# Axial piston variable pump A10VO series 32



- Optimized medium pressure pump for high power machines
- Sizes 45 to 180
- Nominal pressure 280 bar (4100 psi)
- Maximum pressure 350 bar (5100 psi)
- Open circuit

**Features**

- Variable displacement pump with axial piston rotary group of swashplate design for hydrostatic drives in open circuit
- Flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- Hydrostatically unloaded cradle bearing
- Port for measurement sensor on high pressure port for all sizes with port plate 22/72 and 32/82
- Low noise level
- Increased functional reliability
- High efficiency
- Good power to weight ratio
- Universal through drive for all sizes with port plate 22/72 and 32/82
- Optional pulsation damping

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Values in the US customary unit system are converted and rounded values. In case of doubt, only metric values are valid.

## Type code

| 01 | 02 | 03 | 04 | | 05 | 06 | | 07 | 08 | 09 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A10V** | **O** | | | **/** | **32** | | **–** | **V** | | | | | | |

**Axial piston unit**

| | | |
|---|---|---|
| 01 | Swashplate design, variable, nominal pressure 280 bar (4100 psi), maximum pressure 350 bar (5100 psi) | **A10V** |

**Operating mode**

| | | |
|---|---|---|
| 02 | Pump, open circuit | **O** |

**Sizes (NG)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 03 | Geometric displacement, see "Technical data" on page 8 | **45** | **71** | **100** | **140** | **180** | |

**Control devices**

| | | | | | | 45 | 71 | 100 | 140 | 180 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 04 | Pressure controller | hydraulic | | | | ● | ● | ● | ● | ● | **DR** |
| | with flow controller | hydraulic | X-T open | | | ● | ● | ● | ● | ● | **DRF** |
| | | | X-T plugged | with flushing function | | ● | ● | ● | ● | ● | **DRS** |
| | | | X-T plugged | without flushing function | | ● | ● | ● | ● | ● | **DRSC** |
| | pressure cut-off | hydraulic | remote controlled | | | ● | ● | ● | ● | ● | **DRG** |
| | | electric | negative control | | $U$ = 12 V | ● | ● | ● | ● | ● | **ED71** |
| | | | | | $U$ = 24 V | ● | ● | ● | ● | ● | **ED72** |
| | | electric | positive control | | $U$ = 12 V | ● | ● | ● | ● | ● | **ER71**[1] |
| | | | | | $U$ = 24 V | ● | ● | ● | ● | ● | **ER72**[1] |
| | Electrohydraulic control valve | | positive control | | $U$ = 12 V to 24 V | – | ●[3] | ●[2] | ●[2] | ○ | **EC4** |
| | | | negative control | | | – | ○[3] | ○[2] | ○[2] | ○ | **EB4** |
| | Power controller with | | | | | | | | | | |
| | pressure cut-off | hydraulic | beginning of control | to | 50 bar | ● | ● | ● | ● | ● | **LA5D** |
| | | | | from | 51 to 90 bar | ● | ● | ● | ● | ● | **LA6D** |
| | | | | | 91 to 160 bar | ● | ● | ● | ● | ● | **LA7D** |
| | | | | | 161 to 240 bar | ● | ● | ● | ● | ● | **LA8D** |
| | | | | via | 240 bar | ● | ● | ● | ● | ● | **LA9D** |
| | pressure cut-off and flow control | hydraulic | beginning of control | see LA.D | | ● | ● | ● | ● | ● | **LA.DS** |
| | remote controlled pressure cut-off | hydraulic | beginning of control | see LA.D | | ● | ● | ● | ● | ● | **LA.DG** |
| | separate flow control | hydraulic | beginning of control | see LA.D | | ● | ● | ● | ● | ● | **LA.S** |

**Series**

| | | |
|---|---|---|
| 05 | Series 3, index 2 | **32** |

**Directions of rotation**

| | | | |
|---|---|---|---|
| 06 | Viewed on drive shaft | clockwise | **R** |
| | | counter-clockwise | **L** |

● = Available ○ = On request – = Not available

1) Observe the project planning notes on page 19.
2) Only available with mounting flange D (not available for versions with mounting flange C).
3) Not available for versions with mounting flange U.

| 01 | 02 | 03 | 04 | | 05 | 06 | | 07 | 08 | 09 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A10V** | **O** | | | **/** | **32** | | **–** | **V** | | | | | | |

**Seal**

| | | |
|---|---|---|
| 07 | FKM (fluorocarbon rubber) | **V** |

| **Drive shaft** | | | **45** | **71** | **100** | **140** | **180** | |
|---|---|---|---|---|---|---|---|---|
| 08 | Splined shaft ISO 3019-1<br><br>View in the data sheet has been standardized. For a detailed view, see the installation drawing. | standard shaft | ● | ● | ● | ● | ● | **S** |
| | | same as shaft "S", but for higher torque | ● | ● | – | – | – | **R** |
| | | reduced diameter, limited suitability for through drive (see table of values, page 10) | ● | ● | ● | ● | – | **U** |
| | | same as shaft "U", but for higher torque, limited suitability for through drive (see table of values, page 10) | ○ | ● | ● | ● | ● | **W** |

| **Mounting flange** | | | **45** | **71** | **100** | **140** | **180** | |
|---|---|---|---|---|---|---|---|---|
| 09 | Based on ISO 3019-1 (SAE) | SAE B; 2-hole | ● | – | – | – | – | **C** |
| | | SAE C; 2-hole | – | ● | ● | ● | – | |
| | | SAE C; 4-hole | ● | ● | – | – | – | **D** |
| | | SAE D; 4-hole | – | – | ● | ● | ● | |
| | | | – | ● | – | – | – | **U** |

| **Working port** | | | **45** | **71** | **100** | **140** | **180** | |
|---|---|---|---|---|---|---|---|---|
| 10 | SAE flange ports according to ISO 6162 (port plates and through drive assignment, see order item 11) | at rear, **metric** fastening thread (not for through drive, "N00" only) | ● | ● | ● | ● | ● | **11** |
| | | at rear, **UNC** fastening thread (not for through drive, "N00" only) | – | – | – | ● | ● | **61** |
| | | at top, at bottom, on opposite side, **metric** fastening thread | ● | ● | ● | ● | ● | **12** |
| | | top, bottom, opposite, fastening thread **UNC** | – | – | – | ● | ● | **62** |
| | | top, bottom, opposite, fastening thread **metric**, with universal through drive U..; **without** pulsation damping | ● | ● | ● | ● | ● | **22**[1)] |
| | | top, bottom, opposite, **UNC** fastening thread, with universal through drive U..; **without** pulsation damping | ● | ● | ● | ● | ● | **72**[1)] |
| | | top, bottom, opposite, fastening thread **metric**, with universal through drive U..; **with** pulsation damping | ● | ● | ●[2)] | ○ | ● | **32**[1)] |
| | | top, bottom, opposite, **UNC** fastening thread, with universal through drive U..; **with** pulsation damping | ● | ● | ●[2)] | ○ | ● | **82**[1)] |

● = Available ○ = On request – = Not available

1) Only with mounting flange (type code position 09) D or U
2) Use only possible in the case of reduced rotational speeds. See also "Technical data" on page 8.

| 01 | 02 | 03 | 04 | | 05 | 06 | | 07 | 08 | 09 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A10V** | **O** | | | **/** | **32** | | **–** | **V** | | | | | | |

**Through drive** (for mounting options, see page 68)

| | For flange ISO 3019-1 | | Hub for splined shaft[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11 | Diameter | Mounting[3] | Diameter | | | | | | |
| | Only for **port plate 12/62** | | | | **45** | **71** | **100** | **140** | **180** | |
| | Without through drive | | | | ● | ● | ● | ● | ● | **N00** |
| | 82-2 (A) | | 5/8 in | 9T 16/32DP | ● | ● | ● | ● | – | **K01** |
| | | | 3/4 in | 11T 16/32DP | ● | ● | ● | ● | – | **K52** |
| | 101-2 (B) | | 7/8 in | 13T 16/32DP | ● | ● | ● | ● | – | **K68** |
| | | | 1 in | 15T 16/32DP | ● | ● | ● | ● | – | **K04** |
| | 127-2 (C) | | 1 1/4 in | 14T 12/24DP | – | ● | ● | ● | – | **K07** |
| | | | 1 1/2 in | 17T12/24DP | – | – | ● | ● | – | **K24** |
| | 127-4 (C) | | 1 1/4 in | 14T 12/24DP | – | ○ | ● | ● | – | **K15** |
| | 152-4 (D) | | 1 3/4 in | 13T 8/16DP | – | – | – | ● | – | **K17** |
| | Only for **port plate 22/72 and 32/82** | | | | **45** | **71** | **100** | **140** | **180** | |
| | Without through drive[2] | | | | ● | ● | ● | ● | ● | **U00** |
| | 82-2 (A) | | 5/8 in | 9T 16/32DP | ○ | ● | ● | ● | ● | **U01** |
| | | | 3/4 in | 11T 16/32DP | ● | ● | ● | ● | ● | **U52** |
| | 101-2 (B) | | 7/8 in | 13T 16/32DP | ● | ● | ● | ● | ● | **U68** |
| | | | 1 in | 15T 16/32DP | ○ | ● | ● | ● | ● | **U04** |
| | 127-2 (C) | | 1 1/4 in | 14T 12/24DP | – | ● | ● | ● | ● | **U07** |
| | | | 1 1/2 in | 17T 12/24DP | – | – | ● | ● | ● | **U24** |
| | 127-4 (C) | | 1 in | 15T 16/32DP | ○ | ○ | ● | ● | ○ | **UE2** |
| | | | 1 1/4 in | 14T 12/24DP | – | – | ● | ● | ● | **U15** |
| | 152-4 (D) | | 1 3/4 in | 13T 8/16DP | – | – | – | ● | ● | **U17** |

| **Connector for solenoids**[4] | | **45** | **71** | **100** | **140** | **180** | |
|---|---|---|---|---|---|---|---|
| 12 | Without connector (without solenoid, only for hydraulic controls, without code) | ● | ● | ● | ● | ● | |
| | DEUTSCH molded connector, 2-pin – without suppressor diode | ● | ● | ● | ● | ● | **P** |

| **Swivel angle sensor** | | | | **45** | **71** | **100** | **140** | **180** | |
|---|---|---|---|---|---|---|---|---|---|
| 13 | Without swivel angle sensor (without code) | | | ● | ● | ● | ● | ● | |
| | With electric swivel angle sensor PAL (as per data sheet 95161) | ratiometric | Power supply U = 5V DC | – | ●[6] | ●[5] | ●[5] | ○ | **H** |
| | | SENT/SENT | | – | ○ | ○ | ○ | ○ | **P** |

● = Available ○ = On request – = Not available

**Notice**

- Note the project planning notes on page 76 and the project planning notes regarding each control device.
- In addition to the type code, please specify the relevant technical data when placing your order.

