200)	231 (317)	325 (446)	454 (624)	589 (802)
Input torque at drive shaft, maximum <sup>2)</sup>	K	$T_{E \max}$ lb-ft (Nm)	156 (212)	319 (433)	553 (750)	875 (1186)	875 (1186)
		$\varnothing$ in (mm)	1 (25.4)	1.25 (31.75)	1.50 (38.1)	1.75 (44.45)	1.75 (44.45)
	S	$T_{E \max}$ lb-ft (Nm)	235 (319)	462 (626)	814 (1104)	1195 (1620)	1195 (1620)
		$\varnothing$ in	1	1 1/4	1 1/2	1 3/4	1 3/4
	R	$T_{E \max}$ lb-ft (Nm)	295 (400)	475 (644)	-	-	-
		$\varnothing$ in	1	1 1/4	-	-	-
Maximum through-drive torque	K	$T_{D \max}$ lb-ft (Nm)	156 (212)	319 (433)	553 (750)	875 (1186)	875 (1186)
	S	$T_{D \max}$ lb-ft (Nm)	235 (319)	363 (492)	574 (778)	934 (1266)	934 (1266)
	R	$T_{D \max}$ lb-ft (Nm)	269 (365)	404 (548)	-	-	-

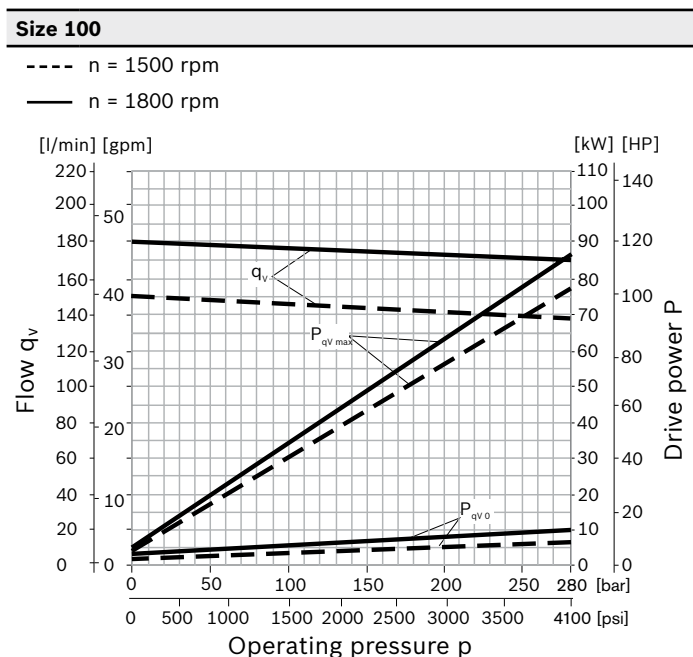
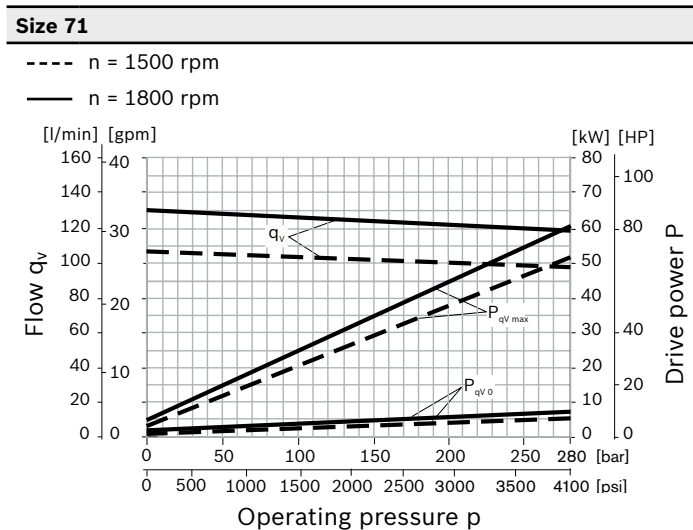
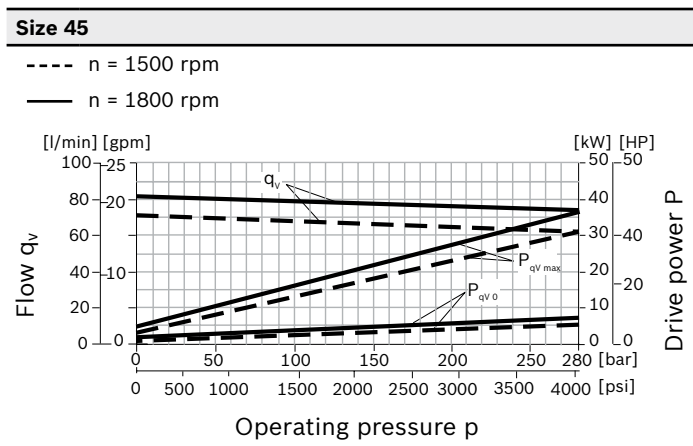
**▼ Distribution of torques**


Torque at 1 <sup>st</sup> pump	$T_1$
Torque at 2 <sup>nd</sup> pump	$T_2$
Torque at 3 <sup>rd</sup> 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) Without considering efficiency

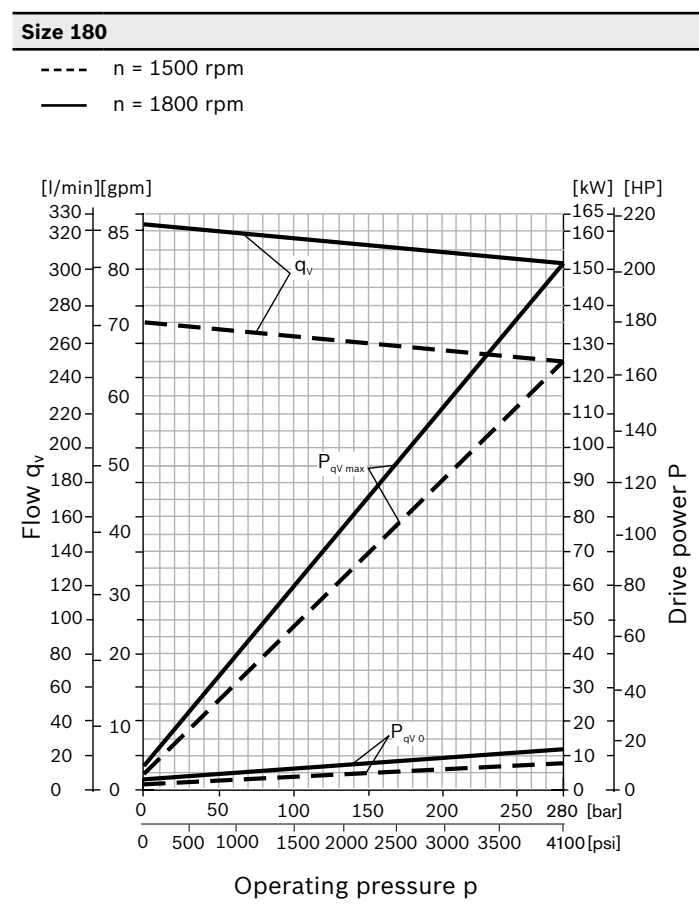
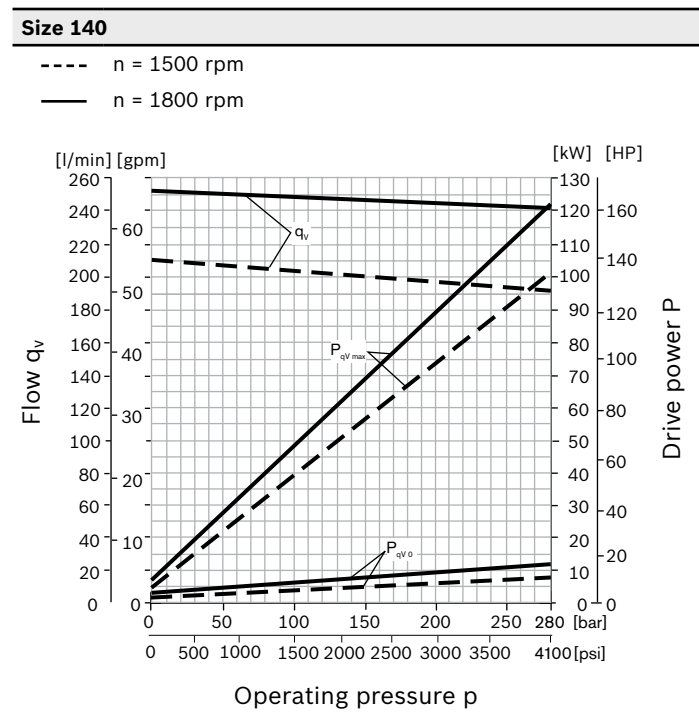
2) For drive shafts with no radial force

**Drive power and flow**



**Note**

- ▶ Characteristic curves measured using ISO VG 46 DIN 51519 hydraulic fluid and  $\theta = 122^\circ\text{F}$  ( $50^\circ\text{C}$ )



## DG – Two-point control, directly operated

The variable pump can be set to a minimum swivel angle by connecting an external control pressure to port **X**.

This will supply control fluid directly to the stroke piston; a minimum control pressure of  $p_{st} \geq 725 \text{ psi}$  (50 bar) is required.

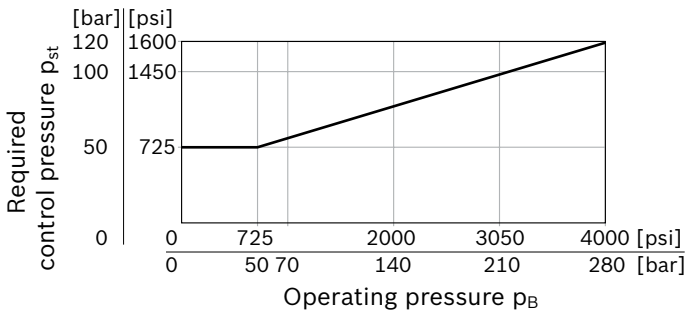
The variable pump can only be switched between  $V_{g \text{ min}}$  and  $V_{g \text{ max}}$ .

Please note, that the required control pressure at port **X** is directly dependent on the actual operating pressure  $p_B$  at port **B**. (See control pressure characteristic).

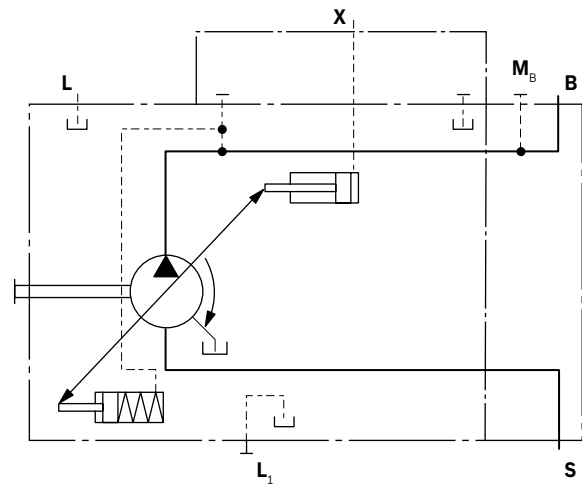
The maximum permissible control pressure is 4100 psi (280 bar).

- ▶ Control pressure  $p_{st}$  in  $X = 0 \text{ psi}$  (0 bar)  $\triangleq V_{g \text{ max}}$
- ▶ Control pressure  $p_{st}$  in  $X \geq 725 \text{ psi}$  (50 bar)  $\triangleq V_{g \text{ min}}$

### ▼ Control pressure characteristic curve



### ▼ Schematic DG

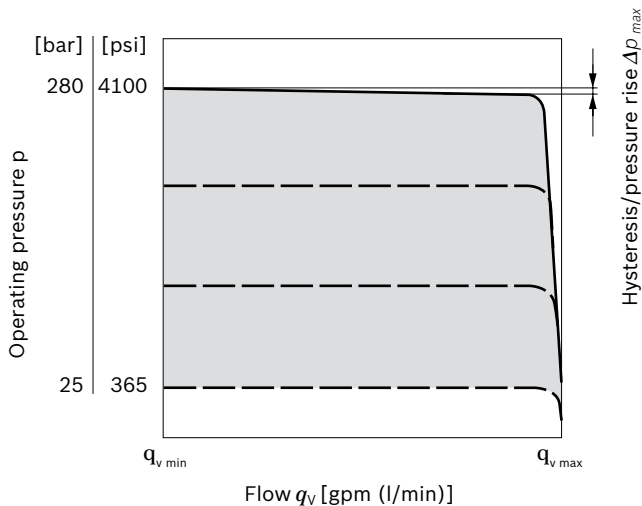


## DR – Pressure control

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.

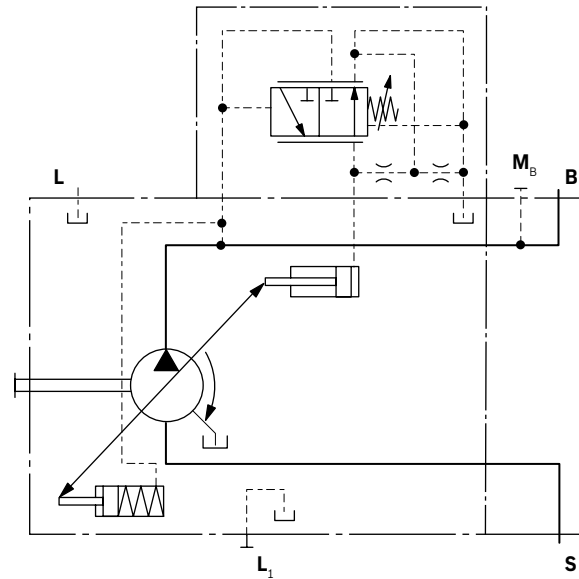
- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 365 to 4100 psi (25 to 280 bar).  
Standard is 4100 psi (280 bar).

### ▼ Characteristic DR



Characteristic curve valid at  $n_1 = 1800$  rpm and  $t_{\text{fluid}} = 122$  °F (50 °C).

### ▼ Schematic DR



### Controller data

NG		45	71	100	140	180
Pressure rise, maximum	$\Delta p$ [psi]	90	115	145	175	200
	$\Delta p$ [(bar)]	(6)	(8)	(10)	(12)	(14)
Hysteresis and repeatability	$\Delta p$ [psi (bar)]	maximum 45 (3)				
Pilot fluid consumption	gpm (l/min)	maximum approx. 0.8 (3)				

Flow losses at  $q_{v \max}$  see page 10.

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.

## 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 12.

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 control valve is set as standard to 290 psi (20 bar). At port **X**, the amount of control fluid is about 0.4 gpm (1.5 l/min). If a different setting (range 145 to 320 psi (10 to 22 bar)) is required, please state in plain text.

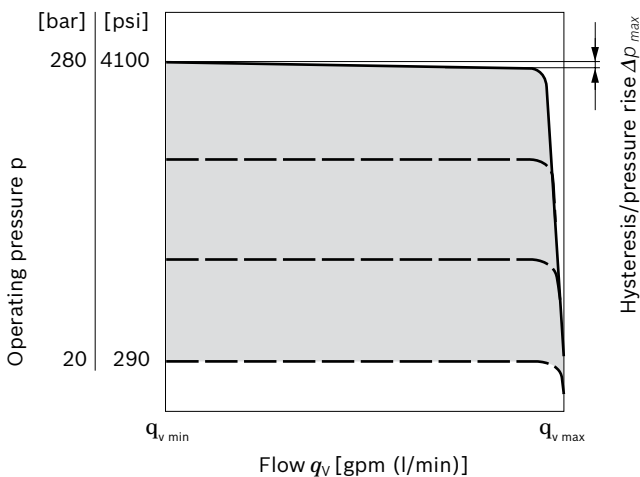
As a separate pressure relief valve, we recommend:

- ▶ **DBDH 6** (hydraulic) to RE 25402 or
- ▶ **DBETR-SO 381** with orifice  $\varnothing$  0.03 in (0.8 mm) in P (electric) according to data sheet 29166.

The max. length of piping should not exceed 6.5 ft (2 m).

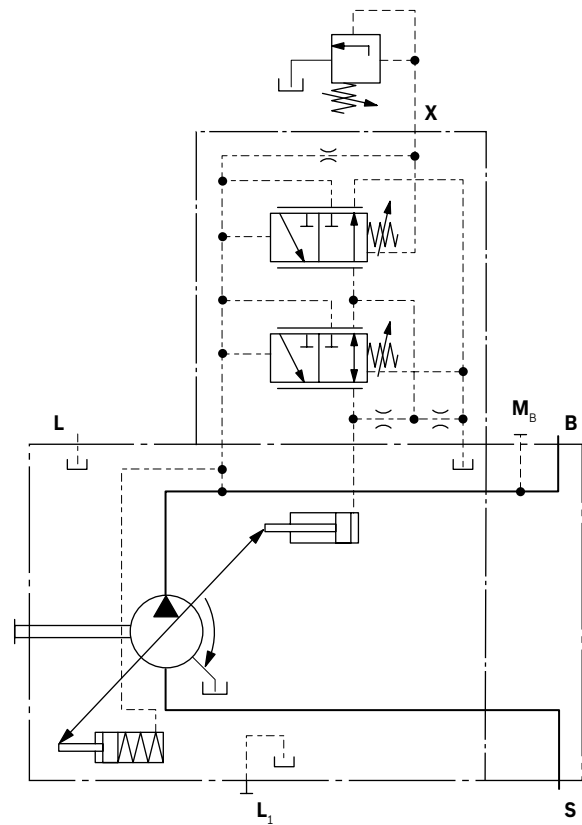
- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 290 to 4100 psi (20 to 280 bar).

### ▼ Characteristic curve DRG



Characteristic curve valid at  $n_1 = 1800$  rpm and  $t_{\text{fluid}} = 122$  °F (50 °C).

### ▼ Schematic DRG



### Controller data

NG		45	71	100	140	180
Pressure rise, maximum	$\Delta p$ [psi]	90	115	145	175	200
	$\Delta p$ [(bar)]	(6)	(8)	(10)	(12)	(14)
Hysteresis and repeatability	$\Delta p$ [psi (bar)]	maximum 45 (3)				
Control fluid consumption	gpm (l/min)	maximum approx. 1.22 (4.5)				

Flow losses at  $q_{v \max}$  see page 10.

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 – Pressure and flow control

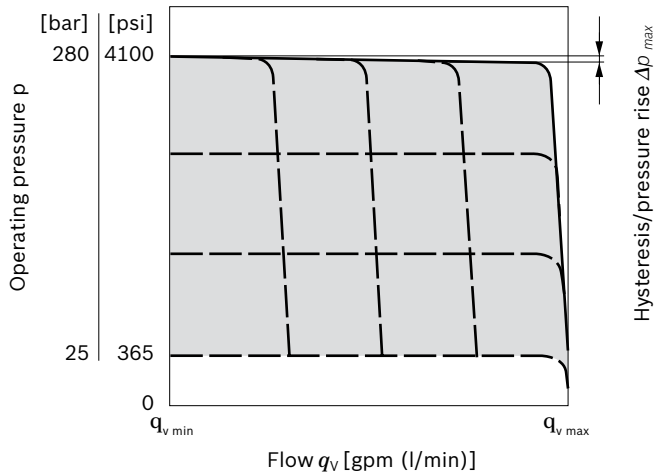
In addition to the pressure control function (see page 12), a variable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual required flow by the consumer, regardless of changing pressure levels. The pressure control overrides the flow control function.

### Note

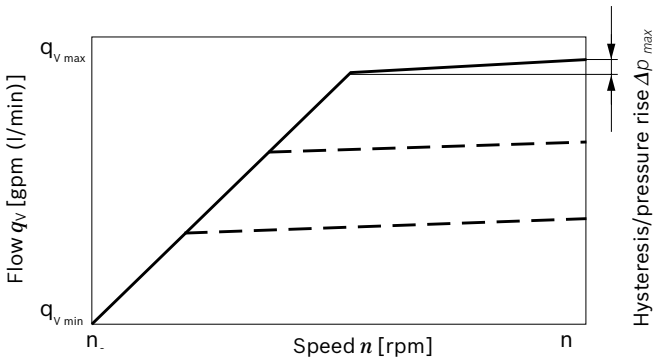
The DRS valve version has no connection between **X** and the reservoir. Unloading the LS-pilot line must be possible in the valve system. Because of the flushing function, sufficient unloading of the **X**-line must also be provided.

- ▶ Basic position in depressurized state:  $V_{g \max}$ .
- ▶ Setting range<sup>1)</sup> for pressure control 365 to 4100 psi (25 to 280 bar) standard is 4100 psi (280 bar).

### ▼ Characteristic curve DRF/DRS

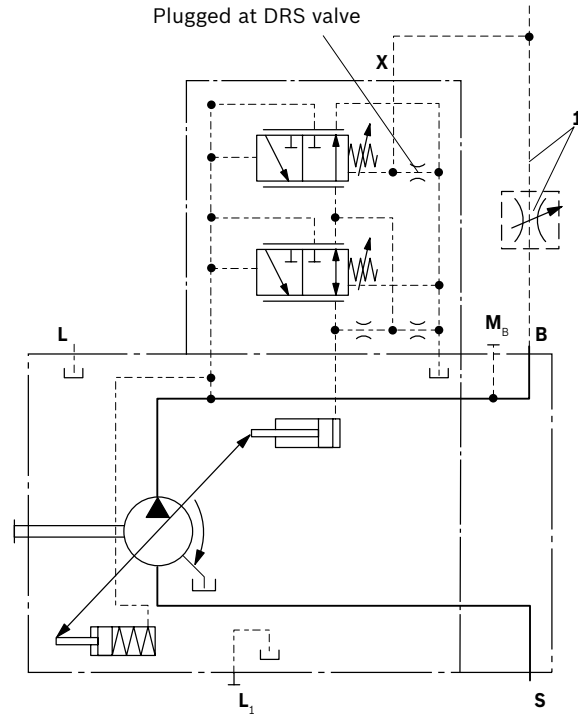


### ▼ Characteristic curve at variable speed



Characteristic curves valid at  $n_1 = 1800$  rpm and  $t_{fluid} = 122$  °F (50 °C).

### ▼ Schematic DG



- 1 The measuring orifice (control block) is not included in the scope of supply.

### Differential pressure $\Delta p$

- ▶ Standard setting: 200 to 320 psi (14 to 22 bar). If another setting is required, please state in clear text. Unloading port **X** to the reservoir results in a zero stroke (standby) pressure which is about 15 to 30 psi (1 to 2 bar) higher than the defined differential pressure  $\Delta p$ . System influences are not taken into account.

### Controller data

DR Pressure control data see page 12.

Maximum flow deviation measured at drive speed  $n = 1500$  rpm.

NG		45	71	100	140	180
Pressure rise, maximum	$\Delta p$ [psi]	90	115	145	175	200
	$\Delta p$ [(bar)]	(6)	(8)	(10)	(12)	(14)
Hysteresis and repeatability	$\Delta p$ [psi]	maximum 45 (3)				
	$\Delta p$ [(bar)]					
Pilot fluid consumption	gpm (l/min)	maximum approx. 1.22 (4.5)				
Flow deviation	$\Delta q_{v \max}$ [gpm]	0.5	0.7	1.0	1.6	2.1
	$\Delta q_{v \max}$ [(l/min)]	(1.8)	(2.8)	(4.0)	(6.0)	(8.0)

- 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.

## LA... Pressure, flow and power control

Pressure control equipped as DR(G), see page 12 (13).  
 Equipment of the flow control like DRS, see page 14.  
 In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant. Flow control is possible below the power control curve. When ordering

please state the power characteristics to be set ex works in clear text, e.g. 27 HP (20 kW) at 1500 rpm.

### Control data

For technical data of pressure control DR see page 12.

For technical data of flow control FR see page 14.

Control fluid consumption max. approx. 1.4 gpm (5.5 l/min)

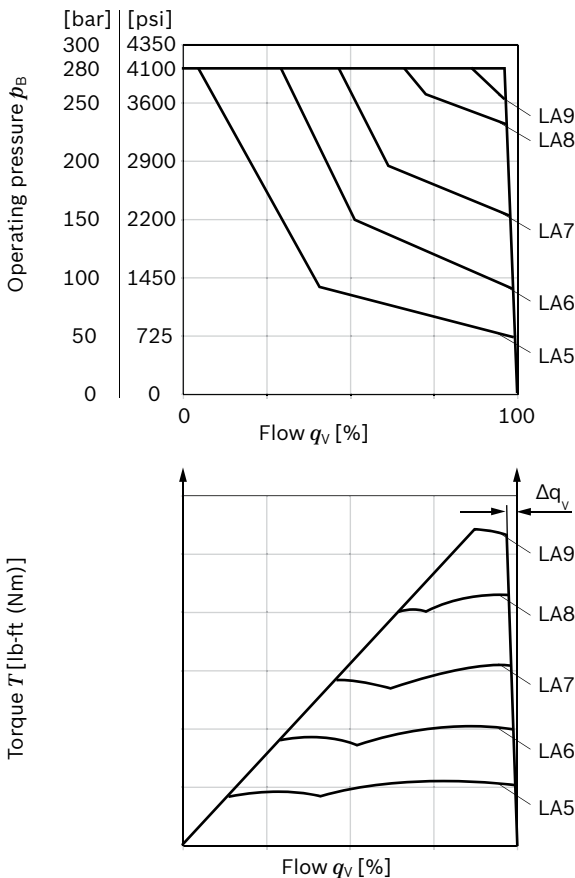
Control begin [psi (bar)]	Torque T [lb-ft (Nm)] for size					Ordering code
	45	71	100	140	180	
up to 725 (50)	up to 29 (42.0)	up to 47 (67.0)	up to 67 (94.0)	up to 95 (132.0)	up to 121 (167.0)	<b>LA5</b>
726 to 1300 (51 to 90)	29.1 - 54 (42.1 - 76.0)	47.1 - 87 (67.1 - 121.0)	67.1 - 122 (94.1 - 169.0)	95.1 - 172 (132.1 - 237.0)	121.1 - 220 (167.1 - 302.0)	<b>LA6</b>
1301 to 2350 (91 to 160)	54.1 - 96 (76.1 - 134.0)	87.1 - 155 (121.1 - 213.0)	122.1 - 218 (169.1 - 299.0)	172.1 - 306 (237.1 - 418.0)	220.1 - 396 (302.1 - 540.0)	<b>LA7</b>
2351 to 3500 (161 to 240)	96.1 - 147 (134.1 - 202.0)	155.1 - 233 (213.1 - 319.0)	218.1 - 329 (299.1 - 449.0)	306.1 - 461 (418.1 - 629.0)	396.1 - 595 (540.1 - 810.0)	<b>LA8</b>
over 3500 (240)	over 147.1 (202.1)	over 233.1 (319.1)	over 329.1 (449.1)	over 461.1 (629.1)	over 595.1 (810.1)	<b>LA9</b>

Conversion of the torque values in power [kW]

$$P = \frac{T}{3.5 (6.4)} \text{ [HP (kW)] (at 1500 rpm)} \quad \text{or}$$

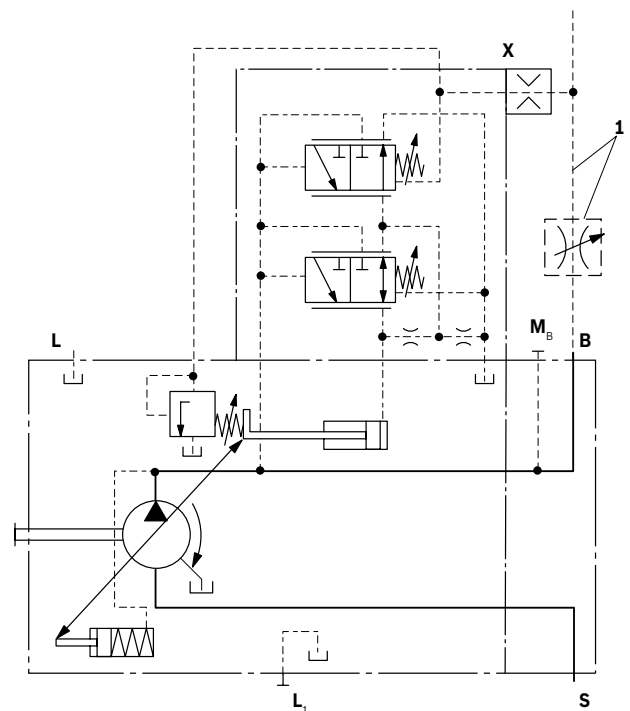
$$P = \frac{2\pi \times T \times n}{33000 (60000)} \text{ [HP (kW)] (For rotational speeds see page 7)}$$

### ▼ Characteristic curve LA.DS



### ▼ Schematic LA.DS

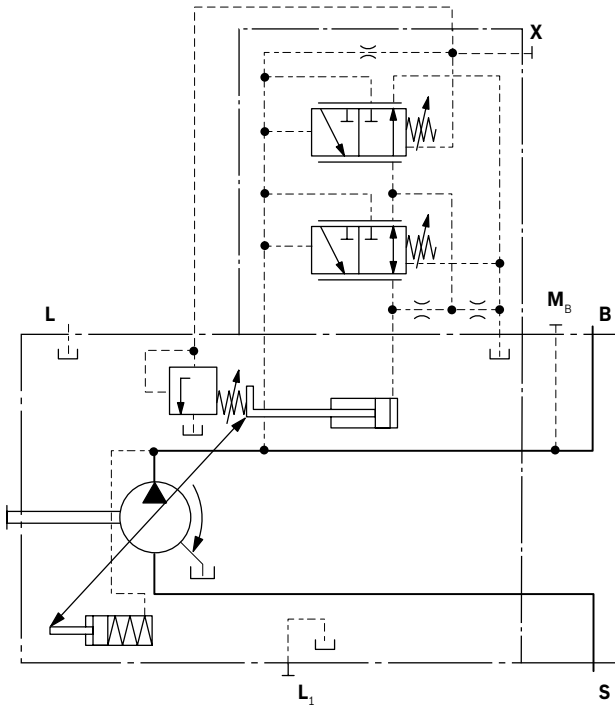
(for further combination options with LA.. see page 16)



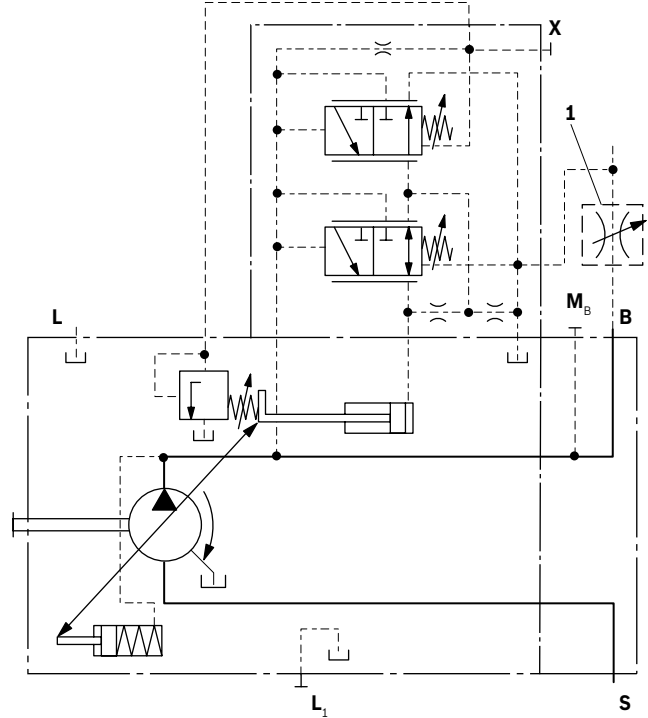
**1** The measuring orifice is not included in the scope of supply.

## LA... Variations

### ▼ Schematic LA.D with pressure cut-off

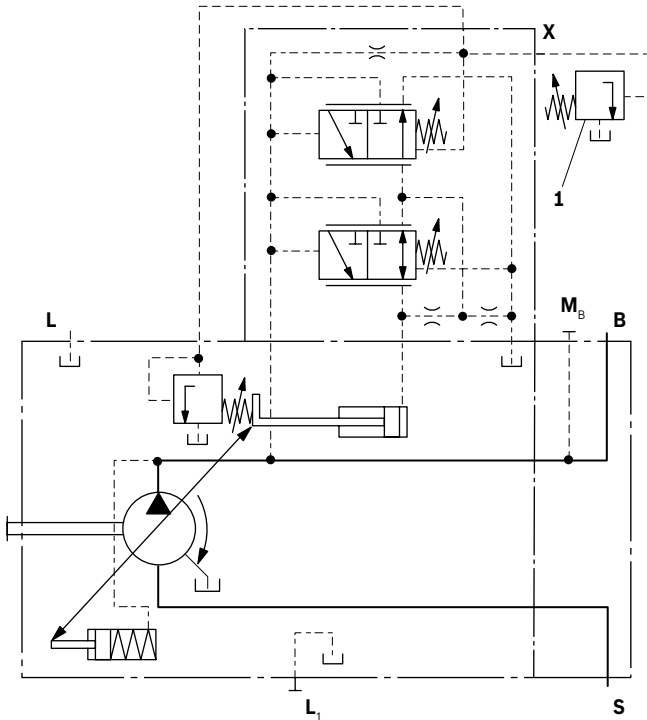


### ▼ Schematic LA.S with separate flow control



**1** The measuring orifice is not included in the scope of supply.

### ▼ Schematic LA.DG with pressure cut-off, remotely operated



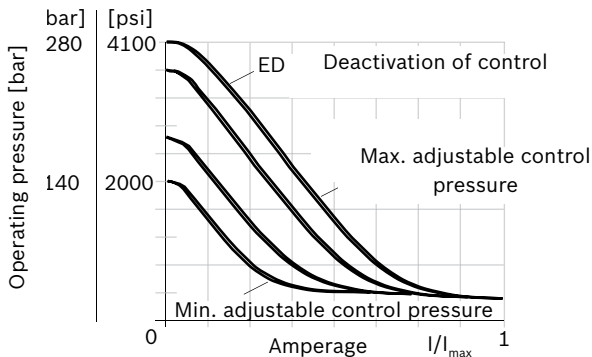
**1** The measuring orifice is not included in the scope of supply.