1) According to ANSI B92.1a (splined shaft according to ISO 3019-1)
2) With through-drive shaft, without hub, without intermediate flange, plugged on a functionally reliable basis with cover. For mounting kits, see data sheet 95581.
3) Mounting holes pattern viewed from through drive with control at top.
4) Connectors for other electric components may deviate.
5) Only available with mounting flange D (not available for versions with mounting flange C).
6) Not available for versions with mounting flange U.

## Hydraulic fluids

The A10VO variable pump is designed for operation with HLP mineral oil according to DIN 51524.
See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: HFD hydraulic fluids (for permissible technical data, see data sheet 90225)

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

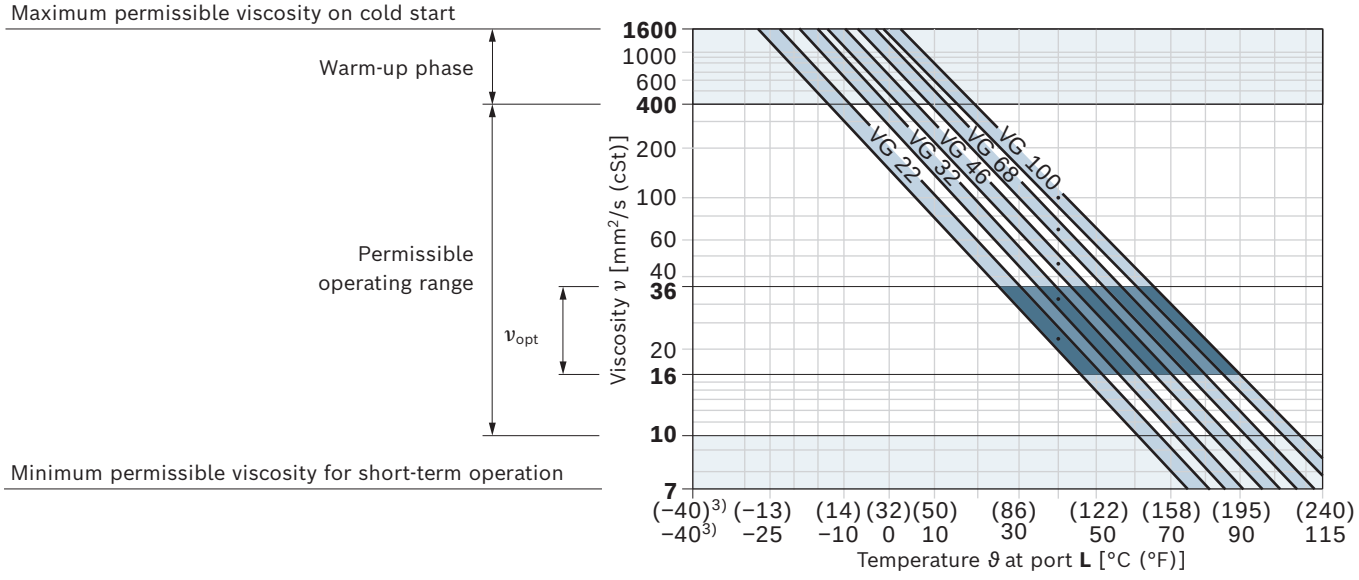
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The selection of hydraulic fluid shall take place so that the operating viscosity in the operating temperature range is within the optimum range ($v_{opt}$; see selection diagram).

**Viscosity and temperature of hydraulic fluids**

| | Viscosity | Shaft seal | Temperature[2] | Comment |
|---|---|---|---|---|
| Cold start | $v_{max}$ ≤ 1600 mm²/s (cSt) | FKM | $\vartheta_{St}$ ≥ −25 °C (-13 °F) | $t$ ≤ 3 min, without load ($p$ ≤ 50 bar (725 psi)), $n$ ≤ 1000 rpm<br>Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K (45 °F) |
| Warm-up phase | $v$ = 1600 ... 400 mm²/s (cSt) | | | $t$ ≤ 15 min, $p$ ≤ 0.7 × $p_{nom}$ und $n$ ≤ 0.5 × $n_{nom}$ |
| Permissible operating range | $v$ = 400 ... 10 mm²/s (cSt)[1] | FKM | $\vartheta$ ≤ +110 °C (+230 °F) | Measured at port **L**, **L₁** |
| | $v_{opt}$ = 36 ... 16 mm²/s (cSt) | | | Optimal operating viscosity and efficiency range |
| Short-term operation | $v_{min}$ = 10 ... 7 mm²/s (cSt) | FKM | $\vartheta$ ≤ +110 °C (+230 °F) | $t$ ≤ 3 min, $p$ ≤ 0.3 × $p_{nom}$ , measured at port **L** |

▼ **Selection diagram**




1) This corresponds, e.g. on the VG 46, to a temperature range of +4 °C to +85 °C (+39 °F to +185 °F) (see selection diagram)

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

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

**Filtration of the hydraulic fluid**

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

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

At a hydraulic fluid viscosity of less than 10 $mm^2/s$ (cSt) (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

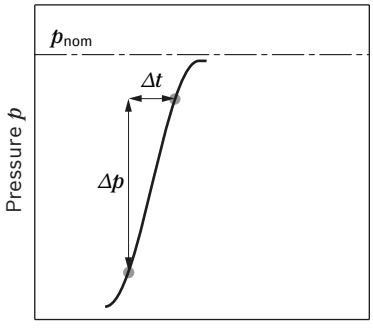
Examples of temperatures of hydraulic fluids at a viscosity of 10 $mm^2/s$ (cSt):

- 73 °C (163 °F) at HLP 32
- 85 °C (185 °F) at HLP 46

## Working pressure range

| **Pressure at port B** | | | **Definition** |
|---|---|---|---|
| Nominal pressure $p_{nom}$ | | 280 bar (4100 psi) | The nominal pressure corresponds to the maximum design pressure. |
| Maximum pressure $p_{max}$ | | 350 bar (5100 psi) | The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period. |
| Single operating period | | 2 ms | |
| Total operating period | | 300 h | |
| Minimum pressure $p_{B\ absolute}$ (high-pressure side) | | 10 bar (145 psi)[1] | Minimum pressure on the high-pressure side (**B**) required to prevent damage to the axial piston unit. |
| Rate of pressure change $R_{A\ max}$ | | 16000 bar/s (232060 psi/s) | Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range. |
| **Pressure at suction port S (inlet)** | | | |
| Minimum pressure $p_{S\ min}$ | NG 45 to 100 at 1800 rpm | 0.8 bar (12 psi) absolute | Minimum pressure at suction port **S** (inlet) which is required to prevent damage to the axial piston unit. The minimum pressure depends on the rotational speed and displacement of the axial piston unit. |
| | NG 140 to 180 at 1800 rpm | 1.0 bar (15 psi) absolute | |
| Maximum pressure $p_{S\ max}$ | | 10 bar (145 psi)[2] | |
| **Case pressure at port $L_1$, $L_2$** | | | |
| Maximum pressure $p_{L\ max}$ | | 2 bar (30 psi)[2] absolute | Maximum 0.5 bar (7.5 psi) higher than inlet pressure at port **S**, but not higher than $p_{L\ max}$. The case pressure must always be higher than the ambient pressure at the shaft seal.<br>A drain line to the reservoir is required. |
| **Pilot pressure port X with external high pressure** | | | |
| Maximum pressure $p_{max}$ | | 350 bar (5100 psi) | When designing all control lines with external high pressure, the values for the rate of pressure change, maximum single operating period and total operating period applicable to port **B** must not be exceeded. |

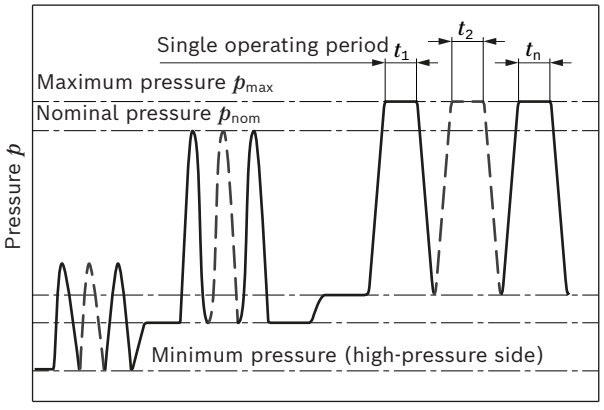
▼ **Rate of pressure change $R_{A\ max}$**




**Notice**

- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.

▼ **Pressure definition**




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

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

## Technical data

| Size | | NG | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|---|---|
| Geometric displacement, per revolution | | $V_{g\,max}$ | $cm^3$ | 45 | 71.1 | 100 | 140 | 180 |
| | | | $inch^3$ | 2.75 | 4.34 | 6.10 | 8.54 | 11 |
| Maximum rotational speed[1)2)] | at $V_{g\,max}$ | $n_{nom}$ | rpm | 3000 | 2550 | 2300[4)] | 2200 | 1800 |
| Flow | at $n_{nom}$ and $V_{g\,max}$ | $q_v$ | l/min | 135 | 181 | 230 | 308 | 324 |
| | | | gmp | 35.7 | 47.8 | 60.8 | 81.4 | 85.6 |
| Power | at $n_{nom}$, $V_{g\,max}$ and $\Delta p$ = 280 bar (4000 psi) | $P$ | kW | 63 | 85 | 107 | 144 | 151 |
| | | | HP | 84 | 113 | 143 | 193 | 202 |
| Torque | at $V_{g\,max}$ and $\Delta p$ = 280 bar | $M$ | Nm | 200 | 317 | 446 | 624 | 802 |
| | | | lb-ft | 148 | 234 | 328 | 460 | 592 |
| | at $V_{g\,max}$ and $\Delta p$ = 100 bar | $M$ | Nm | 72 | 113 | 159 | 223 | 286 |
| | | | lb-ft | 53 | 83 | 117 | 164 | 211 |
| Rotary stiffness of drive shaft | S | $c$ | Nm/rad | 37500 | 71884 | 121142 | 169537 | 227153 |
| | | | lb-ft/rad | 27659 | 53019 | 89350 | 125042 | 167539 |
| | R | $c$ | Nm/rad | 41025 | 76545 | – | – | – |
| | | | lb-ft/rad | 30258 | 56457 | – | – | – |
| | U | $c$ | Nm/rad | 30077 | 52779 | 91093 | On request | – |
| | | | lb-ft/rad | 22184 | 38928 | 67187 | | – |
| | W | $c$ | Nm/rad | 34463 | 57460 | 101847 | 165594 | – |
| | | | lb-ft/rad | 25419 | 42380 | 75118 | 122135 | – |
| Moment of inertia of the rotary group | | $J_{TW}$ | $kgm^2$ | 0.0035 | 0.0087 | 0.0167 | 0.0242 | 0.033 |
| | | | $lb\text{-}ft^2$ | 0.083 | 0.2065 | 0.3968 | 0.5743 | 0.7831 |
| Maximum angular acceleration[3)] | | $\alpha$ | $rad/s^2$ | 4000 | 2900 | 2400 | 2000 | 2000 |
| Case volume | | $V$ | l | 1.0 | 1.6 | 2.2 | 3.0 | 2.7 |
| | | | gal | 0.264 | 0.420 | 0.580 | 0.79 | 0.71 |
| Weight (**with** port plate 11(61)N00 and 12(62)N00 **without** through drive) approx. | | $m$ | kg | 25.8 | 40.4 | 56.4 | 70.5 | 75.2 |
| | | | | 57 | 89 | 124 | 155 | 166 |
| Weight (**with** port plate 12(62) **with** through drive Kxx) approx. | | $m$ | kg | 27.4 | 43.3 | 62.6 | 79.5 | – |
| | | | | 60 | 95 | 138 | 175 | – |
| Weight (**with** port plate 22/72Uxx/32/82Uxx) approx. | | $m$ | kg | 32.6 | 51.8 | 76 | 90.2 | 89.4 |
| | | | lbs | 72 | 114 | 168 | 199 | 197 |