## 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.

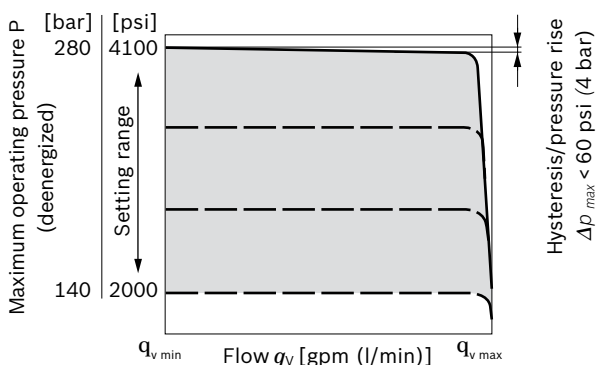
### ▼ Static current-pressure characteristic curve ED

(negative characteristic curve measured with pump in zero stroke)



Hysteresis static current-pressure characteristic curve < 45 psi (3 bar).

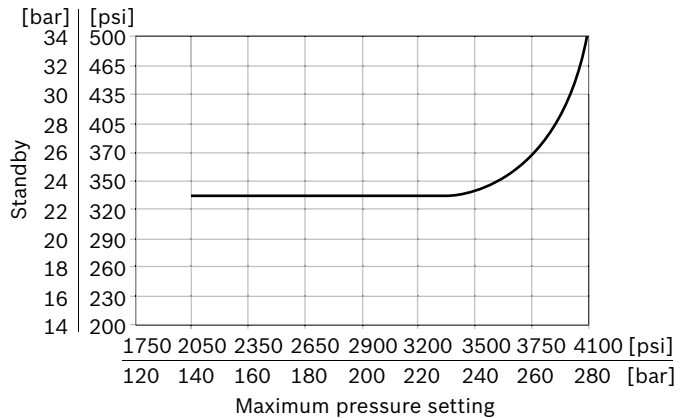
### ▼ Flow-pressure characteristic curve



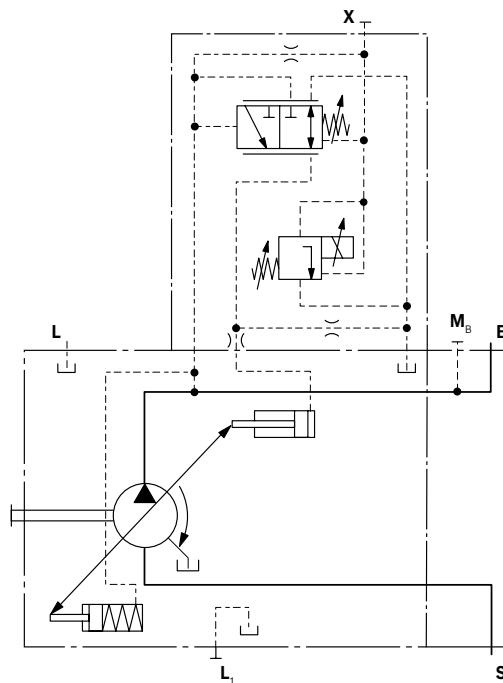
Characteristic curves valid at  $n_1 = 1800$  rpm and  $t_{fluid} = 122$  °F (50 °C).

Pilot fluid consumption: 0.79 to 1.19 gpm (3 to 4.5 l/min). For standby standard setting, see diagram on right, other values on request.

### ▼ Influence of the pressure setting on standby (maximally energized)



### ▼ 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
Actuated time	100 %	100 %
Type of protection: see connector version page 40		

Operating temperature range at valve -4 °F to 311 °F (-20 °C to +115 °C).

## ER – Electro-hydraulic pressure control

The ER 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.

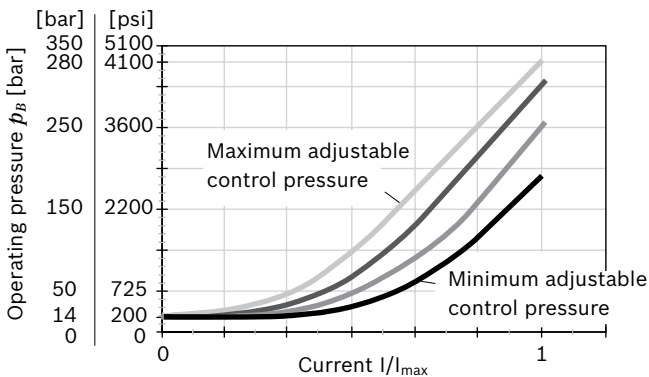
The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to  $p_{min}$  (stand by).

**Observe the project planning notes on page 2.**

### ▼ Static current-pressure characteristic curve ER

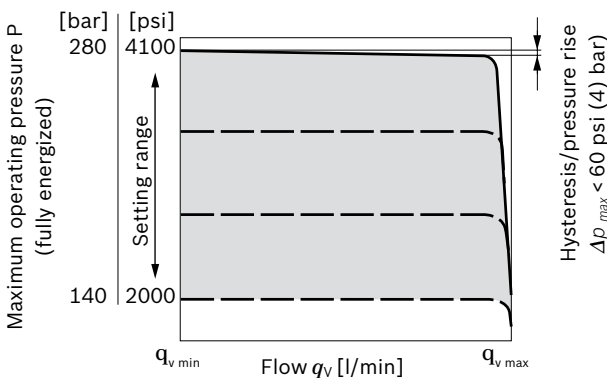
(positive characteristic curve measured with pump in zero stroke)



Hysteresis static current-pressure characteristic curve < 45 psi (3 bar).

Influence of pressure setting on stand-by  $\pm 30$  psi (2 bar).

### ▼ Flow-pressure characteristic curve

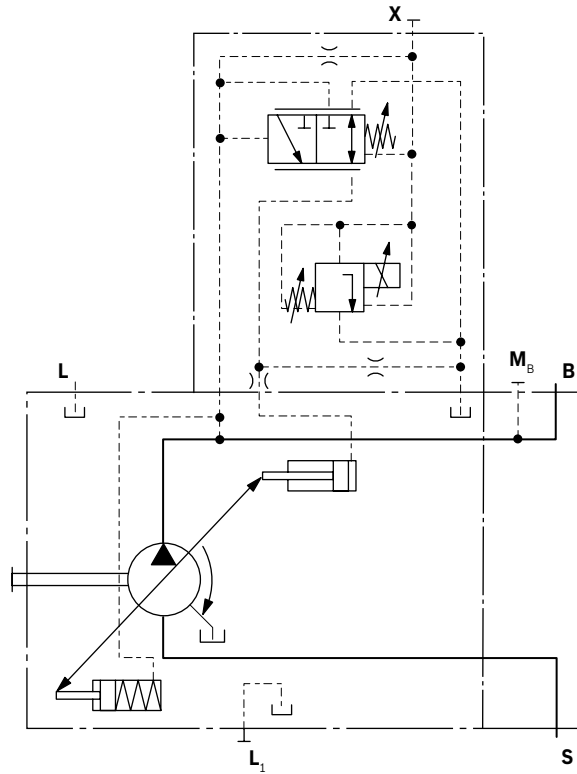


Characteristic curves valid at  $n_1 = 1800$  rpm and  $t_{fluid} = 122$  °F (50 °C).

Pilot fluid consumption: 0.79 to 1.19 gpm (3 to 4.5 l/min).

Standby standard 200 psi (14 bar). Other values on request.

### ▼ Schematic ER71/ER72

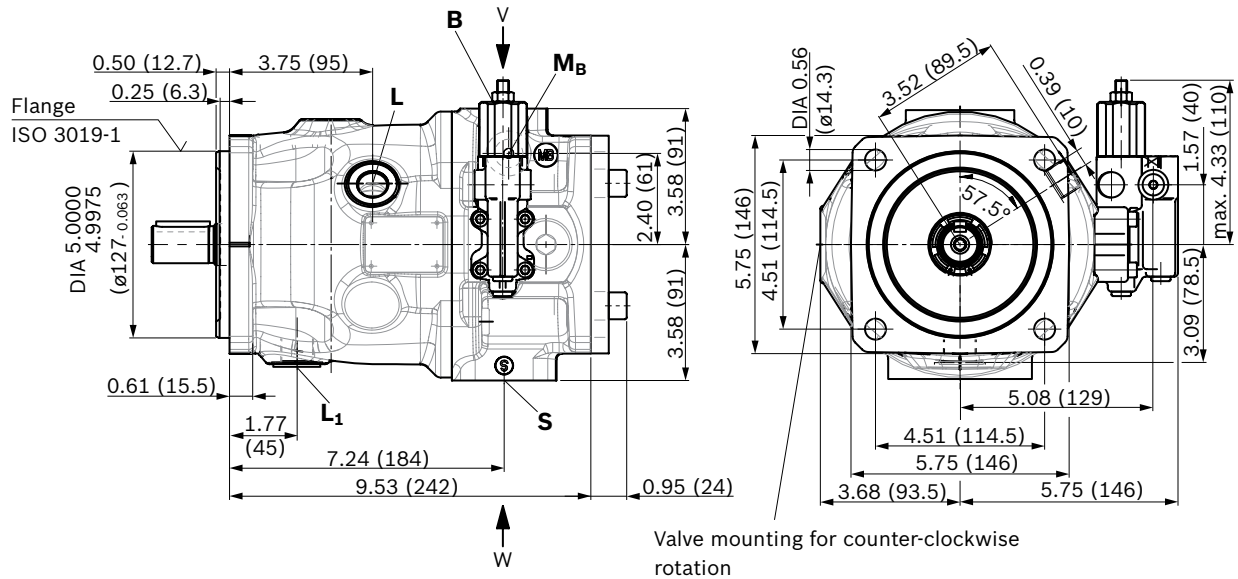


Technical data, solenoid	ER71	ER72
Voltage	12 V ( $\pm 20$ %)	24 V ( $\pm 20$ %)
Control current		
Start of control at $p_{min}$	100 mA	50 mA
End of control at $p_{max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 $\Omega$	22.7 $\Omega$
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
Type of protection: see connector version page 40		

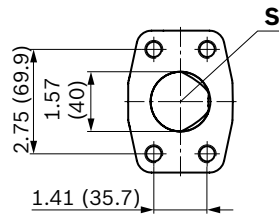
Operating temperature range at valve -4 °F to 311 °F (-20 °C to +115 °C)

**Dimensions size 45**

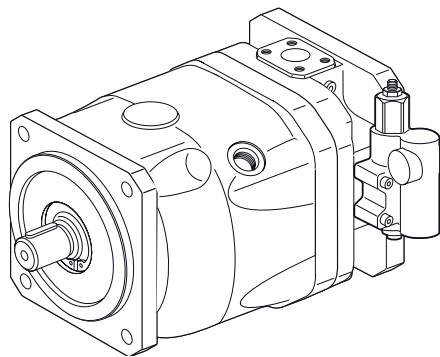
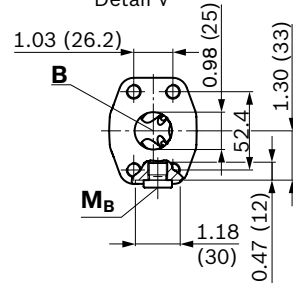
**DR – Pressure control**



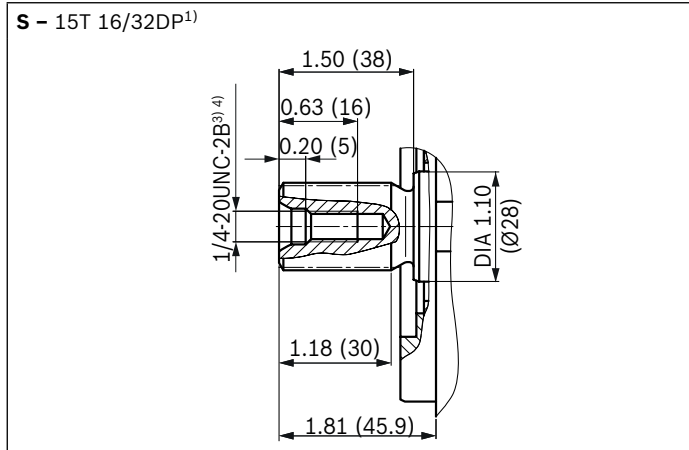
Detail W



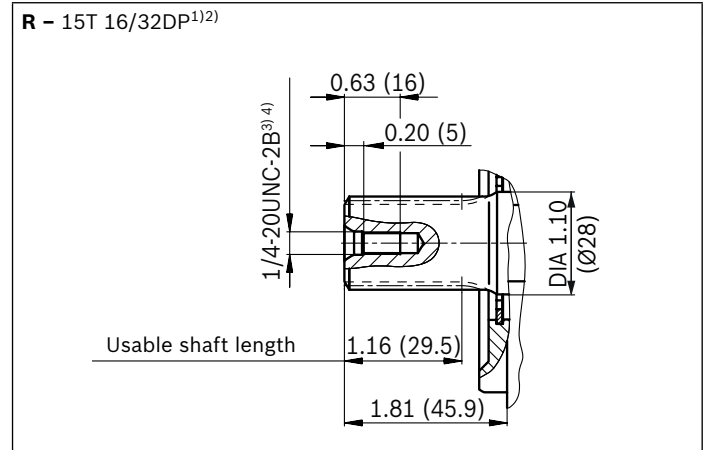
Detail V



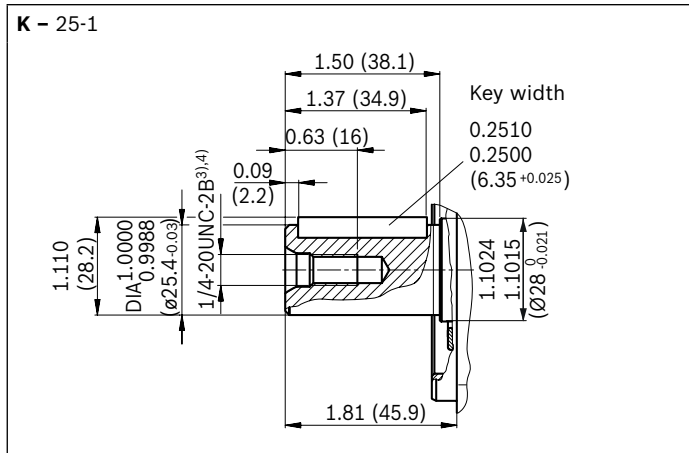
▼ **Splined shaft 1 in (SAE J744)**



▼ **Splined shaft 1 in (SAE J744)**



▼ **Parallel keyed shaft ISO 3019-1**

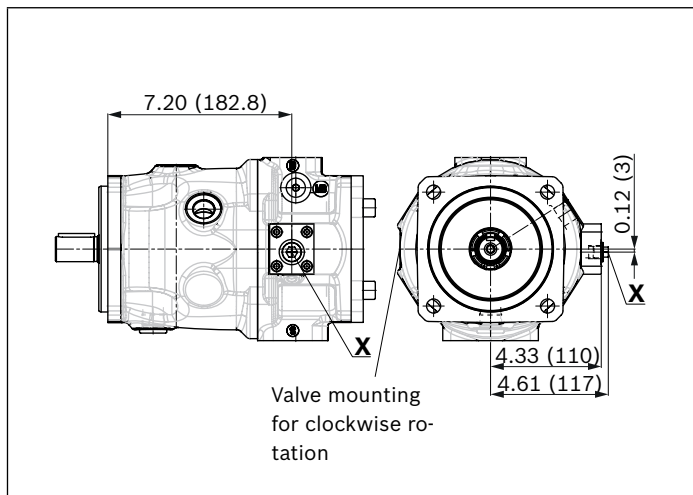


Ports	Standard	Size <sup>4)</sup>	$p_{max}$ [psi (bar)] <sup>5)</sup>	Status <sup>8)</sup>
<b>B</b>	Working line port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 in 3/8-16 UNC-2B, 0.71 (18) deep	5100 (350) O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 1/2 in 1/2-13 UNC-2B; 0.87 (22) deep	145 (10) O
<b>L</b>	Drain port	ISO 11926 <sup>6)</sup>	7/8-14 UNF-2B; 0.51 (13) deep	30 (2) O <sup>7)</sup>
<b>L<sub>1</sub></b>	Drain port	ISO 11926 <sup>6)</sup>	7/8-14 UNF-2B; 0.51 (13) deep	30 (2) X <sup>7)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20 UNF-2A; 0.47 (12) deep	5100 (350) O
<b>X</b>	Pilot pressure (with DG-control)	DIN ISO 228	G 1/4 in; 12 deep	4100 (280) O
<b>M<sub>B</sub></b>	Measuring pressure B	DIN 3852 <sup>6)</sup>	G 1/4 in; 12 deep	5100 (350) X

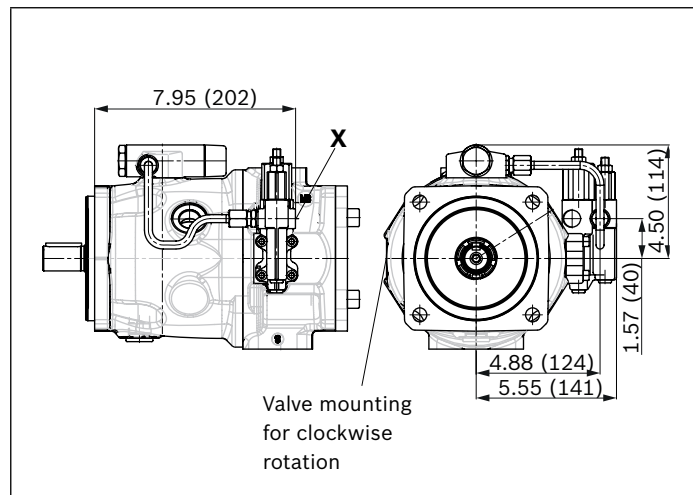
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.  
 3) Thread according to ASME B1.1  
 4) Observe the general instructions on page 44 concerning the maximum tightening torques.

5) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings.  
 6) The spot face can be deeper than as specified in the standard.  
 7) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 41).  
 8) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

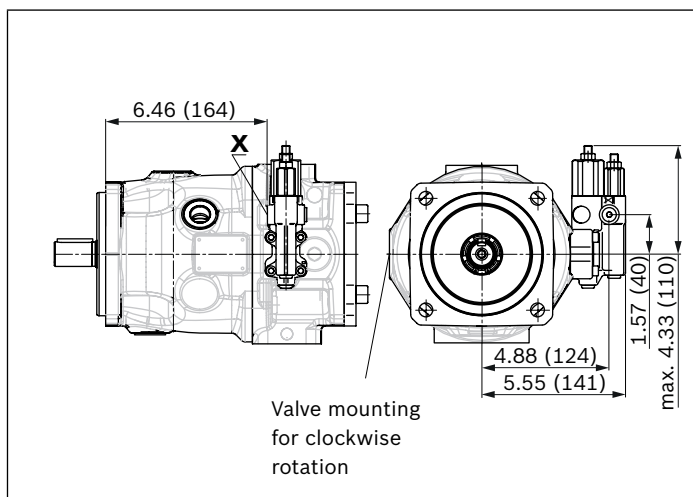
▼ **DG – Two-point control, directly operated**



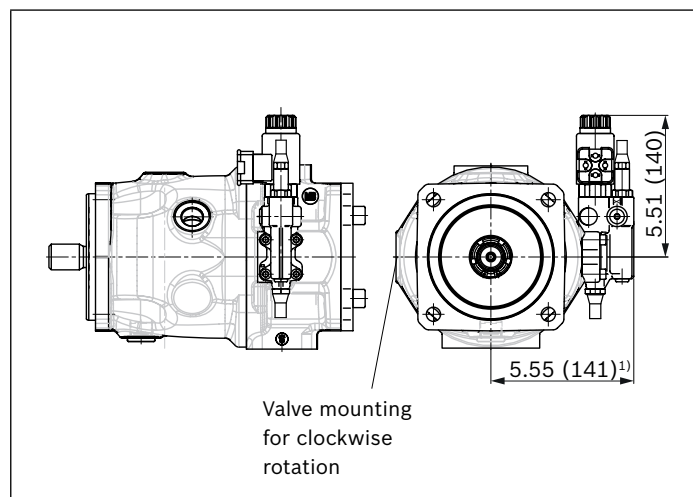
▼ **LA.DS – Pressure, flow and power control**



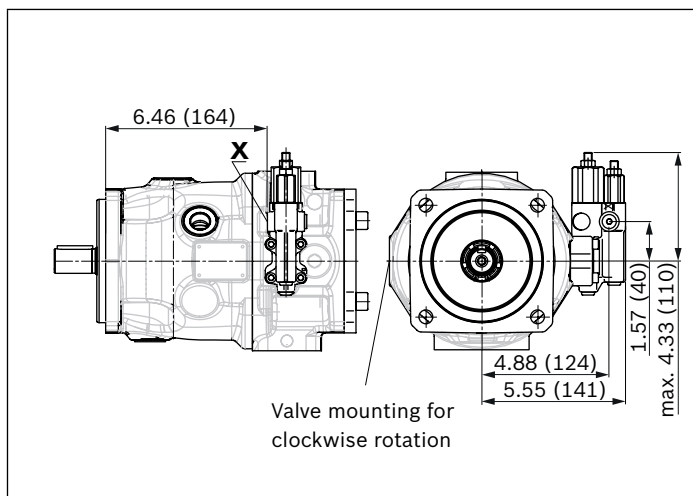
▼ **DRG – Pressure controller, remotely operated**



▼ **ED7./ER7. – Pressure controller, electrical**



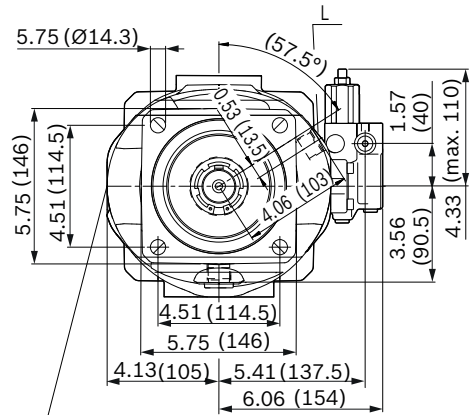
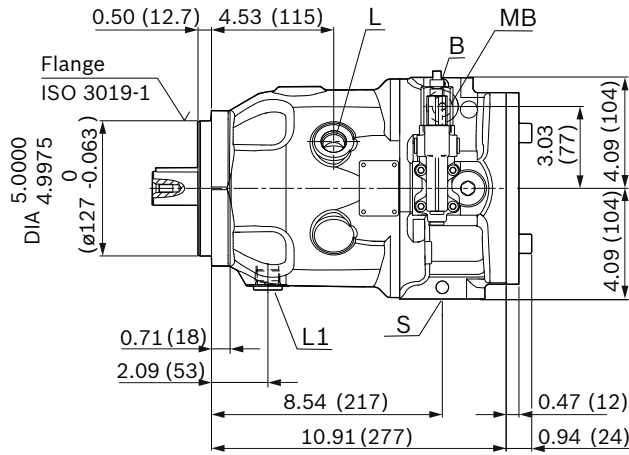
▼ **DRF/DRS – Pressure and flow controller**



1) ER7.: 6.93 (176) if using an intermediate plate pressure controller

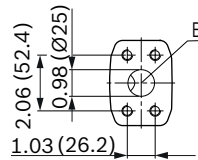
**Dimensions size 71**

**DR – Pressure control**

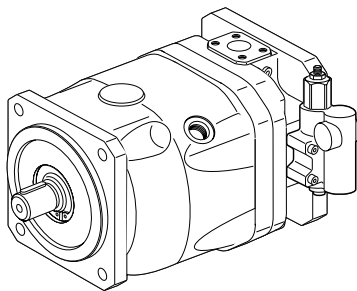
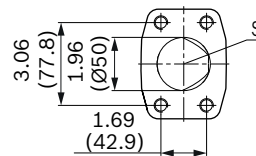


Valve mounting for counter-clockwise rotation

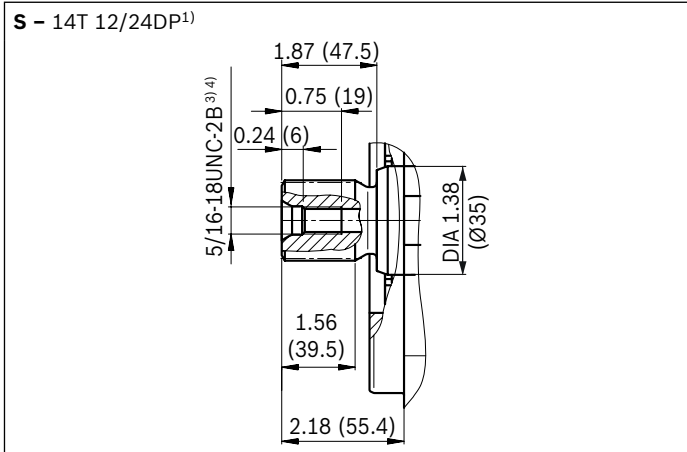
Detail W



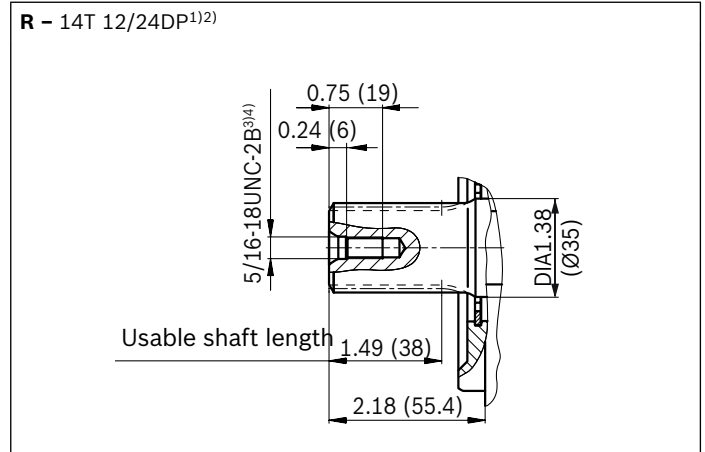
Detail V



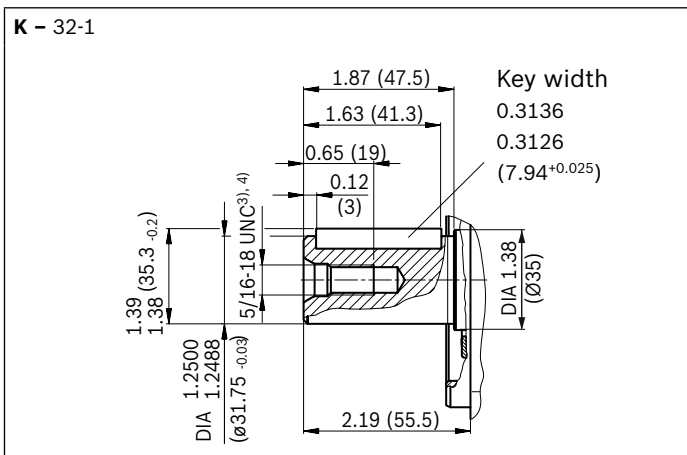
▼ Splined shaft 1 1/4 in (SAE J744)



▼ Splined shaft 1 1/4 in (SAE J744)



▼ Parallel keyed shaft ISO 3019-1

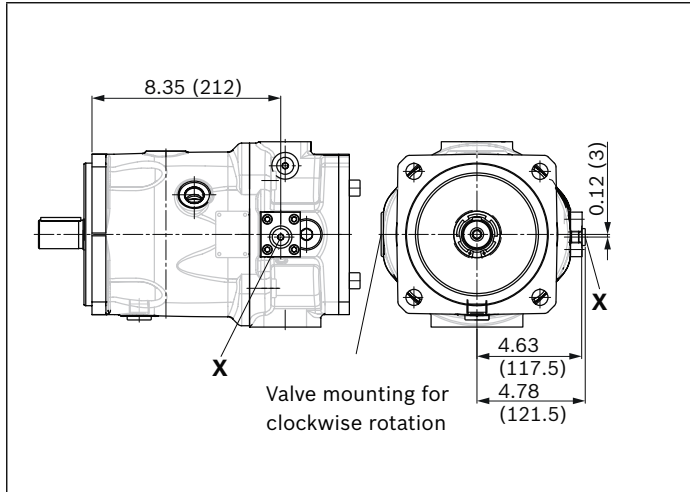


Ports	Standard	Size <sup>4)</sup>	$p_{max abs}$ [psi (bar)] <sup>5)</sup>	Status <sup>8)</sup>
<b>B</b>	Working line port (Standard pressure series) Fastening thread	SAE J518 ASME B1.1	1 in 3/8-16 UNC-2B, 0.71 (18) deep	5100 (350) O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 in 1/2-13 UNC-2B; 0.79 (20) deep	145 (10) O
<b>L</b>	Drain port	DIN 11926 <sup>6)</sup>	7/8-14 UNF-2B; 0.47 (12) deep	30 (2) O <sup>7)</sup>
<b>L<sub>1</sub></b>	Drain port	DIN 11926 <sup>6)</sup>	7/8-14 UNF-2B; 0.47 (12) deep	30 (2) X <sup>7)</sup>
<b>X</b>	Control pressure	DIN 11926	7/16-20 UNF-2A; 0.47 (12) deep	5100 (350) O
<b>X</b>	Pilot pressure (with DG-control)	DIN ISO 228	G 1/4 in; 0.47 (12) deep	4100 (280) O
<b>M<sub>B</sub></b>	Measuring pressure B	DIN 3852 <sup>6)</sup>	G 1/4 in; 0.47 (12) deep	5100 (350) X

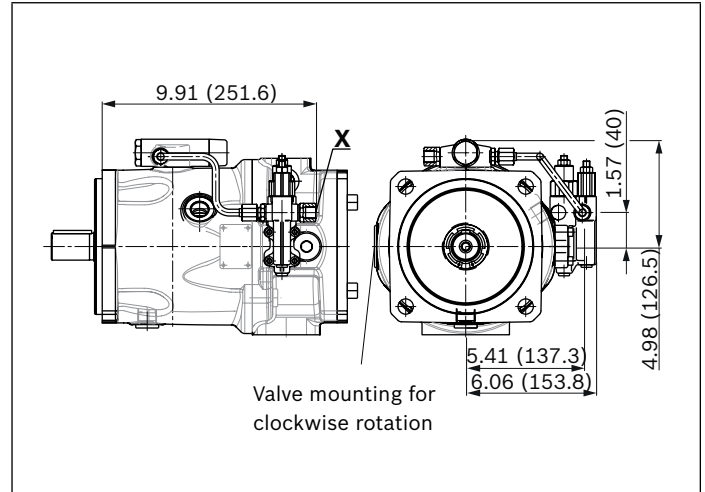
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
 2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.  
 3) Thread according to ASME B1.1  
 4) Observe the general instructions on page 44 concerning the maximum tightening torques.

5) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings.  
 6) The spot face can be deeper than as specified in the standard.  
 7) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 41).  
 8) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

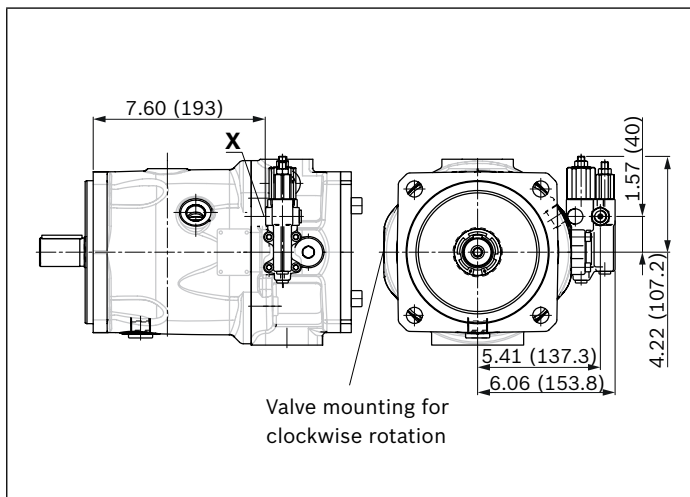
▼ **DG – Two-point control, directly operated**



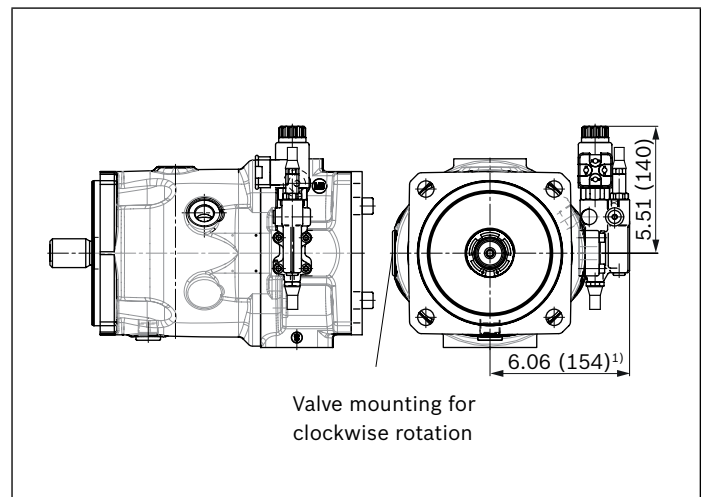
▼ **LA.DS – Pressure, flow and power control**



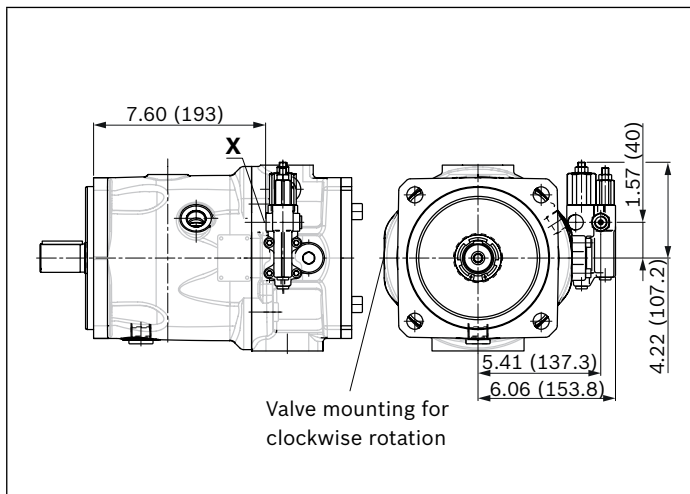
▼ **DRG – Pressure controller, remotely operated**



▼ **ED7./ER7. – Pressure controller, electrical**



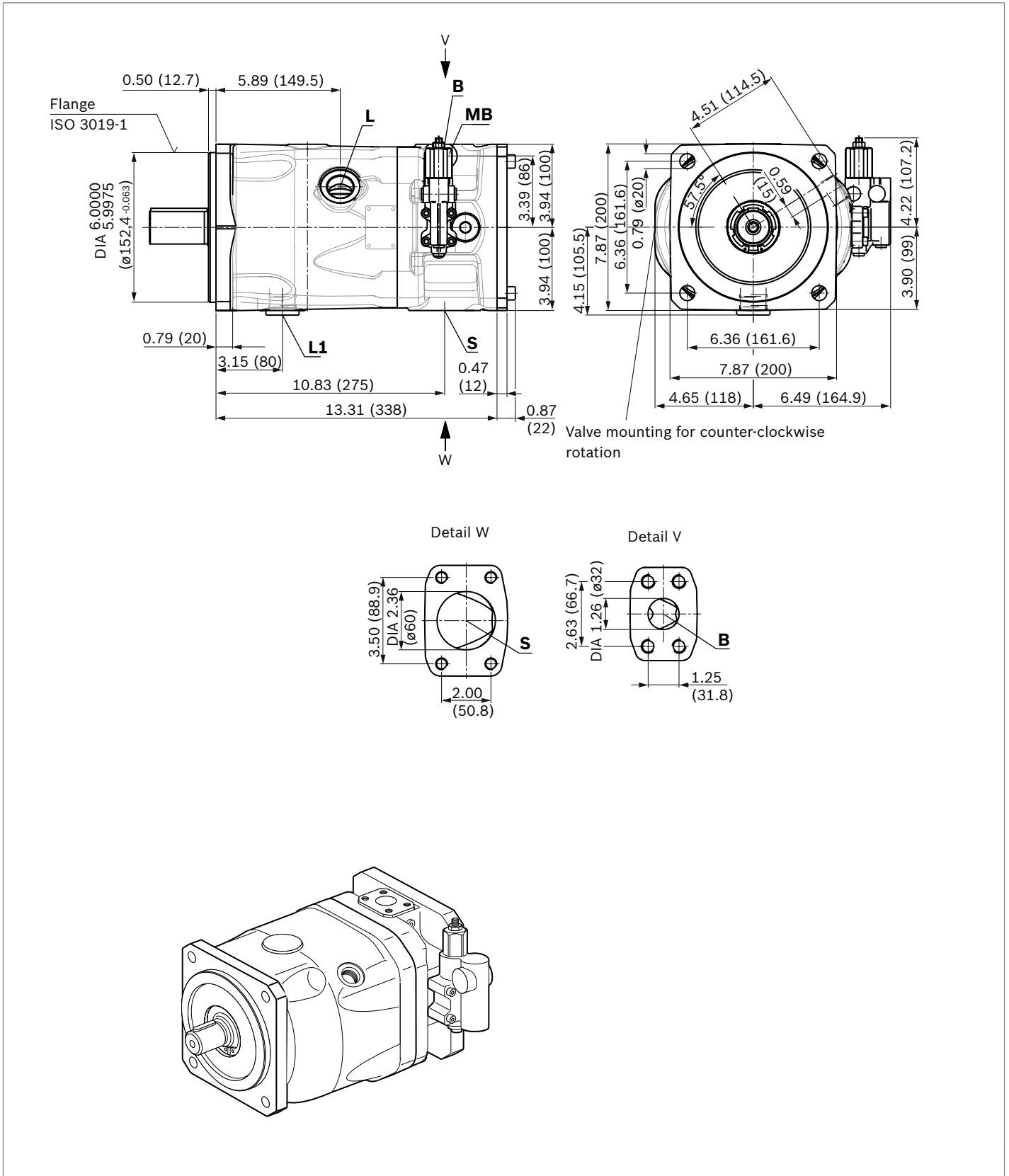
▼ **DRF/DRS – Pressure and flow controller**



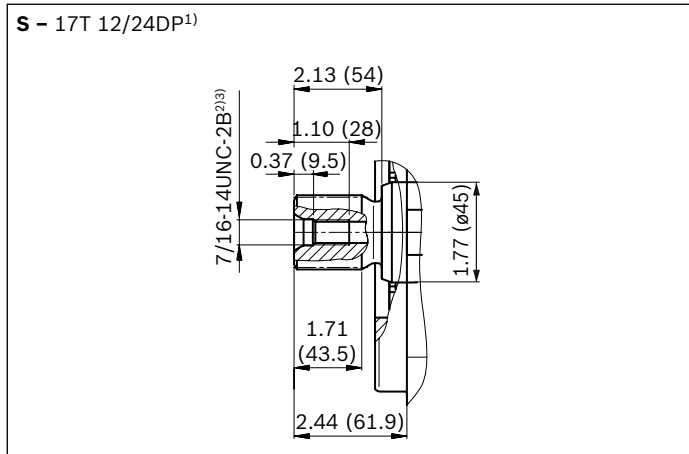
1) ER7.: 7.44 (189) if using an intermediate plate pressure controller

**Dimensions size 100**

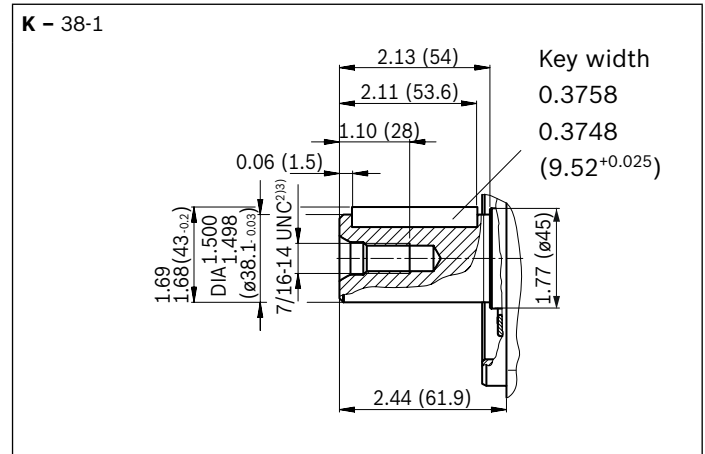
**DR – Pressure control**



▼ **Splined shaft 1 1/2 in (SAE J744)**



▼ **Parallel keyed shaft ISO 3019-1**

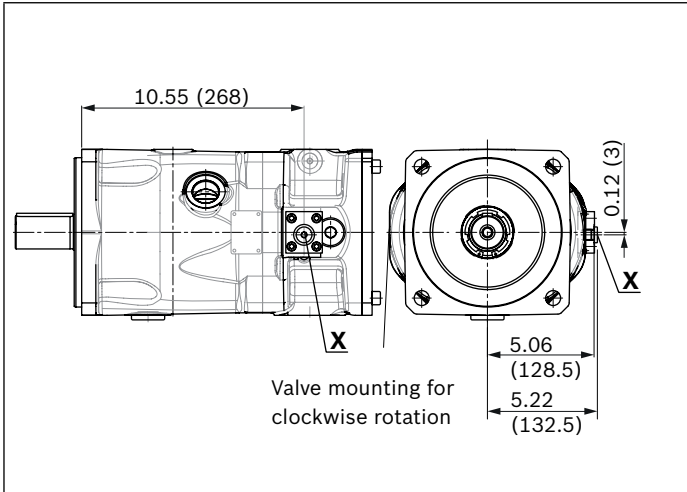


Ports		Standard	Size <sup>3)</sup>	$p_{\max \text{ abs}}$ [psi (bar)] <sup>6)</sup>	Status <sup>7)</sup>
<b>B</b>	Working line port (high-pressure line) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 1/2-13 UNC-2B; 0.75 (19) deep	5100 (350)	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13 UNC-2B; 0.94 (24) deep	145 (10)	O
<b>L</b>	Drain port	ISO 11926 <sup>5)</sup>	1 1/16-12 UNF-2B; 0.63 (16) deep	30 (2)	O <sup>6)</sup>
<b>L<sub>1</sub></b>	Drain port	ISO 11926 <sup>5)</sup>	1 1/16-12 UNF-2B; 0.63 (16) deep	30 (2)	X <sup>6)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20 UNF-2A; 0.47 (12) deep	5100 (350)	O
<b>X</b>	Pilot pressure (with DG-control)	DIN ISO 228	G 1/4 in; 0.47 (12) deep	4100 (280)	O
<b>M<sub>B</sub></b>	Measuring pressure B	DIN 3852 <sup>5)</sup>	G 1/4 in; 0.47 (12) deep	5100 (350)	X

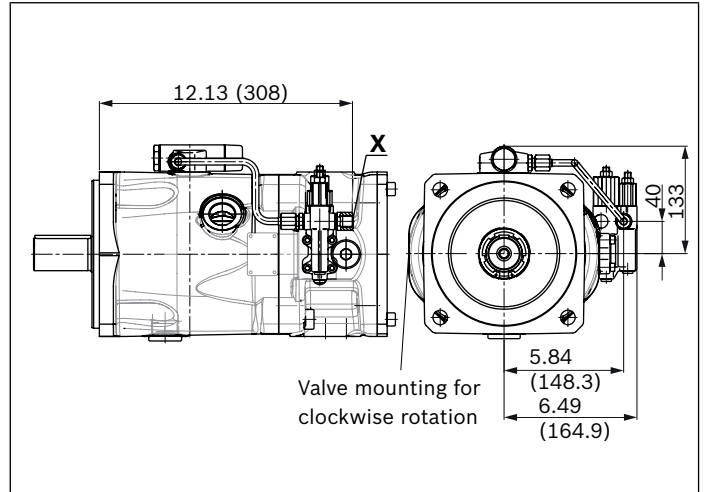
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
2) Thread according to ASME B1.1  
3) Observe the general instructions on page 44 concerning the maximum tightening torques.

4) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings.  
5) The spot face can be deeper than as specified in the standard.  
6) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 41).  
7) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

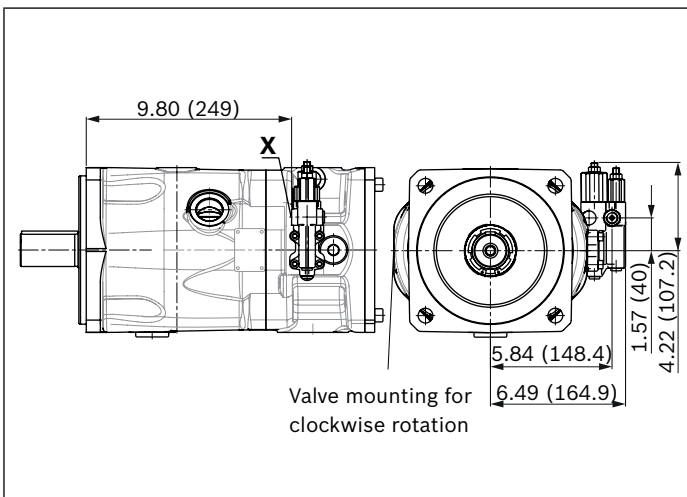
▼ **DG – Two-point control, directly operated**



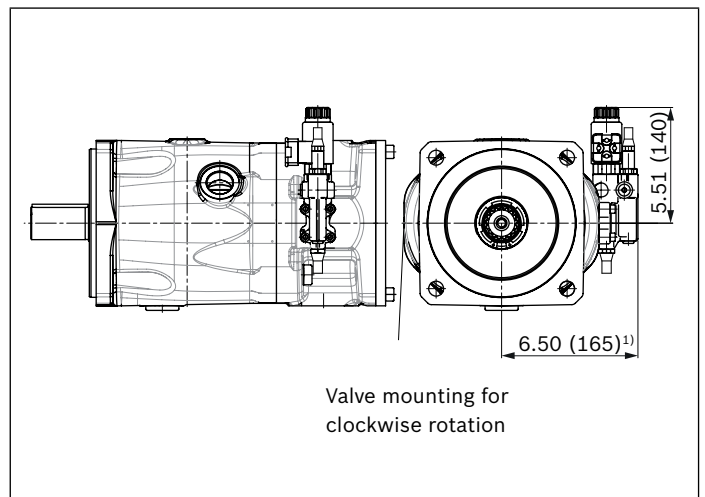
▼ **LA.DS – Pressure, flow and power control**



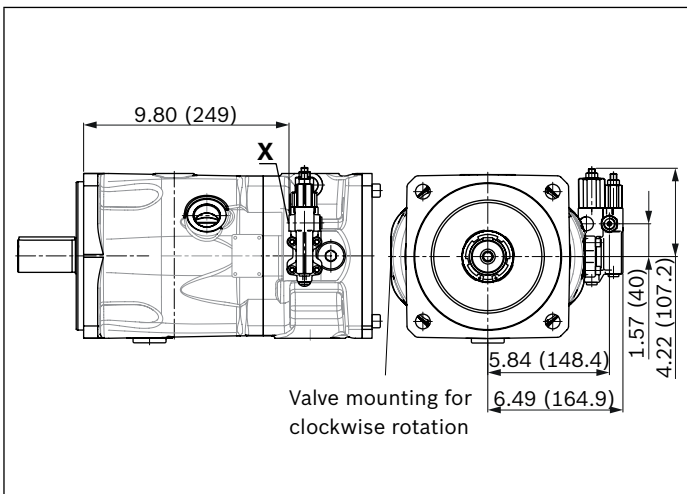
▼ **DRG – Pressure controller, remotely operated**



▼ **ED7./ER7. – Pressure controller, electrical**



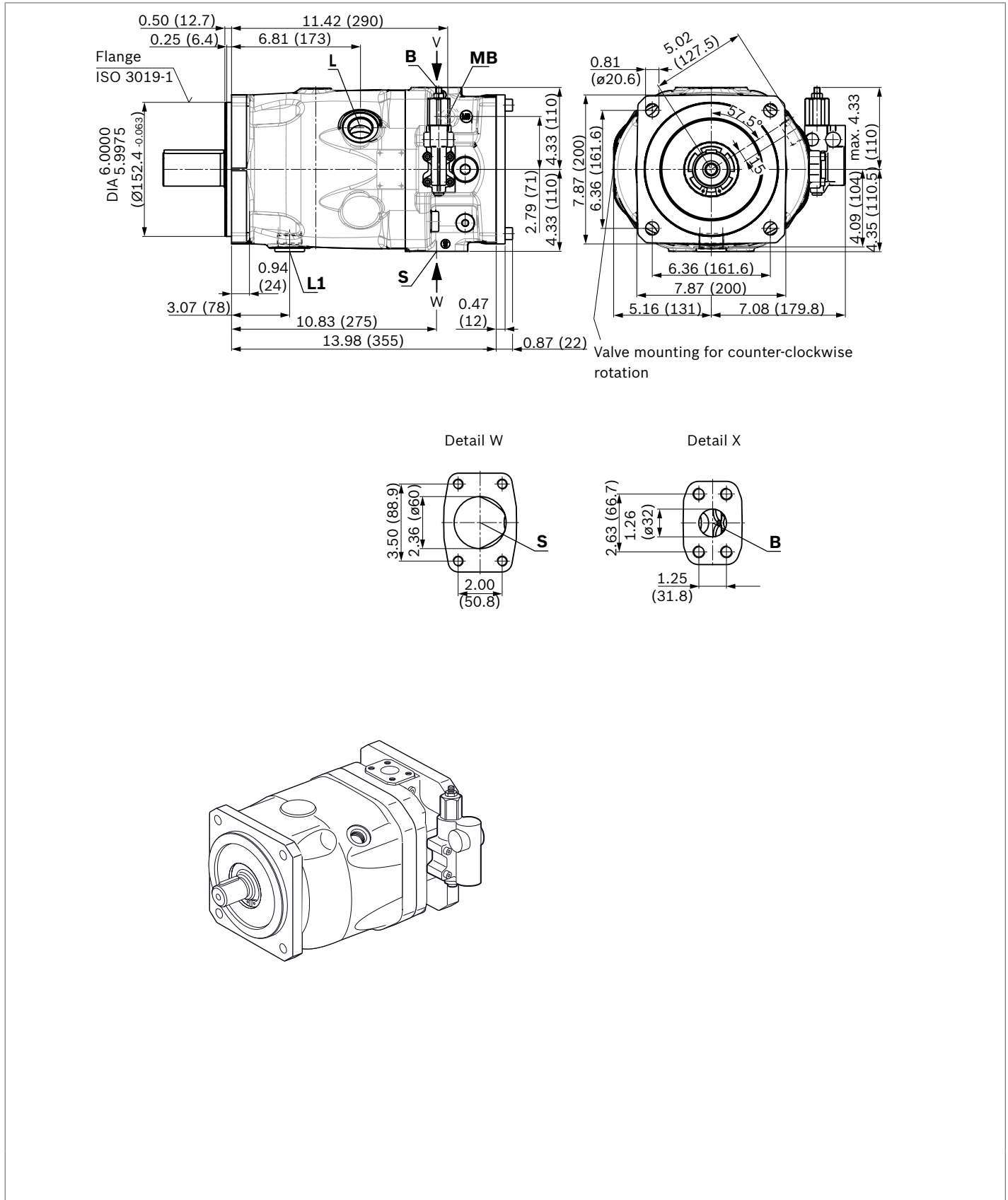
▼ **DRF/DRS – Pressure and flow controller**



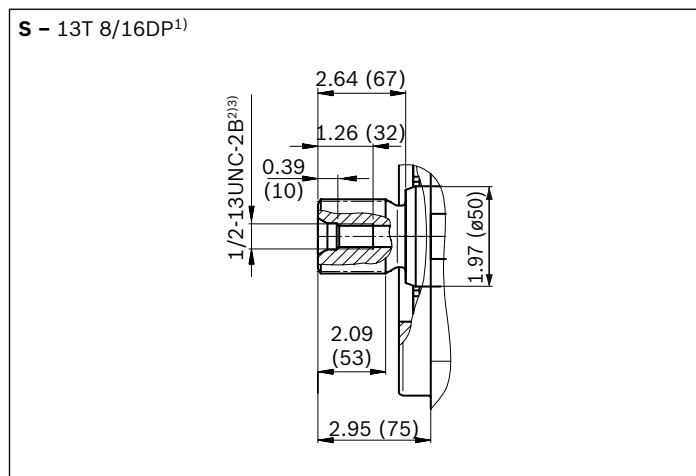
1) ER7.: 7.87 (200) if using an intermediate plate pressure controller

**Dimensions size 140**

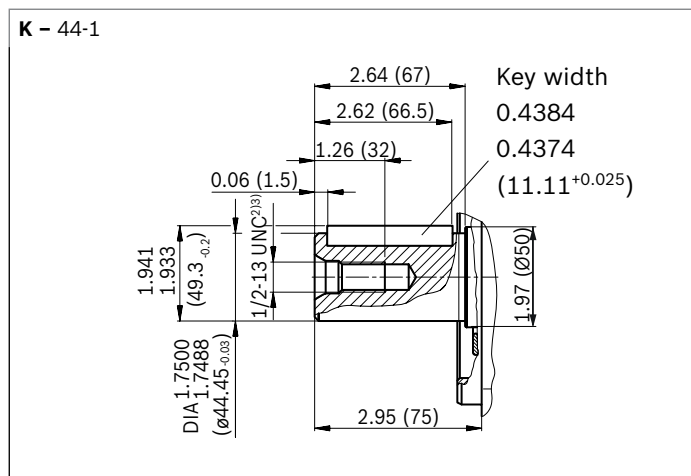
**DR – Pressure control**



▼ **Splined shaft 1 3/4 in SAE J744**



▼ **Parallel keyed shaft ISO 3019-1**

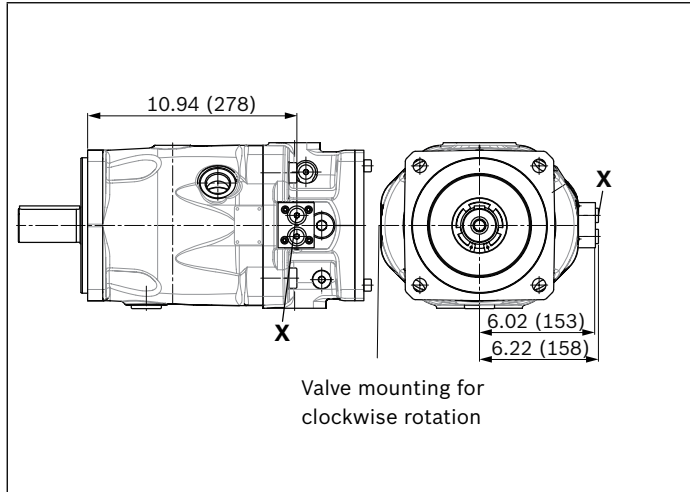


Ports		Standard	Size <sup>3)</sup>	$p_{max abs}$ [psi (bar)] <sup>4)</sup>	Status <sup>7)</sup>
<b>B</b>	Working line port (high-pressure line) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 1/2-13 UNC-2B; 0.75 (19) deep	5100 (350)	O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13UNC-2B; 0.67 (17) deep	145 (10)	O
<b>L</b>	Drain port	ISO 11926 <sup>5)</sup>	1 1/16-12 UNF-2B; 0.59 (15) deep	30 (2)	O <sup>6)</sup>
<b>L<sub>1</sub></b>	Drain port	ISO 11926 <sup>5)</sup>	1 1/16-12 UNF-2B; 0.59 (15) deep	30 (2)	X <sup>6)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20 UNF-2B; 0.47 (12) deep	5100 (350)	O
<b>X</b>	Pilot pressure (with DG-control)	DIN ISO 228	G 1/4 in; 0.47 (12) deep	4100 (280)	O
<b>M<sub>B</sub></b>	Measuring pressure B	DIN 3852 <sup>5)</sup>	G 1/4 in; 0.47 (12) deep	5100 (350)	X

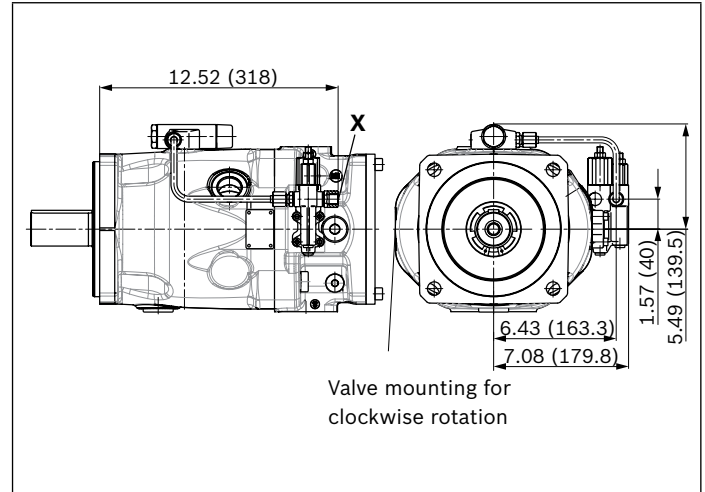
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
2) Thread according to ASME B1.1  
3) Observe the general instructions on page 44 concerning the maximum tightening torques.

4) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings.  
5) The spot face can be deeper than as specified in the standard.  
6) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 41).  
7) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

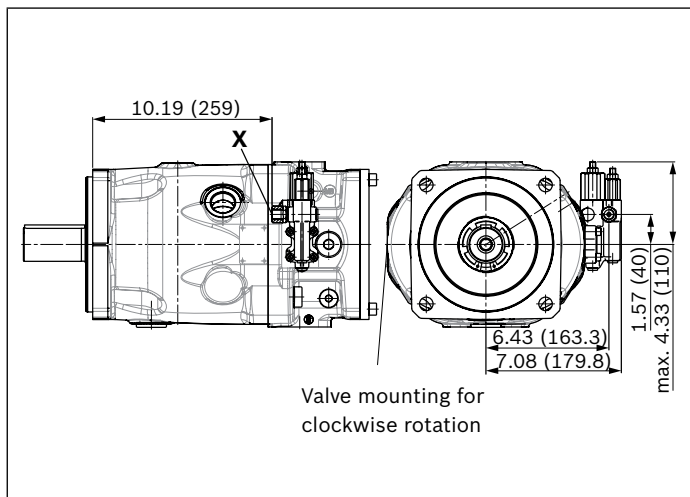
▼ **DG – Two-point control, directly operated**



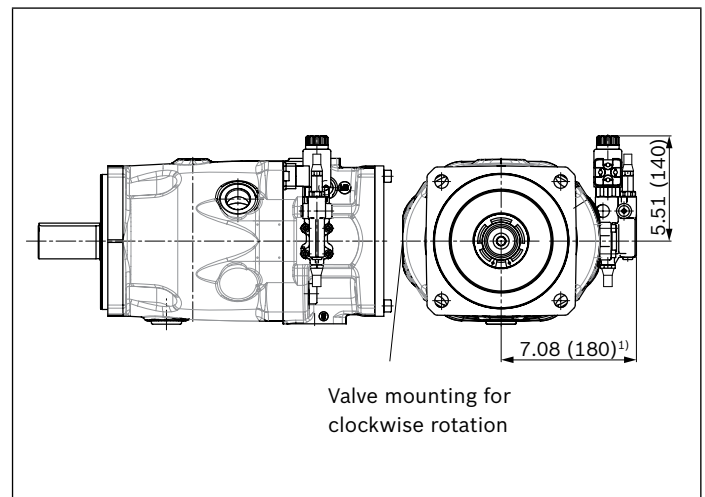
▼ **LA.DS – Pressure, flow and power control**



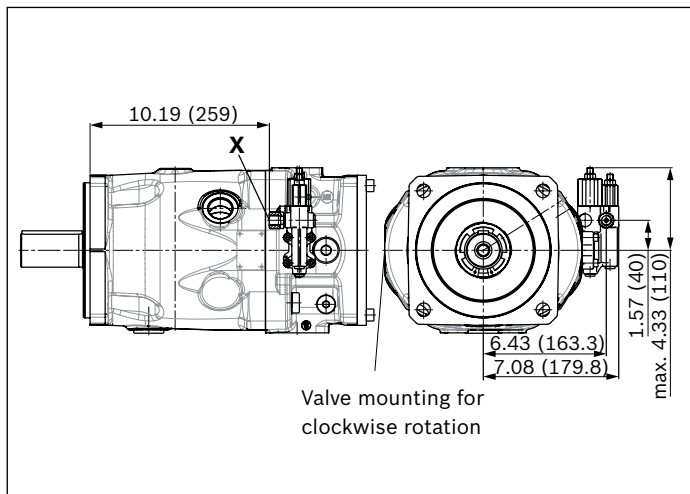
▼ **DRG – Pressure controller, remotely operated**



▼ **ED7./ER7. – Pressure controller, electrical**



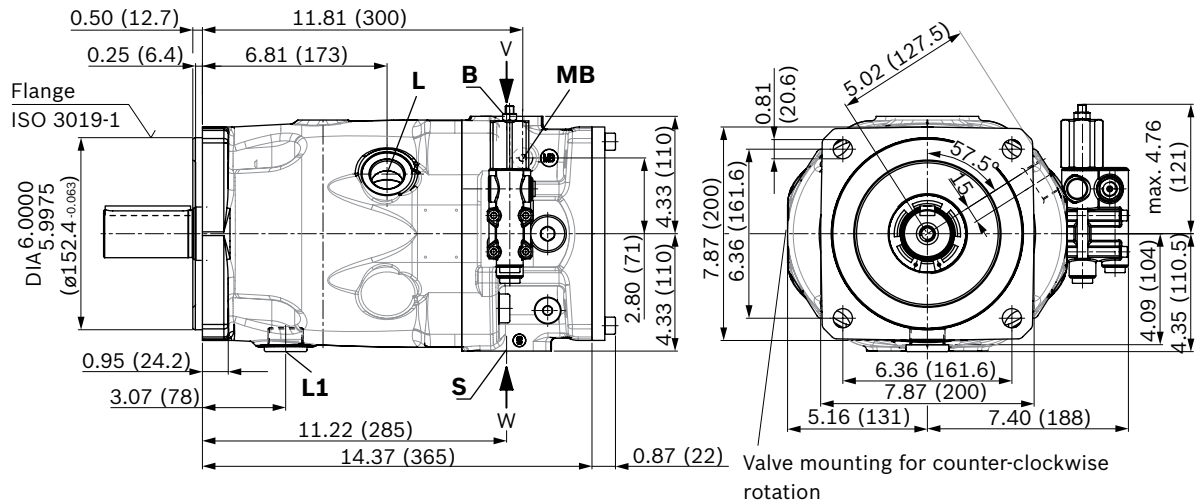
▼ **DRF/DRS – Pressure and flow controller**



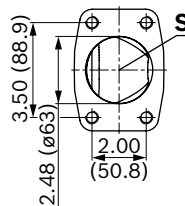
1) ER7.: 215 mm if using an intermediate plate pressure controller

**Dimensions size 180**

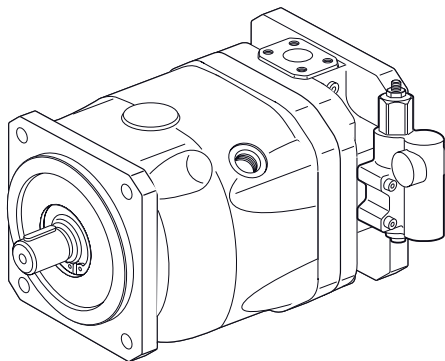
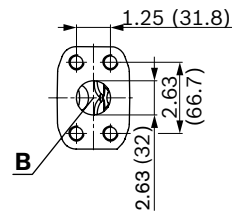
**DR – Pressure control**



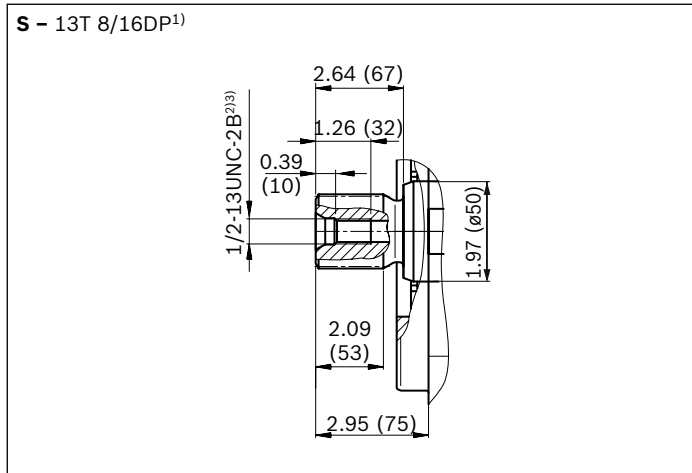
Detail W



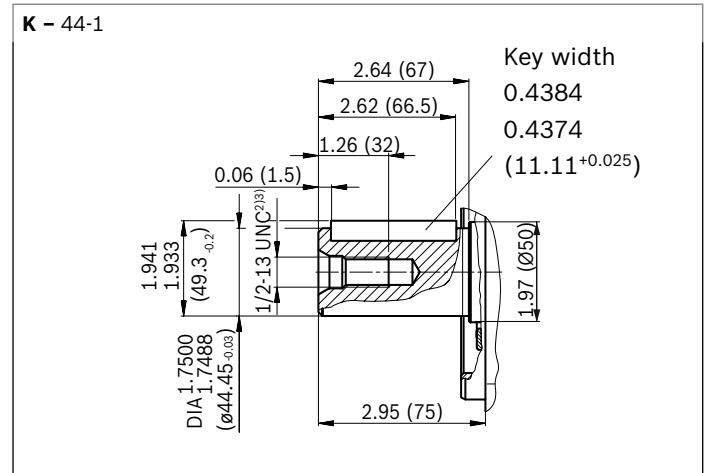
Detail X



▼ **Splined shaft 1 3/4 in SAE J744**



▼ **Parallel keyed shaft ISO 3019-1**

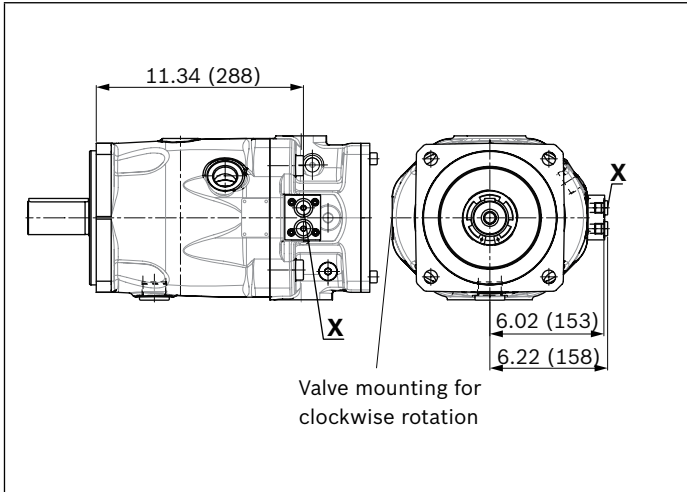


Ports	Standard	Size <sup>3)</sup>	$p_{\max \text{ abs}}$ [psi (bar)] <sup>4)</sup>	Status <sup>7)</sup>
<b>B</b>	Working line port (high-pressure line) Fastening thread	SAE J518 ASME B1.1	1 1/4 in 1/2-13 UNC-2B; 0.75 (19) deep	5100 (350) O
<b>S</b>	Suction port (standard pressure series) Fastening thread	SAE J518 ASME B1.1	2 1/2 in 1/2-13 UNC-2B; 0.94 (17) deep	145 (10) O
<b>L</b>	Drain port	ISO 11926 <sup>5)</sup>	1 5/16-12 UNF-2B; 0.59 (15) deep	30 (2) O <sup>6)</sup>
<b>L<sub>1</sub></b>	Drain port	ISO 11926 <sup>5)</sup>	1 5/16-12 UNF-2B; 0.59 (15) deep	30 (2) X <sup>6)</sup>
<b>X</b>	Control pressure	ISO 11926	7/16-20 UNF-2B; 0.47 (12) deep	5100 (350) O
<b>X</b>	Pilot pressure (with DG-control)	DIN ISO 228	G 1/4 in; 0.47 (12) deep	4100 (280) O
<b>M<sub>B</sub></b>	Measuring pressure B	DIN 3852 <sup>5)</sup>	G 1/4 in; 0.47 (12) deep	5100 (350) X