**Notice**

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

1) The values are applicable:
– at absolute pressure $p_{abs}$ = 1.0 bar (15 psi) at suction port **S**
– for the optimum viscosity range from $v_{opt}$ = 36 to 16 $mm^2/s$ (cSt)
– with hydraulic fluid based on mineral oils

2) Higher rotational speeds on request.

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

4) Maximum rotational speed 2150 rpm for version with port plate 32/82.

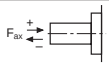
| **Determination of the characteristics** | | | |
|---|---|---|---|
| Flow | $q_v = \frac{V_g \times n \times \eta_v}{1000}$ | | [l/min] |
| | $q_v = \frac{V_g \times n \times \eta_v}{231}$ | | [gpm] |
| Torque | $M = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$ | | [Nm] |
| | $M = \frac{V_g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

Key

| | | |
|---|---|---|
| $V_g$ | = | Displacement per revolution [$cm^3$ ($in^3$)] |
| $\Delta p$ | = | Differential pressure [bar (psi)] |
| $n$ | = | Rotational speed [rpm] |
| $\eta_v$ | = | Volumetric efficiency |
| $\eta_{hm}$ | = | Hydraulic-mechanical efficiency |
| $\eta_t$ | = | Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$) |

**Pre compression volume for pulsation reduction (PCV)**
The PCV reduces the pressure pulsation applied to the system by the pump. The peak-to-peak pulsation [bar (psi)] is reduced by approximately 30 to 50% depending on the operating point.
Depending on the mechanical design of the working machine, in our experience machine noise is reduced quite significantly.
The pre compression volume is standard on the connection plate 32/82 in the scope of delivery.

### Permissible radial and axial loading of the drive shaft

| Size | | NG | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|---|---|
| Maximum radial force at a/2 |  | $F_{q\ max}$ | N | 1500 | 1900 | 2300 | 2800 | 2300 |
| | | | lb | 337 | 427 | 517 | 629 | 517 |
| Maximum axial force |  | $\pm F_{ax\ max}$ | N | 1500 | 2400 | 4000 | 4800 | 800 |
| | | | lb | 337 | 540) | 900 | 1080 | 180 |

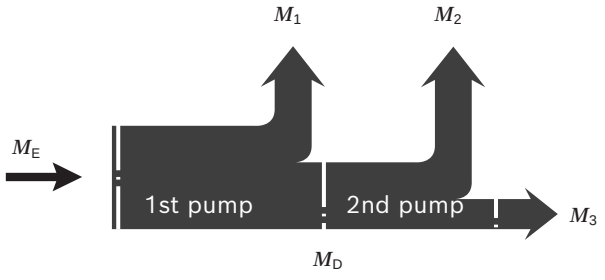
**Notice**

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

### Permissible input and through-drive torques

| Size | | | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|---|---|
| Torque at $V_{g\,max}$ and | | $M_{max}$ | Nm | 200 | 317 | 446 | 624 | 802 |
| $\Delta p$ = 280 bar (4100 psi)[1] | | | lb-ft | 148 | 234 | 328 | 460 | 592 |
| Maximum input torque on drive shaft[2] | | | | | | | | |
| | S | $M_{E\ max}$ | Nm | 319 | 626 | 1104 | 1620 | 1834 |
| | | | lb-ft | 235 | 462 | 814 | 1195 | 1353 |
| | | Ø | inch | 1 | 1 1/4 | 1 1/2 | 1 3/4 | 1 3/4 |
| | R | $M_{E\ max}$ | Nm | 400 | 644 | – | – | – |
| | | | lb-ft | 295 | 475 | – | – | – |
| | | Ø | inch | 1 | 1 1/4 | – | – | – |
| | U | $M_{E\ max}$ | Nm | 188 | 300 | 595 | on | – |
| | | | lb-ft | 139 | 221 | 439 | Request | – |
| | | Ø | inch | 7/8 | 1 | 1 1/4 | 1 1/2 | – |
| | W | $M_{E\ max}$ | Nm | – | 394 | 636 | 1220 | 1488 |
| | | | lb-ft | – | 291 | 469 | 900 | 1097 |
| | | Ø | inch | – | 1 | 1 1/4 | 1 1/2 | 1 1/2 |
| Maximum through-drive torque | | | | | | | | |
| | S | $M_{D\ max}$ | Nm | 319 | 492 | 778 | 1266 | 1266 |
| | | | lb-ft | 235 | 363 | 574 | 934 | 934 |
| | R | $M_{D\ max}$ | Nm | 365 | 548 | – | – | – |
| | | | lb-ft | 269 | 404 | – | – | – |
| | U | $M_{D\ max}$ | Nm | 188 | 300 | 595 | on | – |
| | | | lb-ft | 139 | 221 | 439 | Request | – |
| | W | $M_{D\ max}$ | Nm | – | – | 636 | 1220 | 1266 |
| | | | lb-ft | – | – | 469 | 900 | 934 |

▼ **Distribution of torques**




| | | | |
|---|---|---|---|
| Torque at 1st pump | $M_1$ | | |
| Torque at 2nd pump | $M_2$ | | |
| Torque at 3rd pump | $M_3$ | | |
| Input torque | $M_E$ | = | $M_1 + M_2 + M_3$ |
| | $M_E$ | < | $M_{E\ max}$ |
| Through-drive torque | $M_D$ | = | $M_2 + M_3$ |
| | $M_D$ | < | $M_{D\ max}$ |

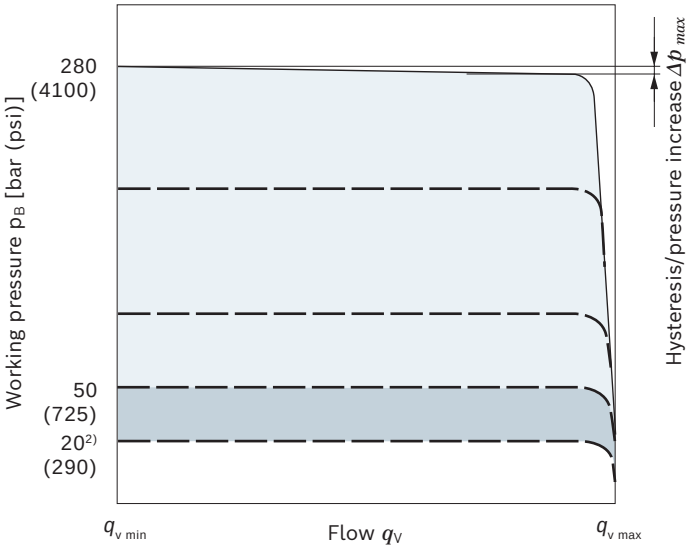
1) Efficiency not considered
2) For drive shafts with no radial force

## DR – Pressure controller

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

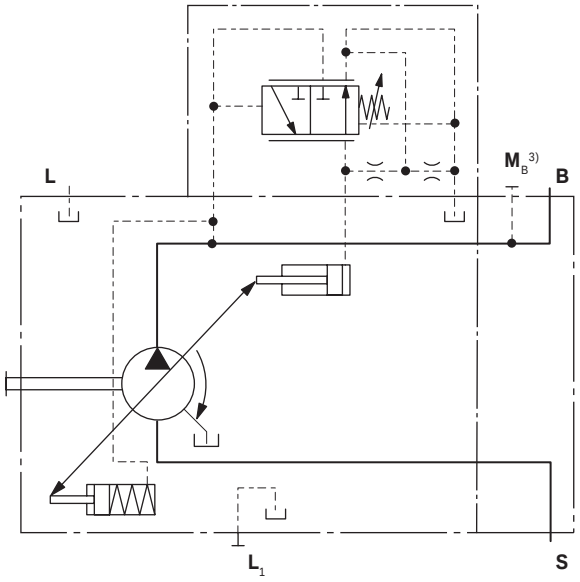
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] for infinitely variable 50 to 280 bar pressure control (725 to 4100 psi).
  Standard is 280 bar (4100 psi).

▼ **Characteristic curve DR**




Characteristic curve valid at $n_1$ = 1500 rpm and $\vartheta_{fluid}$ = 50 °C (122 °F).

▼ **Circuit diagram DR**




### Controller data

| Size | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|
| Pressure increase | $\Delta p$ [bar] | 6 | 8 | 10 | 12 | 14 |
| | [psi] | 90 | 115 | 145 | 175 | 200 |
| Hysteresis | $\Delta p$ [bar] | maximum 4 | | | | |
| | [psi] | maximum 60 | | | | |
| Pilot fluid consumption | [l/min] | maximum approx. 3 | | | | |
| | [gpm] | maximum approx. 0.8 | | | | |

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

2) For settings below 50 bar (725 psi), please use the SO275 special pressure controller (setting range: 20 ti 100 bar (290 to 1450 psi)).

3) Only for port plate 22/72 and 32/82

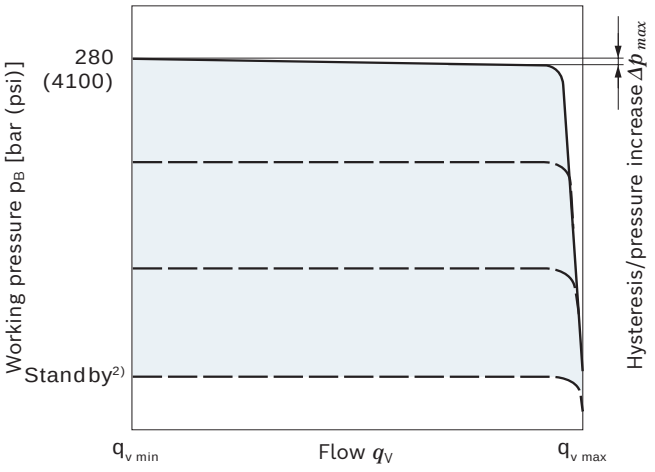
## DRG – Pressure controller, remote controlled

For the remote controlled pressure controller, the pressure limitation is performed using a separately arranged pressure relief valve. Therefore, any pressure control value under the pressure set on the pressure controller can be regulated. Pressure controller DR see page 11.
A pressure relief valve is externally piped up to port **X** for remote control. This relief valve is not included in the scope of delivery of the DRG control.
When there is differential pressure of 20 bar (290 psi) $\Delta p$ (standard setting), the control fluid quantity at port **X** is approx. 1.5 l/min (0.4 gpm). If another setting is required (range from 14 to 22 bar (200 to 320 psi)) please state in plain text.
As a separate pressure relief valve (**1**) we recommend:

- A direct operated, hydraulic or electric proportional one, suitable for the control fluid quantity mentioned above.
  The maximum line length should not exceed 2 m (6.5 ft).
- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] for pressure control 50 to 280 bar (725 to 4100 psi) (**3**).
  Standard is 280 bar (4100 psi).
- Setting range for differential pressure 14 to 22 bar (200 to 320 psi) (**2**), standard is 20 bar (290 psi).

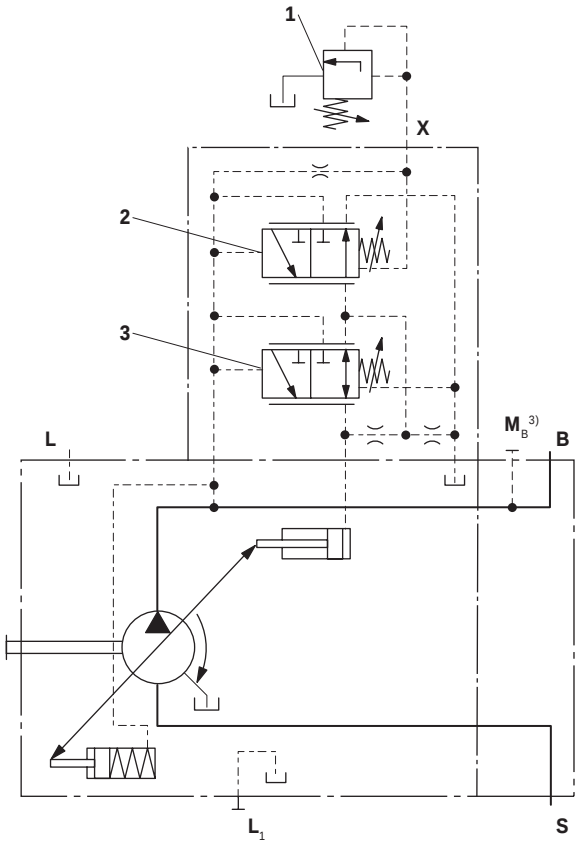
Unloading port **X** to the reservoir results in a zero stroke pressure (standby) which is approx. 1 to 2 bar (15 to 30 psi) higher than the defined differential pressure $\Delta p$, however system influences are not taken into account.

▼ **Characteristic curve DRG**




Characteristic curve valid at $n_1$ = 1500 rpm and $\vartheta_{fluid}$ = 50 °C (122 °F).

▼ **Circuit diagram DRG**




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

**Controller data**

| Size | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|
| Pressure increase maximum | $\Delta p$ [bar] | 6 | 8 | 10 | 12 | 14 |
| | $\Delta p$ [psi] | 90 | 115 | 145 | 175 | 500 |
| Hysteresis | $\Delta p$ [bar] | maximum 4 | | | | |
| | $\Delta p$ [psi] | maximum 60 | | | | |
| Pilot fluid consumption | [l/min] | maximum approx. 4.5 | | | | |
| | [gpm] | maximum approx. 1.19 | | | | |

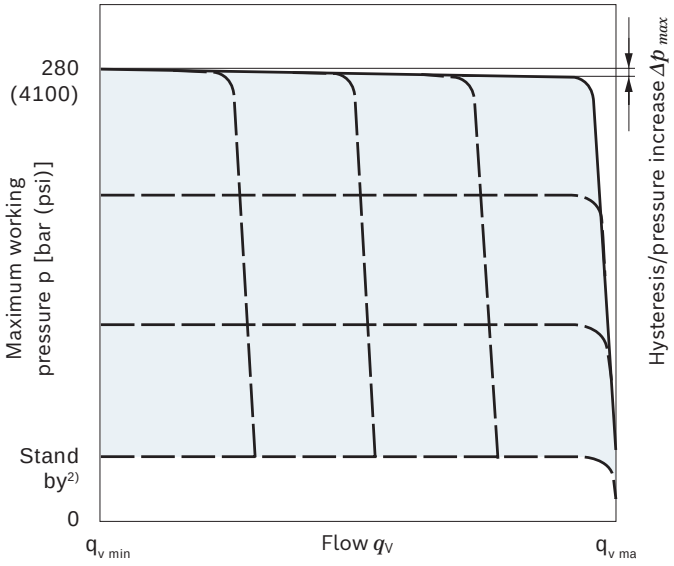
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting $\Delta p$ on controller (**2**)
3) Only for port plate 22/72 and 32/82

## DRF/DRS/DRSC – Pressure flow controller

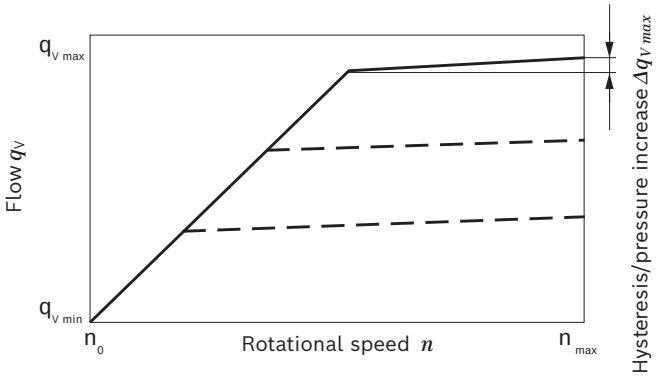
In addition to the pressure controller function (see page 11), an adjustable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer. With all controller combinations, the $V_g$ reduction has priority.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range[1] to 280 bar (4100 psi)
  Standard is 280 bar (4100 psi)
- DR pressure controller data see page 11

▼ **Characteristic curve DRF/DRS/DRSC**

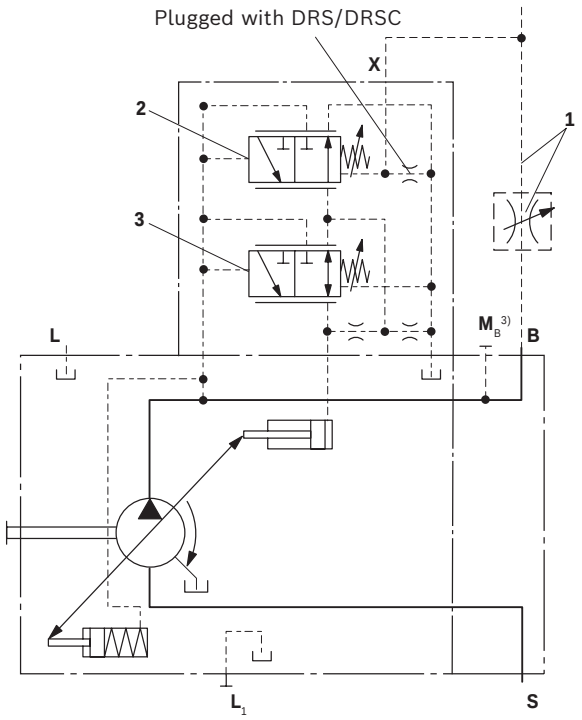



▼ **Characteristic curve at variable rotational speed**




Characteristic curves valid at $n_1$ = 1500 rpm and $\vartheta_{fluid}$ = 50 °C (122 °F).

▼ **Circuit diagram DRF**




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

**Notice**
The DRS and DRSC versions have no unloading from **X** to the reservoir.
The LS must thus be unloaded in the system.
Because of the flushing function of the flow controller in the DRS control valve, sufficient unloading of the **X**-line must also be ensured.
If this unloading of the **X**-line cannot be ensured, the DRF control valve must be used.

For further information see page 14

1) To prevent damage to the pump and the system, the permissible setting range must not be exceeded. The range of possible settings at the valve is higher.
2) Zero stroke pressure from pressure setting $\Delta p$ on controller (**2**)
3) Only for port plate 22/72 and 32/82

**Differential pressure Δp**

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

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

**Controller data**

DR pressure controller data, see page 11.
Maximum flow deviation measured at drive speed n = 1500 rpm.

| NG | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|
| Pressure increase maximum | $\Delta p$ [bar] | 6 | 8 | 10 | 12 | 14 |
| | $\Delta p$ [psi] | 90 | 115 | 145 | 175 | 200 |
| Flow deviation | $\Delta q_{V\,max}$ [l/min] | 1.8 | 2.8 | 4.0 | 6.0 | 8.0 |
| | $\Delta q_{V\,max}$ [gpm] | 0.48 | 0.74 | 1.06 | 1.59 | 2.11 |
| Hysteresis | $\Delta p$ [bar] | maximum 4 | | | | |
| | $\Delta p$ [psi] | maximum 60 | | | | |
| Pilot fluid consumption | [l/min] | maximum approx. 3 to 4.5 (DRF)<br>maximum approx. 3 (DRSC) | | | | |
| | [gpm] | maximum approx. 0.8 to 1.2 (DRF)<br>maximum approx. 0.8 (DRSC) | | | | |

## LA... – Pressure, flow and power controller

Pressure controller equipped as DR(G),
see page 11 (12).
Equipment of the flow controller like DRS, see page 13.
To achieve a constant drive torque with varying working pressures, the swivel angle and also 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 at the factory in plain text, e.g. 20 kW (27 HP) at 1500 rpm.