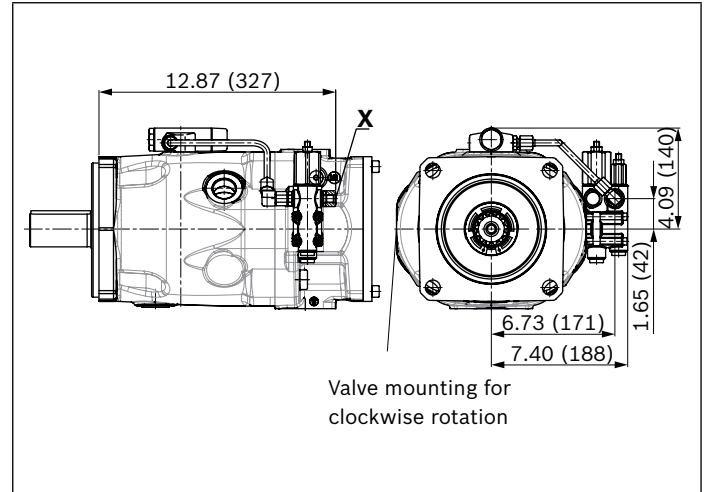
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
2) Thread according to ASME B1.1  
3) Observe the general instructions on page 44 concerning the maximum tightening torques.

4) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings.  
5) The spot face can be deeper than as specified in the standard.  
6) Depending on the installation position, L or L<sub>1</sub> must be connected (also see installation instructions starting on page 41).  
7) O = Must be connected (plugged on delivery) X = Plugged (in normal operation)

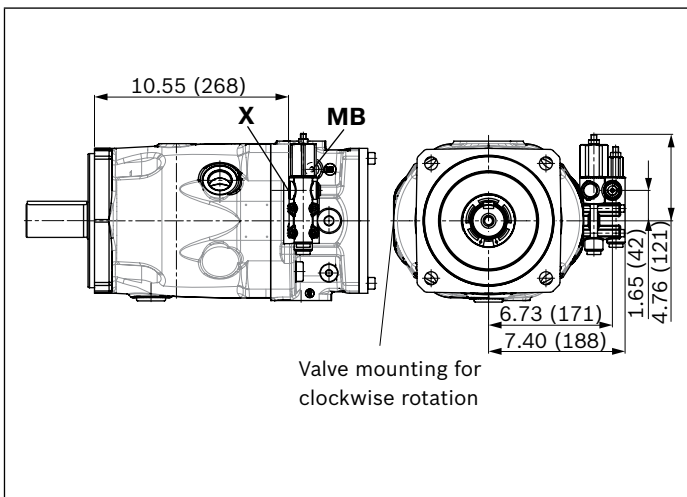
▼ **DG – Two-point control, directly operated**



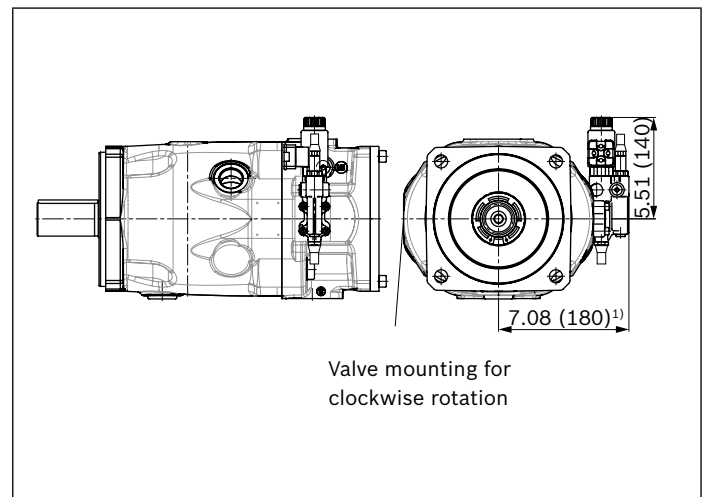
▼ **LA.DS – Pressure, flow and power control**



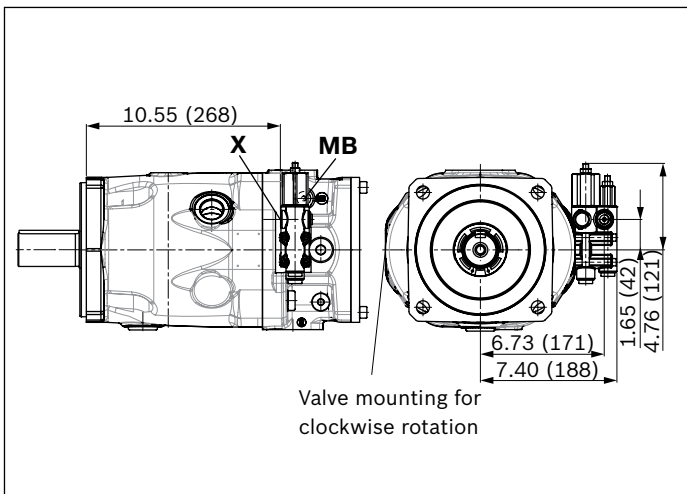
▼ **DRG – Pressure controller, remotely operated**



▼ **ED7./ER7. – Pressure controller, electrical**



▼ **DRF/DRS – Pressure and flow controller**



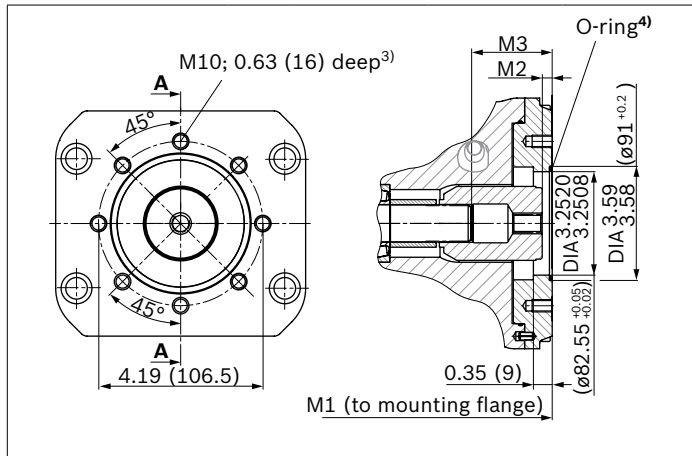
1) ER7.: 215 mm if using an intermediate plate pressure controller

## Through drive dimensions

Flange ISO 3019-1 (SAE J744)		Hub for splined shaft <sup>1)</sup>			Availability over sizes					Code
Diameter	Attachment <sup>2)</sup>	Diameter			45	71	100	140	180	
82-2 (A)	⌀, ⌀, ∞	5/8 in	9T 16/32DP		●	●	●	●	●	U01
	⌀, ⌀, ∞	3/4 in	11T 16/32DP		●	●	●	●	●	U52

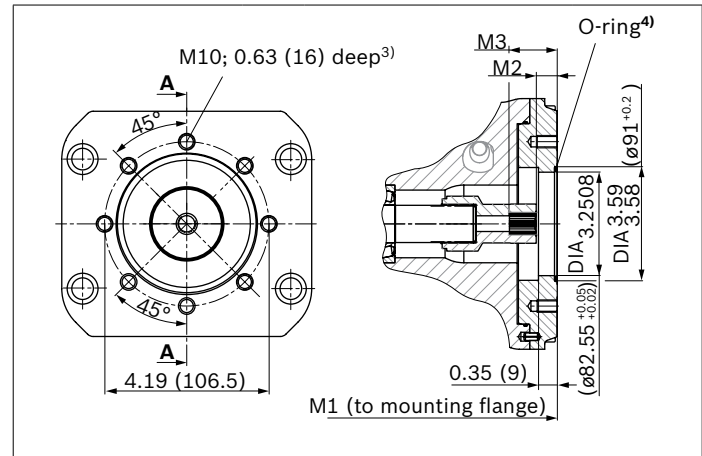
● = Available    ○ = On request

### ▼ 82-2 (A)



U01 (SAE J744 16-4 (A))	NG	M1	M2	M3
	45	10.39 (264)	On request	
	71	11.77 (299)	0.37 (9.3)	2.41 (61.3)
	100	14.17 (360)	0.41 (10.5)	2.56 (65)
	140	14.84 (377)	On request	
	180	15.24 (387)		

### ▼ 82-2 (A)



U52 SAE J744 19-4 (A-B))	NG	M1	M2	M3
	45	10.39 (264)	0.73 (18.6)	1.52 (38.7)
	71	11.77 (299)	0.81 (20.7)	1.63 (41.4)
	100	14.17 (360)	0.67 (17)	1.50 (38)
	140	14.84 (377)	0.75 (19)	1.52 (38.6)
	180	15.24 (387)	On request	

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

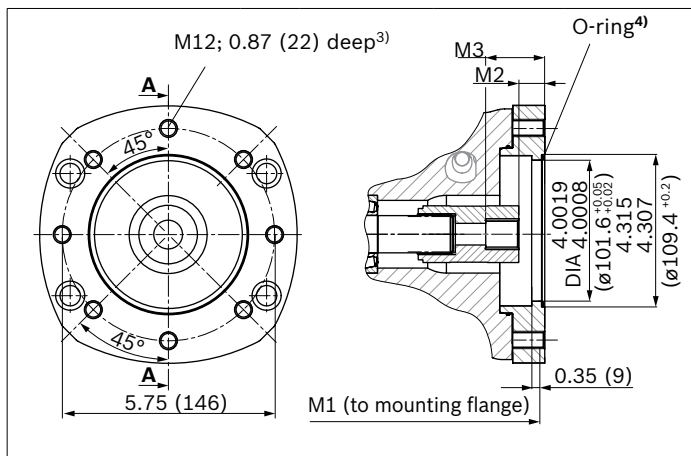
3) Thread according to DIN 13, observe the general instructions on page 44 for the maximum tightening torques.

4) O-ring included in the scope of supply

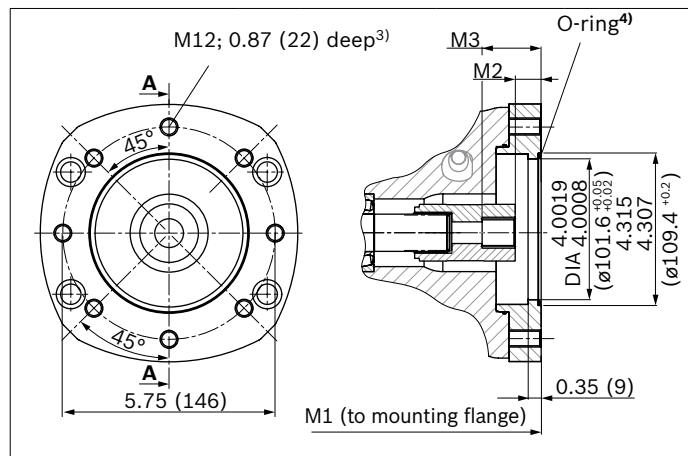
Flange, ISO 3019-2 (metric)		Hub for splined shaft <sup>1)</sup>			Availability over sizes					Code
Diameter	Attachment <sup>2)</sup>	Diameter			45	71	100	140	180	
101-2 (B)	⌀, ♂, ∞	7/8 in	13T 16/32DP		●	●	●	●	●	U68
	⌀, ♂, ∞	1 in	15T 16/32DP		●	●	●	●	●	U04

● = Available    ○ = On request

▼ 101-2



▼ 101-2



U68 (SAE J744 22-4) (B))	NG	M1	M2	M3
	45	10.39 (264)	0.72 (18.2)	1.63 (41.5)
	71	11.77 (299)	0.77 (19.7)	1.74 (44.1)
	100	14.17 (360)	0.68 (17.4)	1.62 (41.3)
	140	14.84 (377)	0.68 (17.4)	1.64 (41.6)
	180	15.24 (387)	0.73 (18.6)	1.67 (42.4)

U04 (SAE J744 25-4) (B-B))	NG	M1	M2	M3
	45	10.39 (264)	On request	
	71	11.77 (299)	0.82 (20.8)	1.93 (49.1)
	100	14.17 (360)	0.69 (17.6)	1.83 (46.6)
	140	14.84 (377)	0.70 (17.9)	1.82 (46.3)
	180	15.24 (387)	On request	

1) Hub for splined shaft 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

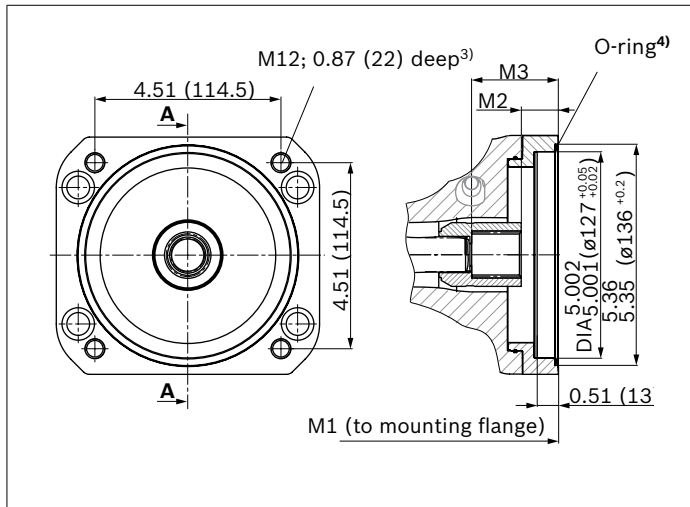
3) Thread according to DIN 13, observe the general instructions on page 44 for the maximum tightening torques.