**Controller data**

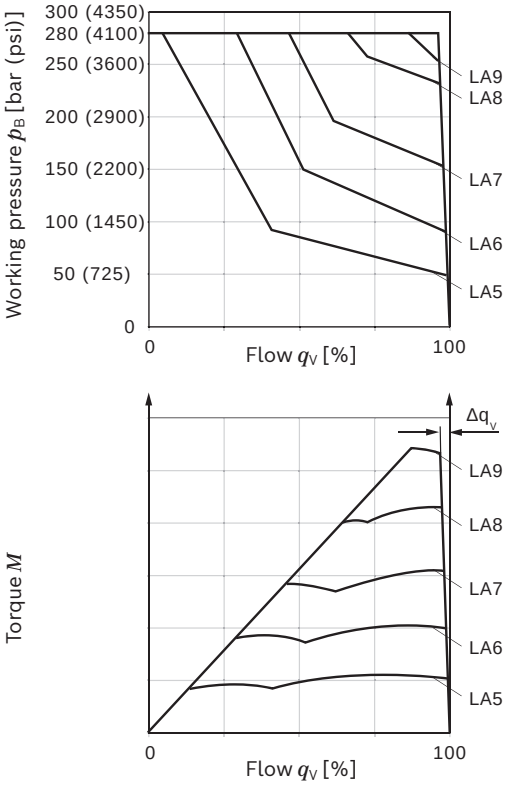
- For technical data of pressure controller DR, see page 11.
- For technical data of flow controller FR, see page 13.
- Pilot fluid consumption max. approx. 5.5 l/min (1.4 gpm).

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

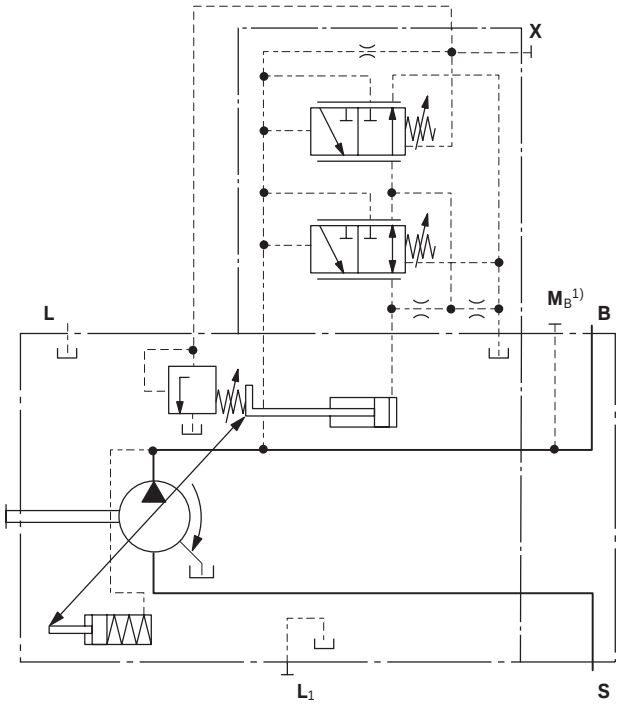
Conversion of the torque values in power [kW (HP)]

$P = \frac{M}{6.4\ (3.5)}$ [kW (HP)] (at 1500 rpm) or $P = \frac{2\pi \times M \times n}{60000\ (33000)}$ [kW (HP)] (For rotational speeds see table on page 8)

▼ **Characteristic curve LA.**



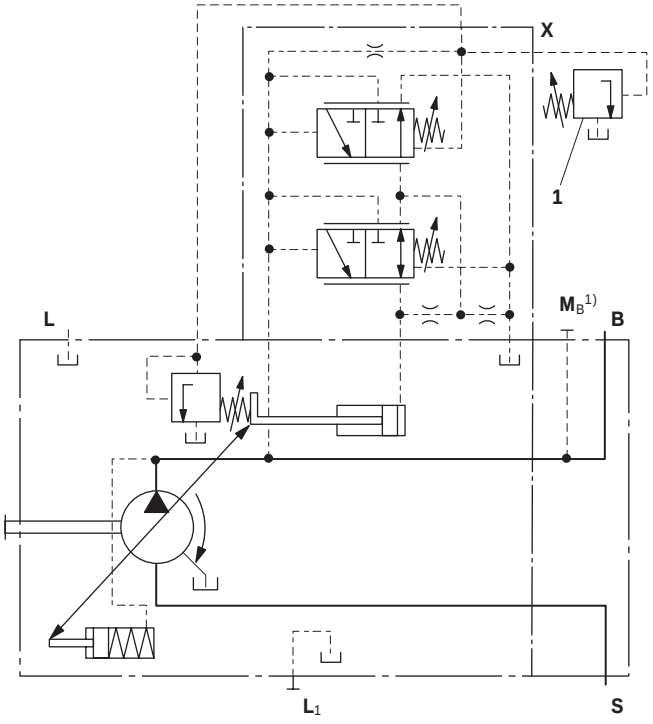

▼ **Circuit diagram LA.D** with pressure cut-off
(for further combination options with LA.. see page 16)



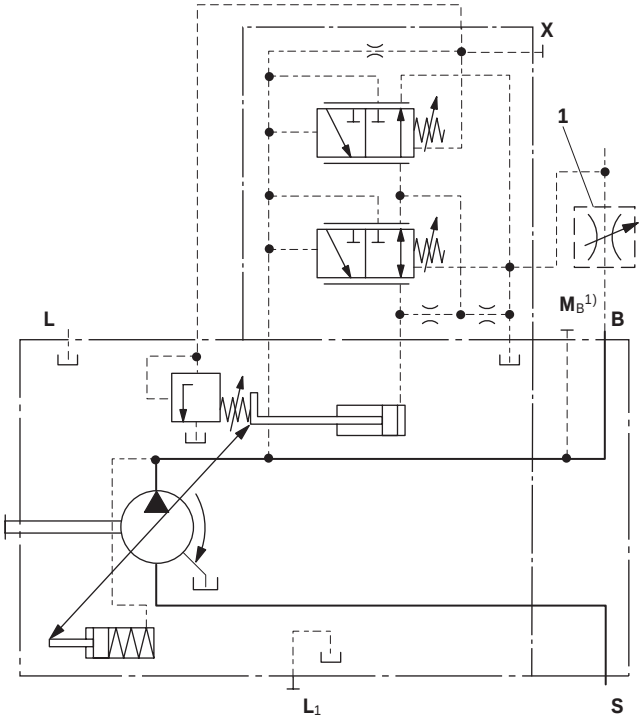

1) Only for port plate 22/72 and 32/82

## LA... – Variations

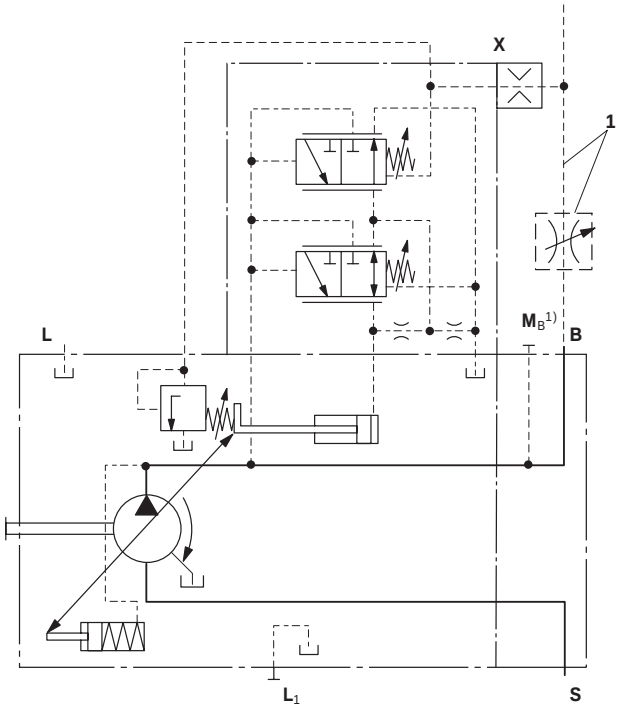
▼ **Circuit diagram LA.DG** with pressure cut-off, remote controlled




▼ **Circuit diagram LA.S** with separate flow control




▼ **Circuit diagram LA.DS**



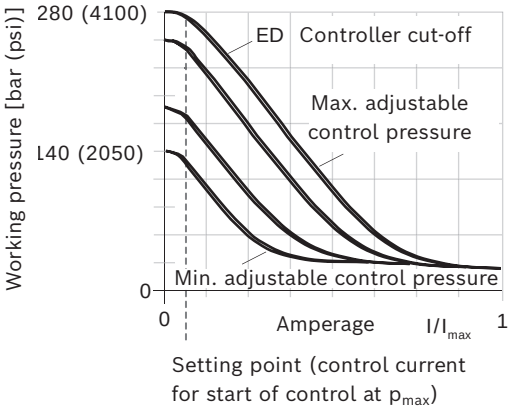

**1** The metering orifice and the pressure relief valve and line are not included in the scope of delivery.

1) Only for port plate 22/72 and 32/82

## ED – Electrohydraulic pressure control

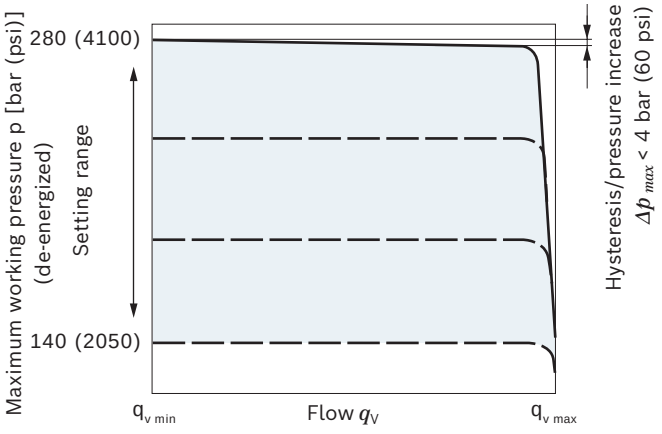
The ED valve is set to a certain pressure by a specified variable solenoid current.
When changing the consumer (load pressure), this causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level. The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level is infinitely adjustable 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 power failure, e.g. for fan speed control). The swivel time characteristic of the ED control was optimized for use as a fan drive system. When ordering, specify the type of application in plain text.

▼ **Current/pressure characteristic curve ED**
(negative characteristic curve)




Hysteresis static <25 bar (365 psi).

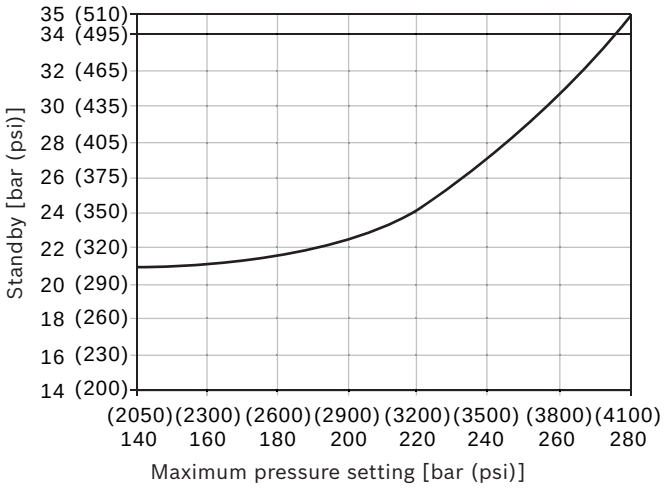
▼ **Flow-pressure characteristic curve**



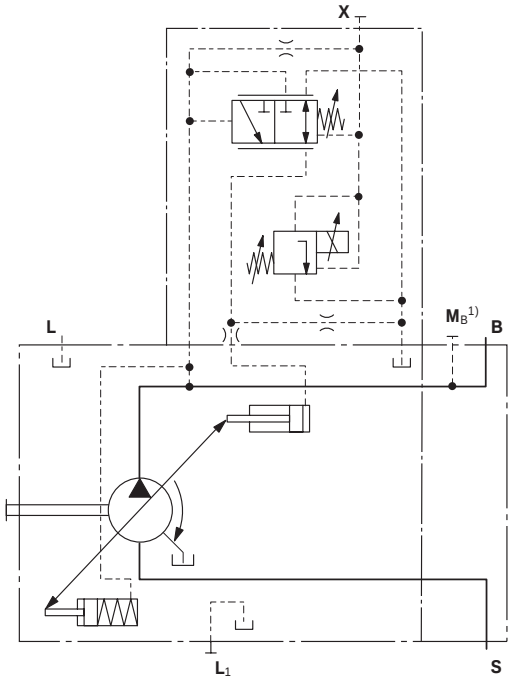

Characteristic curves valid at $n_1$ = 1500 rpm and $\vartheta_{fluid}$ = 50 °C (122 °F).

- Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- For standby standard setting, see the following diagram; other values on request.

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




▼ **Circuit diagram ED71/ED72**




1) Only for port plate 22/72 and 32/82

| Technical data, solenoids | ED71 | ED72 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Control current | | |
| Start of control at $p_{max}$ | 100 mA | 50 mA |
| End of control at $p_{min}$ | 1200 mA | 600 mA |
| Current limit | 1.54 A | 0.77 A |
| Nominal resistance (at 20 °C (68 °F)) | 5.5 Ω | 22.7 Ω |
| Dither frequency | 100 Hz | 100 Hz |
| Recommended amplitude | 120 mA | 60 mA |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 71 | | |
| Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F) | | |

The following electronic control units are available for controlling the electrohydraulic pressure control:

| BODAS Controllers | Data sheet |
|---|---|
| RC5-6, series 40 | 95207 |
| RC18-12, series 40 | 95208 |
| RC27-18, series 40 | 95208 |

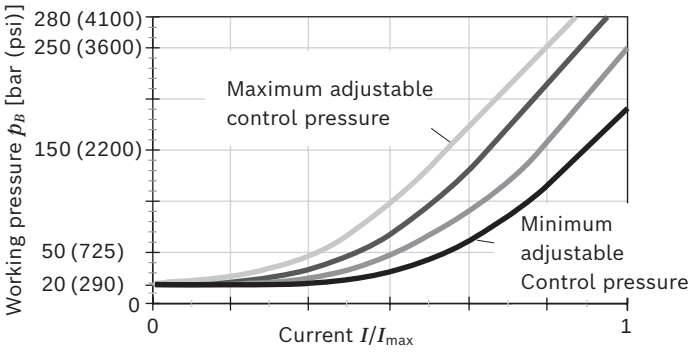
**Notice**
With **ED71**, de-energized operating condition (jump from 100 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).
With **ED72**, de-energized operating condition (jump from 50 to 0 mA) results in a pressure increase of the maximum pressure of 4 to 5 bar (60 to 75 psi).

For circuit diagram and more characteristic curves see page 17

## ER – Electrohydraulic pressure control

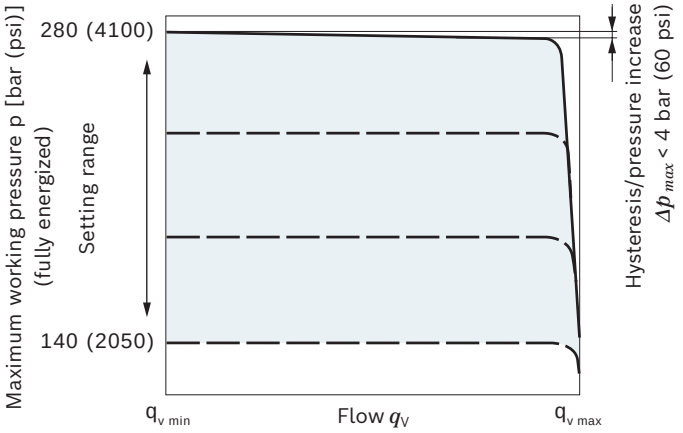
The ER valve is set to a certain pressure by a specified variable solenoid current.
When a change is made at the consumer (load pressure), the position of the control piston will shift.
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.
The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level is infinitely adjustable by varying the solenoid current. If the solenoid current goes to zero, the pressure is limited to $p_{min}$ (standby) by the adjustable, hydraulic pressure cut-off.
Observe project planning note.

▼ **Current/pressure characteristic curve ED**
(positive characteristic curve)




Hysteresis static <25 bar (365 psi).

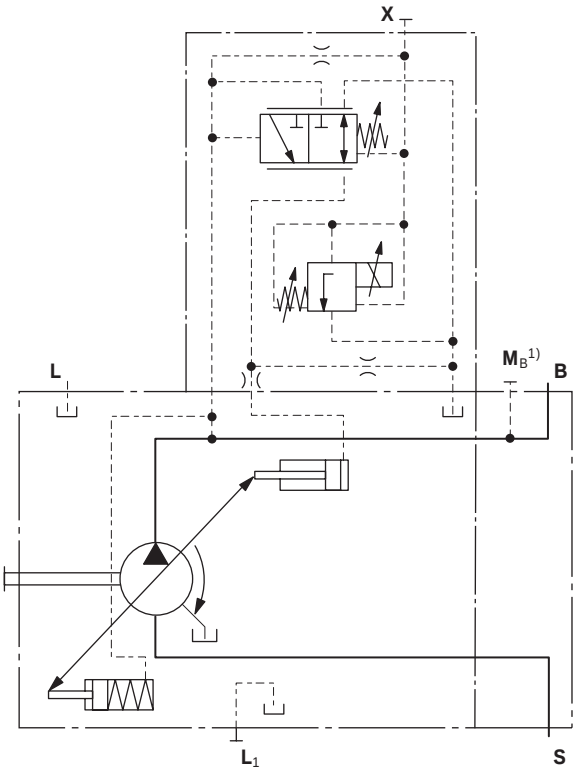
▼ **Flow-pressure characteristic curve**




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

- Pilot fluid consumption: 3 to 4.5 l/min (0.8 to 1.2 gpm).
- Standby standard setting 20 bar (290 psi). Other values on request.
- Influence of pressure setting on standby ± 2 bar (± 30 psi).

▼ **Circuit diagram ER71/ER72**




| Technical data, solenoids | ER71 | ER72 |
|---|---|---|
| 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 |
| Current limit | 1.54 A | 0.77 A |
| Nominal resistance (at 20 °C (68 °F)) | 5.5 Ω | 22.7 Ω |
| Dither frequency | 100 Hz | 100 Hz |
| Recommended amplitude | 120 mA | 60 mA |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 71 | | |
| Operating temperature range at valve -20 °C to +115 °C (-4 °F to +239 °F) | | |

1) Only for port plate 22/72 and 32/82

The following electronic control units are available for controlling the electrohydraulic pressure control:

| BODAS controllers | Data sheet |
|---|---|
| RC5-6, series 40 | 95207 |
| RC18-12, series 40 | 95208 |
| RC27-18, series 40 | 95208 |

**Project planning note!**
Excessive current levels (I > 1200 mA at 12 V or I > 600 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.

## **EC4 – Electrohydraulic control valve** (positive control)

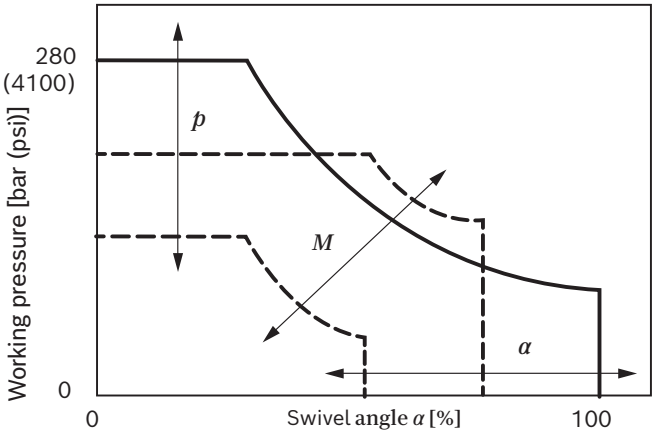
The proportional directional valve EC4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.
The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.
This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.
The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.
If the solenoid current is above the neutral current ($I_{neutral}$), the pump swivels in the direction of $V_{g\,max}$/100%; if it is below, the pump swivels in the direction of $V_{g\,min}$/0%.
A BODAS eOC control system is required to control the pump. The required system components are listed in data sheet 95345 and must be ordered separately.
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically closed-loop control circuits:

- Pressure and differential pressure regulation ($p$)
- Swivel angle and flow control ($\alpha$)
- Torque control ($M$)
- Power control

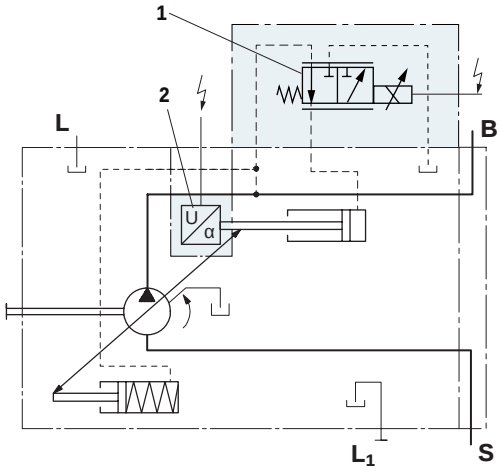
A PAL2/20 swivel angle sensor is also required in order to control the pump with BODAS eOC. It must be specified in type code position 13. For more information on the PAL2/20 swivel angle sensor, see page 72 and data sheet 95161.