4) O-ring included in the scope of supply

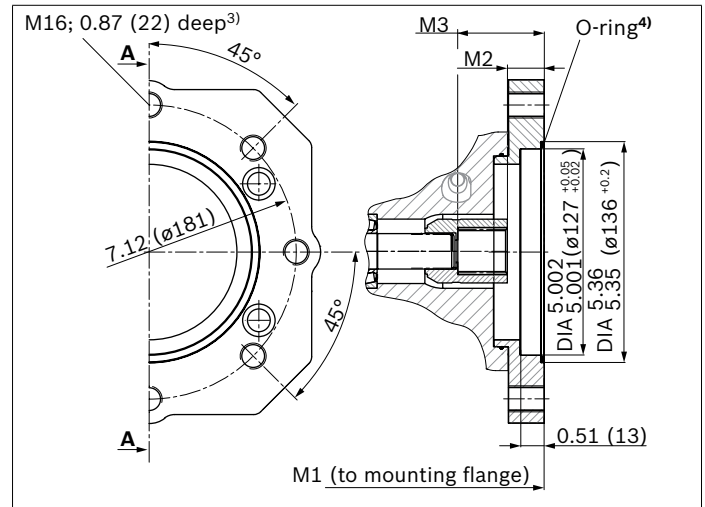
Flange ISO 3019-1 (SAE J744)		Splined shaft <sup>1)</sup>		Availability over sizes					Code
Diameter	Attachment <sup>2)</sup>	Diameter		45	71	100	140	180	
127-4 (C)	⌘	1 in	15T 16/32DP	●	●	●	●	●	UE2
		1 1/4 in	14T 12/24DP	-	●	●	●	●	U15
127-2 (C)	⌘, ⌘, ∞	1 1/2 in	17T 12/24DP	-	-	●	●	●	U24

● = Available    ○ = On request

▼ **127-4 (C)**



▼ **127-2 (C)**




UE2	NG	M1	M2	M3
127-4 (C)				
	45	10.39 (264)	0.74 (18.7)	1.83 (46.6)
	71	11.77 (299)	On request	
	100	14.17 (360)		
	140	14.84 (377)		
	180	15.24 (387)		

U24	NG	M1	M2	M3
127-2 (C)				
	100	14.17 (360)	0.85 (21.5)	2.45 (62.3)
	140	14.84 (377)	0.41 (10.5)	2.45 (62.3)
	180	15.24 (387)	0.39 (9.9)	2.45 (62.3)

U15	NG	M1	M2	M3
127-4 (C)				
	71	11.77 (299)	0.86 (21.8)	2.29 (58.1)
	100	14.17 (360)	On request	
	140	14.84 (377)		
	180	15.24 (387)	0.79 (20)	2.24 (57)

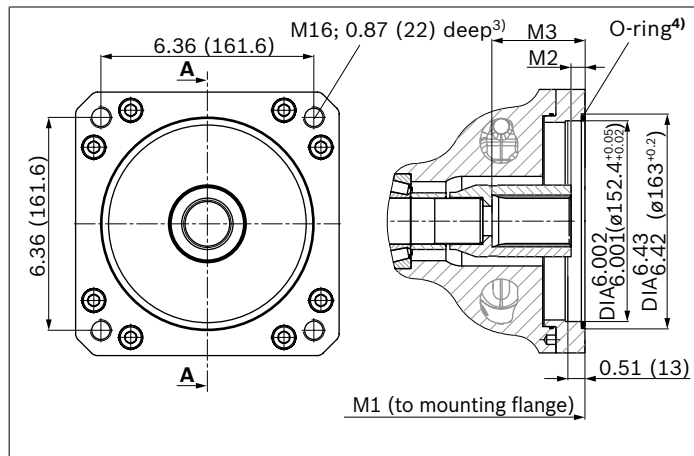
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5  
2) Mounting bores pattern viewed from through drive with control at top

3) Thread according to DIN 13, observe the general instructions on page 44 for the maximum tightening torques.  
4) O-ring included in the scope of supply

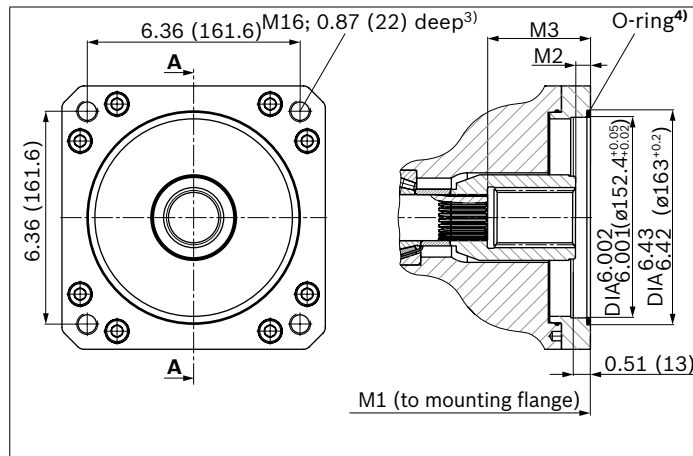
Flange ISO 3019-1 (SAE J744)		Splined shaft <sup>1)</sup>		Availability over sizes					Code
Diameter	Attachment <sup>2)</sup>	Diameter		45	71	100	140	180	
152-4 (D)		1 1/2 in	17T 12/24DP	-	-	●	●	●	U96
		1 3/4 in	13T 8/16DP	-	-	-	●	●	U17

● = Available    ○ = On request

▼ 152-4 (D)



▼ 152-4 (D)



U96	NG	M1	M2	M3
152-4 (D)				
	100	14.17 (360)	On request	
	140	14.84 (377)		
	180	15.24 (387)		

U17	NG	M1	M2	M3
152-4 (D)				
	140	14.84 (377)	0.43 (11)	3.05 (77.5)
	180	15.24 (387)	0.43 (11)	3.05 (77.5)

1) Hub for splined shaft 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 44 for the maximum tightening torques.  
4) O-ring included in the scope of supply

## Overview of fitting options

Through drive		Attachment of 2 <sup>nd</sup> pump				
Flange (SAE) ISO 3019-1	Hub for splined shaft	Short des.	A10VSO/32 NG (shaft)	A10VSO/31 NG (shaft)	A10VO/52 and 53 NG (shaft)	Gear pump
82-2 (A)	5/8 in	U01	–	–	–	AZPF, PGH2
	3/4 in	U52	–	18 (S, R)	10 (S, R)	
101-2 (B)	7/8 in	U68	–	28 (S, R)	–	AZPN, AZPG
	1 in	U04	–	–	–	PGH4
127-4 (C)	1 in	UE2	45 (S, R)	–	–	–
127-4 (C)	1 1/4 in	U15	71 (S)	–	–	–
127-2 (C)	1 1/2 in	U24	100 (S)	–	–	PGH5
152-4 (D)	1 1/2 in	U96	100 (S)	–	–	–
	1 3/4 in	U17	140, 180 (S)	–	–	–

### Combination pumps A10VSO + A10VSO

By using combination pumps, it is possible to have multiple, mutually independent circuits without the need for splitter gearboxes.

When ordering combination pumps, the type designations of the 1<sup>st</sup> and 2<sup>nd</sup> pump must be linked with a “+” sign.

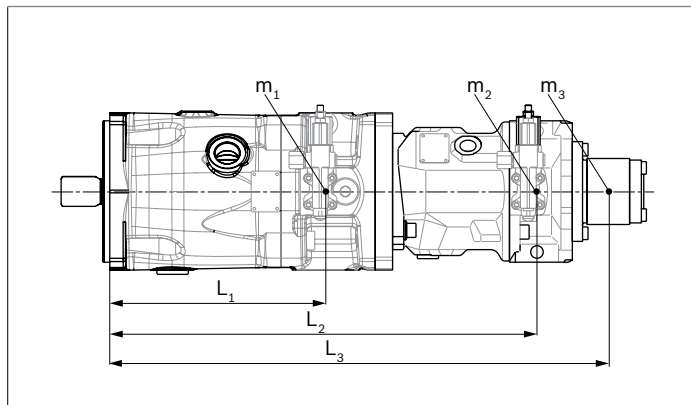
**Order example:**

**A10VSO100DR/32R-VPB32UB8+**

**A10VSO71DRF/32R-VSB22U00**

It is permissible to use a combination of two single pumps of the same 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	[lbs (kg)]
$l_1, l_2, l_3$	Distance from center of gravity	[in (mm)]
$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{12 (102)} \text{ [lb-ft (Nm)]}$		

**Permissible mass moment of inertia**

NG			45	71	100	140	180
static	$T_m$	lb-ft	1010	2213	3319	3319	3319
		(Nm)	(1370)	(3000)	(4500)	(4500)	(4500)
dynamic at 10 g (98.1 m/s <sup>2</sup> )	$T_m$	lb-ft	101	221	332	332	332
		(Nm)	(137)	(300)	(450)	(450)	(450)
Mass	$m$	lbs	66	103	152	161	172
		(kg)	(30)	(47)	(69)	(73)	(78)
Distance from center of gravity	$l_1$	in	5.12	5.59	6.65	6.77	7.72
		(mm)	(130)	(142)	(169)	(172)	(196)

Please also pay attention to the installation information on page 43.

## Connector for solenoids

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

without bidirectional suppressor diode \_\_\_\_\_H

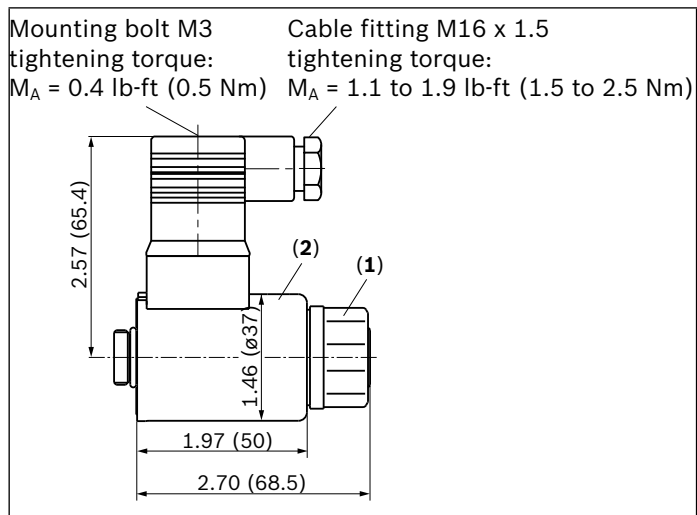
There is the following type of protection with mounted mating connector:

- ▶ IP65 (DIN/EN 60529)

The seal ring in the cable fitting is suitable for lines of diameter 0.18 in to 0.39 in (4.5 mm to 10 mm).

The line connector box is not included in the scope of supply. This can be supplied by Bosch Rexroth on request.

Bosch Rexroth material number: R902602623



### Changing plug position

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

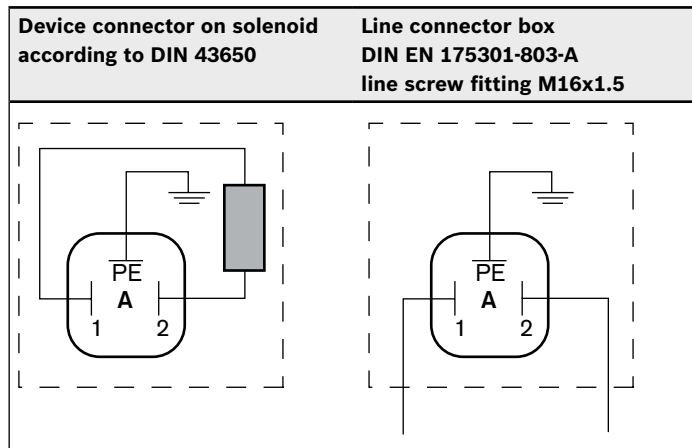
To do this, proceed as follows:

- ▶ 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: 4+0.7 lb-ft (5+1 Nm).

(WAF 26, 12-sided DIN 3124)

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



### Electronic controls

Control	Electronics function	electronics	Further information
Electric pressure control	Controlled power outlet	VT 2000 <sup>1)</sup>	analog 29904
		VT 11029 <sup>1)</sup>	analog 29741
		VT 11030 <sup>1)</sup>	

1) only 24 V nominal voltage

## Installation instructions

### General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be considered with a long-term standstill.

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 pump housing must be discharged to the reservoir via the highest available drain port (**L**, **L<sub>1</sub>**). For combinations of multiple units, the case drain fluid must be drained off at each pump. We recommend laying separate drain lines. If this is not possible, a shared drain line may need to be laid. If a shared drain 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 line and drain line 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  $h_{s\ max} = 31.50\ in\ (800\ mm)$ . The minimum suction pressure at port **S** (see the technical data on page 6) must not be fallen short of during operation and at cold starting either.

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.

For key, see page 43.

### Installation position

See the following examples **1** to **9**.

Further installation positions are available upon request.  
Recommended installation position: **1** and **3**

### Below-reservoir installation (standard)

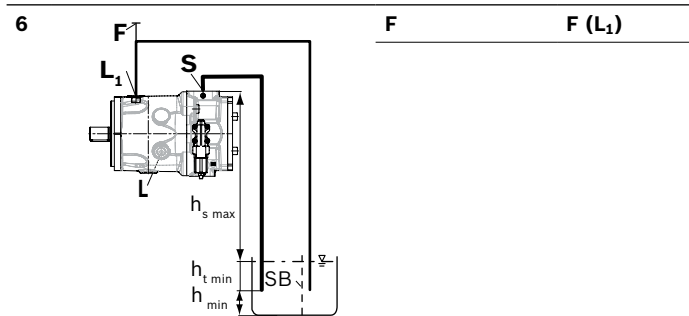
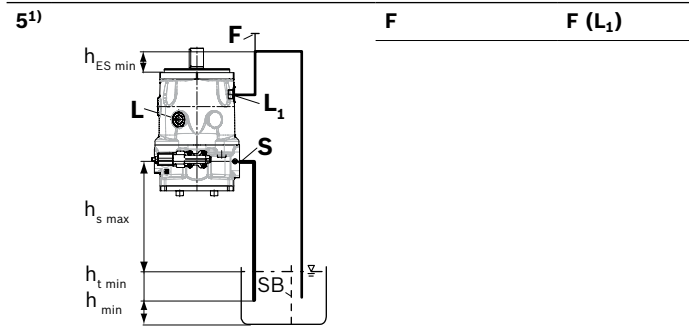
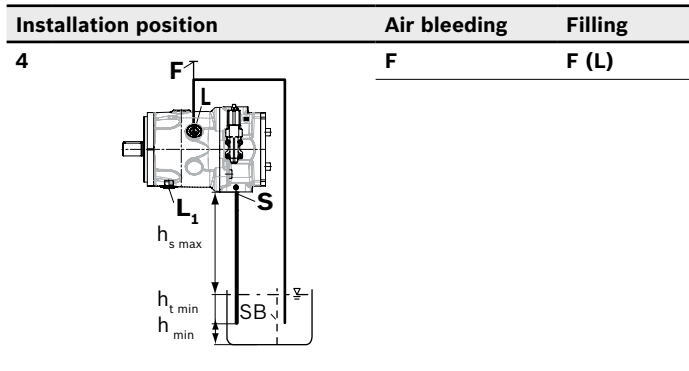
Below-reservoir installation is when the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Installation position	Air bleeding	Filling
<b>1</b>	<b>F</b>	<b>F (L)</b>
<b>2<sup>1)</sup></b>	<b>F</b>	<b>F (L<sub>1</sub>)</b>
<b>3</b>	<b>F</b>	<b>F (L<sub>1</sub>)</b>

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

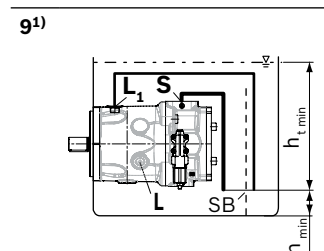
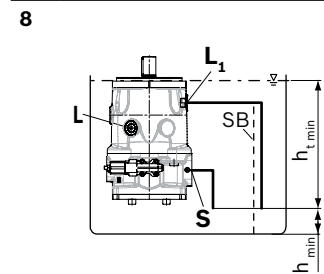
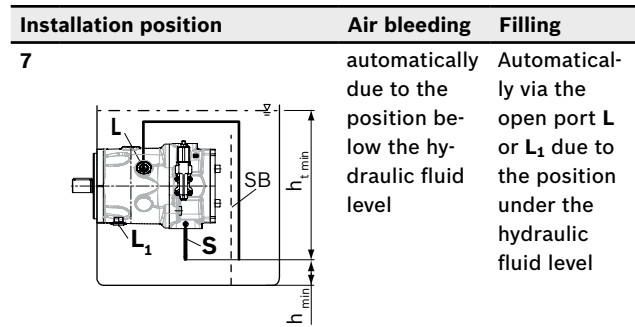
Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining in position 5, the height difference  $h_{ES\ min}$  must be at least 0.98 in (25 mm). Observe the maximum permissible suction height  $h_{S\ max} = 31.50$  in (800 mm).



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

### Inside-reservoir installation

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.



For key, see page 43.

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.

**Key and assembly note**

Key	
<b>L (F)</b>	Filling / air bleeding
<b>S</b>	Suction port
<b>T</b>	Drain port
<b>SB</b>	Baffle (baffle plate)
<b>h<sub>t min</sub></b>	Minimum necessary immersion depth (7.87 in (200 mm))
<b>h<sub>min</sub></b>	Minimum required spacing to reservoir base (3.94 in (100 mm))
<b>h<sub>ES min</sub></b>	Minimum necessary height needed to protect the axial piston unit from draining (0.98 in (25 mm)).
<b>h<sub>S max</sub></b>	Maximum permissible suction height (31.50 in (800 mm))

**Assembly note**

Due to the compact design of the casing, socket-head screws with a hexagon socket must be used to attach the axial piston pump. Please observe the maximum permissible surface pressure according to VDI 2230.

Apart from this, you should take into account the information regarding tightening torques on page 44.

## Project planning notes

- ▶ The A10VSO 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 these from Bosch Rexroth.
- ▶ Before finalizing your design, request a binding installation drawing.
- ▶ The data and notes contained herein must be adhered to.
- ▶ Pressure controls 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 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 operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service and function ports are only designed 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 equipment (e.g. valve spools) can, under certain circumstances, get blocked in position as a result of contamination (e.g. impure hydraulic fluid, abrasion, or residual dirt from components). As a result, the flow of hydraulic fluid and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtering) cannot rule out errors, but can only help minimize risks. 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.

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