▶

▼ **Control variants with EC4**
Representation for positive quadrants 0% to +100%




▼ **Circuit diagram EC4**



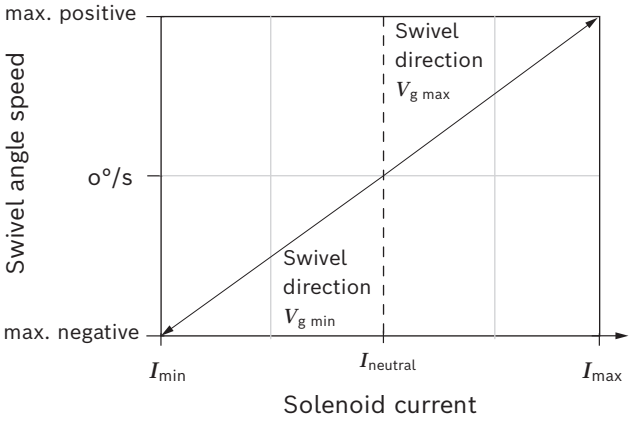

**1** Proportional directional valve EC4
**2** Swivel angle sensor (see data sheet 95161)

For further technical data on the solenoid with respective information, see pages 22 and 71.

The following electronic control units are available for control:

| BODAS Controllers RC series | Data sheet |
|---|---|
| 30 | 95205 |
| 40 | 95207 and 95208 |

▼ **Operating principle EC4**




1) Representation for positive quadrants 0% to +100%

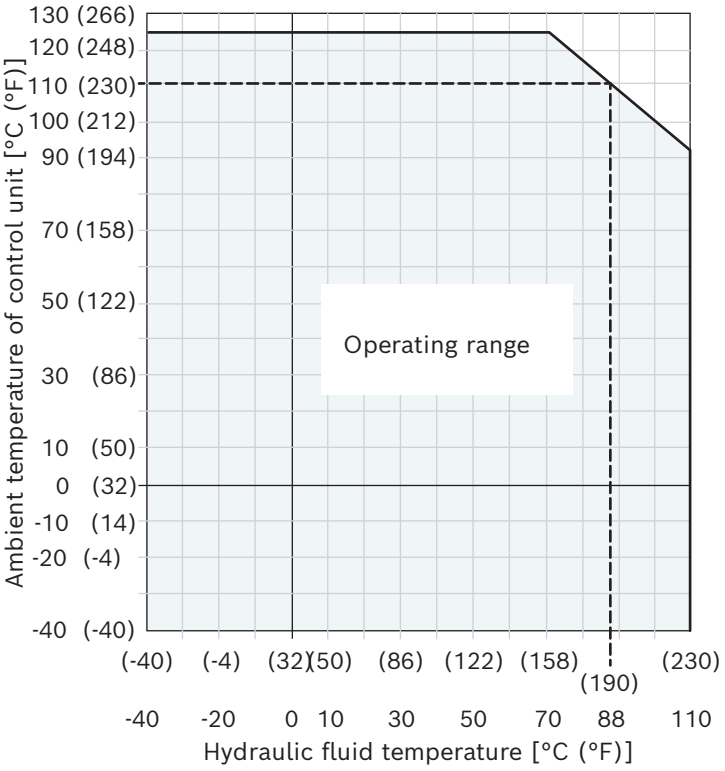
### Solenoid technical data

| | EC4 |
|---|---|
| Permissible maximum solenoid current. The current supply time with $I_{max}$ depends on the mean current value ($I_{permissible\ average}$ 1355 mA) | $I_{max}$ < 1900 mA |
| Permissible average solenoid current over a maximum interval width of 5 s | $I_{Medium\ Perm}$ < 1355 mA |
| Nominal resistance at 20 °C (68 °F) winding temperature | 4.26 Ω |
| Hot resistance 180 °C (356 °F) winding temperature | 6.92 Ω |
| Limit temperature for winding | insulating material class H (180 °C (356 °F)) |
| Hydraulic fluid or operating temperature | from -40 °C to 110 °C (-40 °F to 230 °F) |
| Type of protection and control electronics, see page 71 | |

**Notice**

- The coil has a limit voltage of 36 VDC. In general, the maximum current must not be exceeded by the actual current.
- For calculation of the hot resistance, a temperature coefficient of 0.0039k$^{-1}$ is to be applied.
- A variable dither is necessary. The frequency and amplitude must be adapted to the specific system.

▼ **Characteristic curve of permitted operating range**
**Example:** At a hydraulic fluid temperature of 88 °C (190 °F), an ambient temperature of 110 °C (230 °F) is permitted.



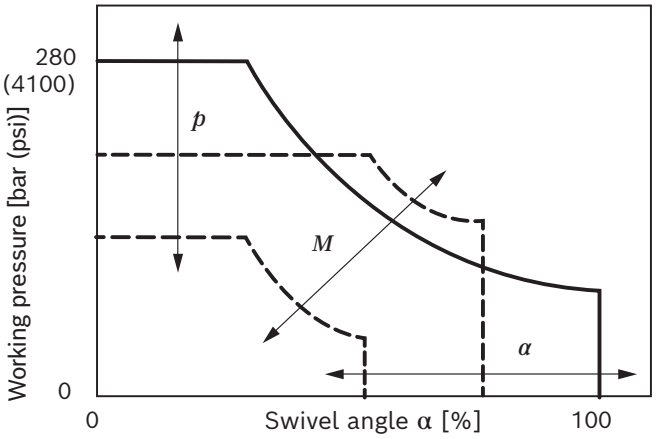
## **EB4 – Electrohydraulic control valve** (negative control)

The proportional directional valve EB4 serves to control an axial piston variable pump with eOC control functions in an electronically closed-loop control circuit.
The valve spool is clamped between a proportional solenoid and a spring and releases an opening cross-section depending on the stroke.
This results in a proportionality of the solenoid current with respect to the opening cross-section and thus the swiveling speed of the pump.
The neutral position, which does not lead to a swivel motion, is assigned to a corresponding neutral current.
If the solenoid current is below the neutral current ($I_{neutral}$), the pump swivels in the direction of $V_{g\,max}$/100%; if it is above, the pump swivels in the direction of $V_{g\,min}$/0%.
A BODAS eOC control system is required to control the pump. The required system components are listed in data sheet 95345 and must be ordered separately.
The BODAS eOC control software supports all four basic control types of axial piston variable pumps in electrically closed-loop control circuits:

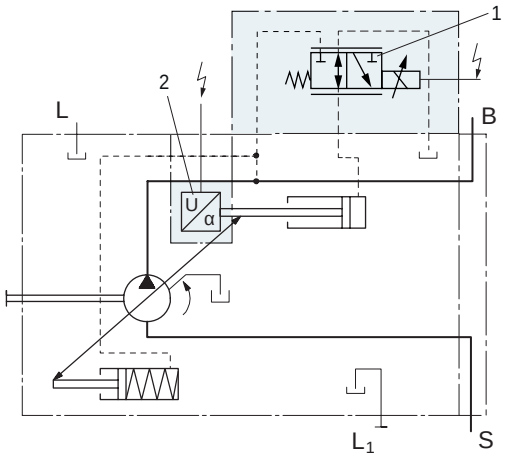
- Pressure and differential pressure regulation ($p$)
- Swivel angle and flow control ($\alpha$)
- Torque control ($M$)
- Power control

A PAL2/20 swivel angle sensor is also required in order to control the pump with BODAS eOC. It must be specified in type code position 13. For more information on the PAL2/20 swivel angle sensor, see page 72 and data sheet 95161.

▼ **Control variants with EB4**
Representation for positive quadrants 0% to +100%




▼ **Circuit diagram EB4**



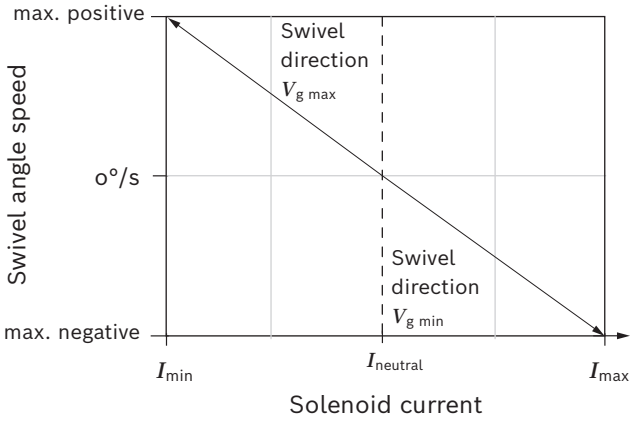

**1** Proportional directional valve EB4
**2** Swivel angle sensor (see data sheet 95161)

For further technical data on the solenoid with respective information, see pages 24 and 71.

The following electronic control units are available for control:

| BODAS Controllers RC series | Data sheet |
|---|---|
| 30 | 95205 |
| 40 | 95207 and 95208 |

▼ **Operating principle EB4**



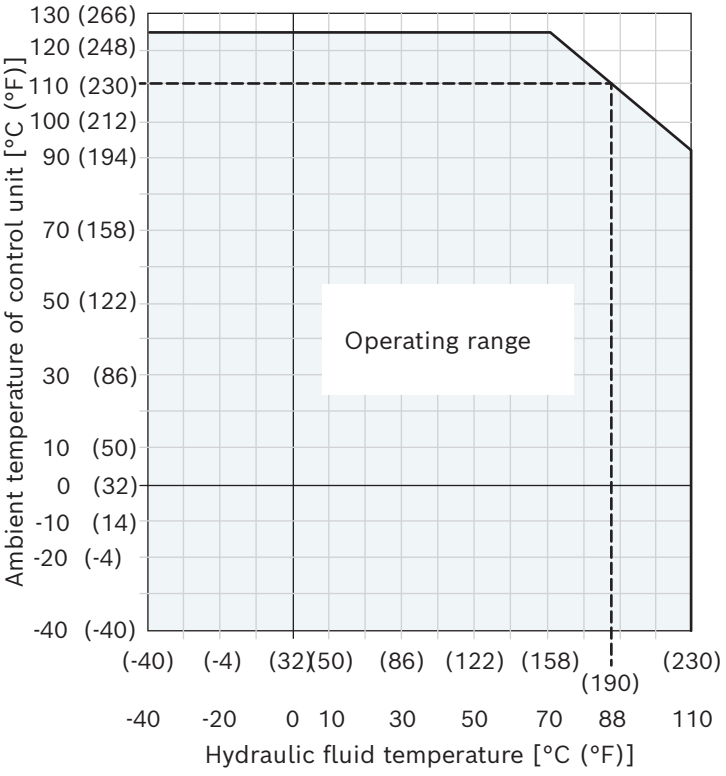
### Solenoid technical data

| | EB4 |
|---|---|
| Permissible maximum solenoid current. The current supply time with $I_{max}$ depends on the mean current value ($I_{permissible\ average}$ 1355 mA) | $I_{max}$ < 4000 mA |
| Permissible average solenoid current over a maximum interval width of 5 s | $I_{Medium\ Perm}$ < 1355 mA |
| Nominal resistance at 20 °C (68 °F) winding temperature | 4.26 Ω |
| Hot resistance at 180°C (356°F) winding temperature | 6.92 Ω |
| Limit temperature for winding | insulating material class H (180 °C (356 °F)) |
| Hydraulic fluid or operating temperature | from -40 °C to 110 °C (-40 °F to 230 °F) |
| Type of protection, see page 71 | |

**Notice**

- The coil has a limit voltage of 36 VDC. In general, the maximum current must not be exceeded by the actual current.
- For calculation of the hot resistance, a temperature coefficient of 0.0039k$^{-1}$ is to be applied.
- A variable dither is necessary. The frequency and amplitude must be adapted to the specific system.

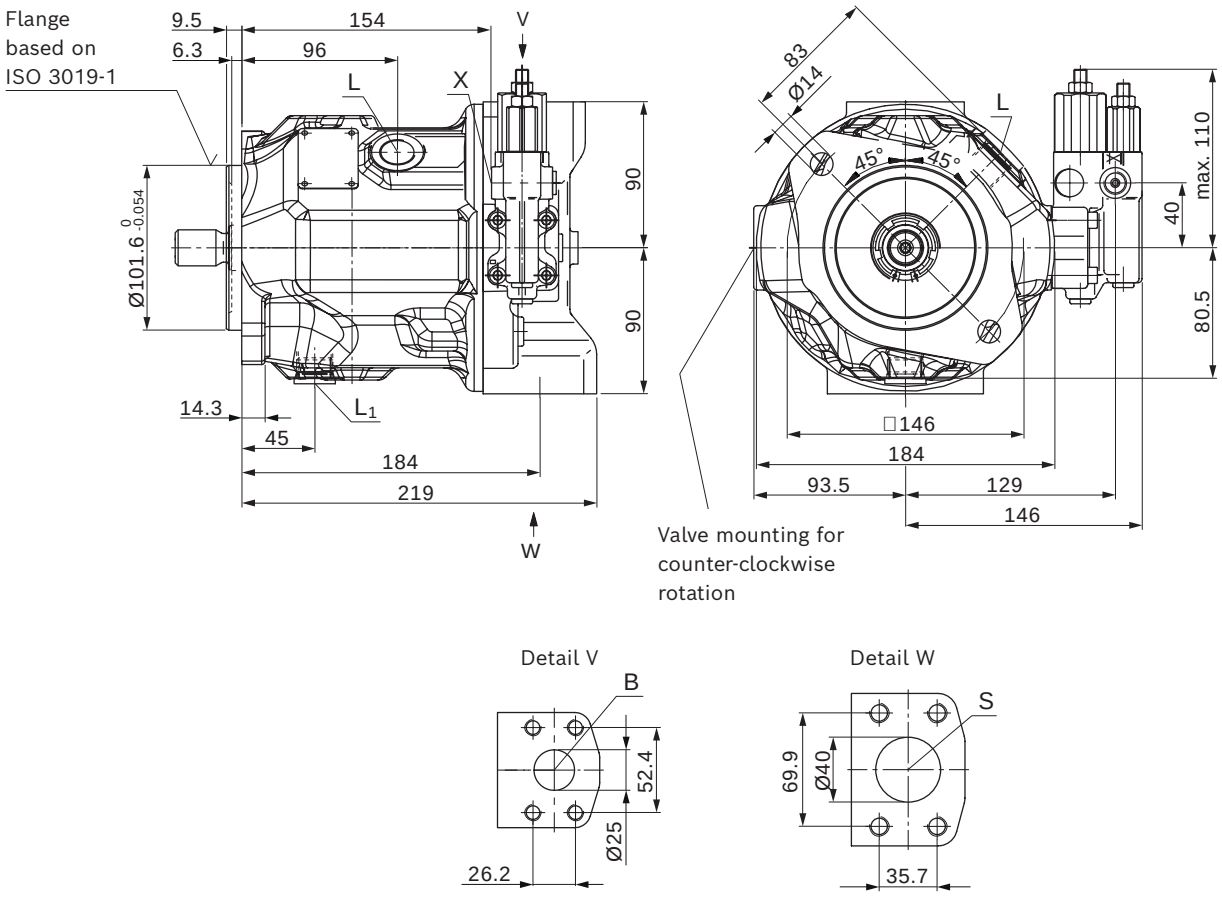
▼ **Characteristic curve of permitted operating range**
**Example:** At a hydraulic fluid temperature of 88 °C (190 °F), an ambient temperature of 110 °C (230 °F) is permitted.



## Dimensions, size 45

### DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-B; 101-2)

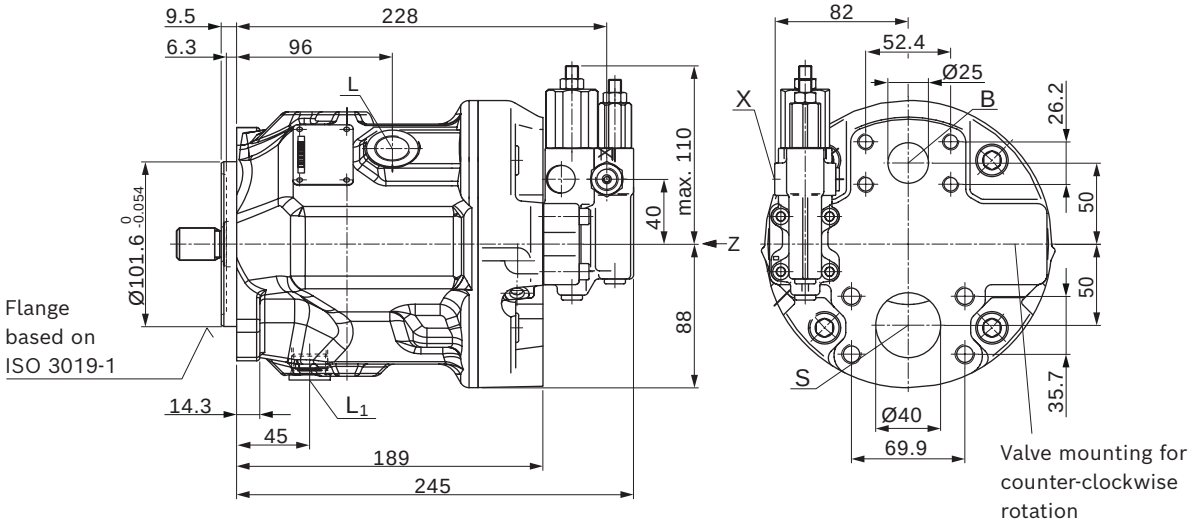
▼ **Port plate 12**





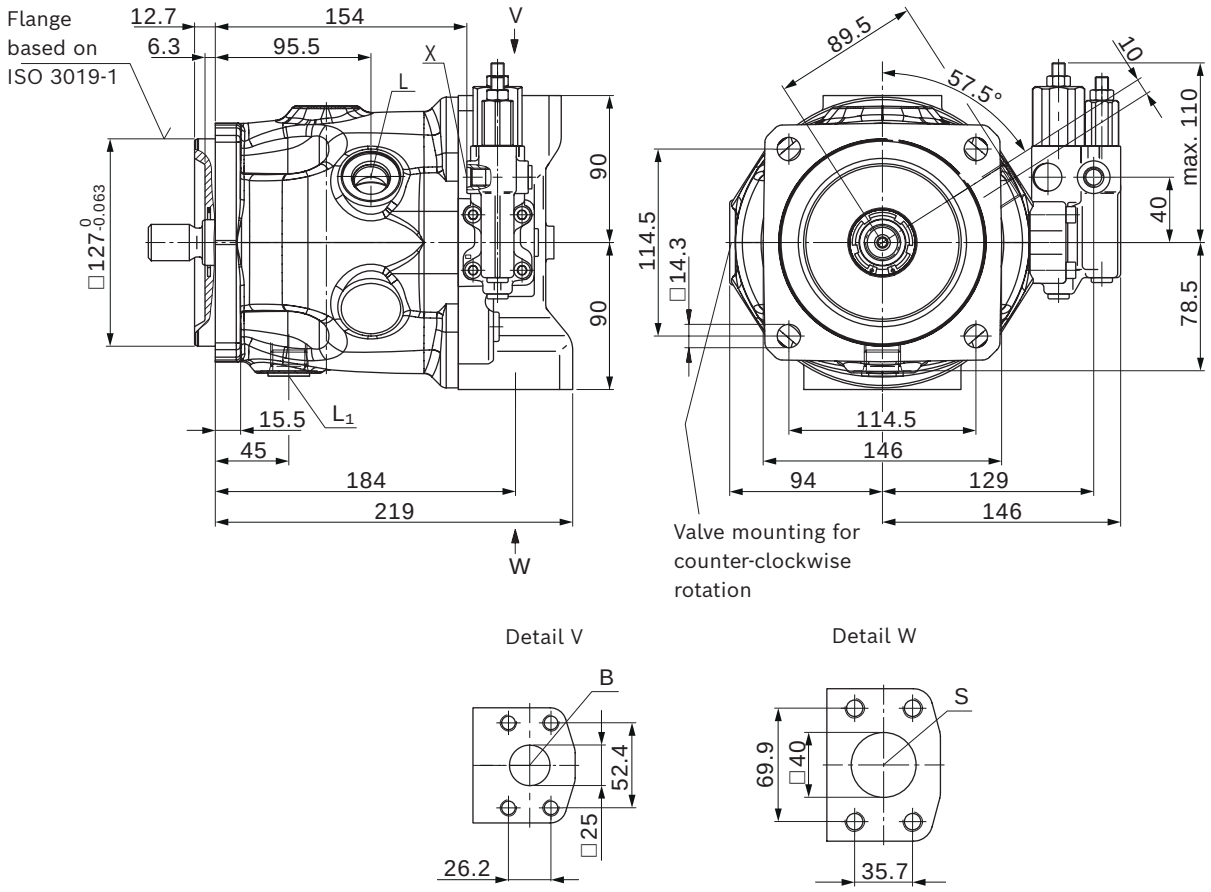


▼ **Port plate 11**



## DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange D (SAE-C; 127-4)

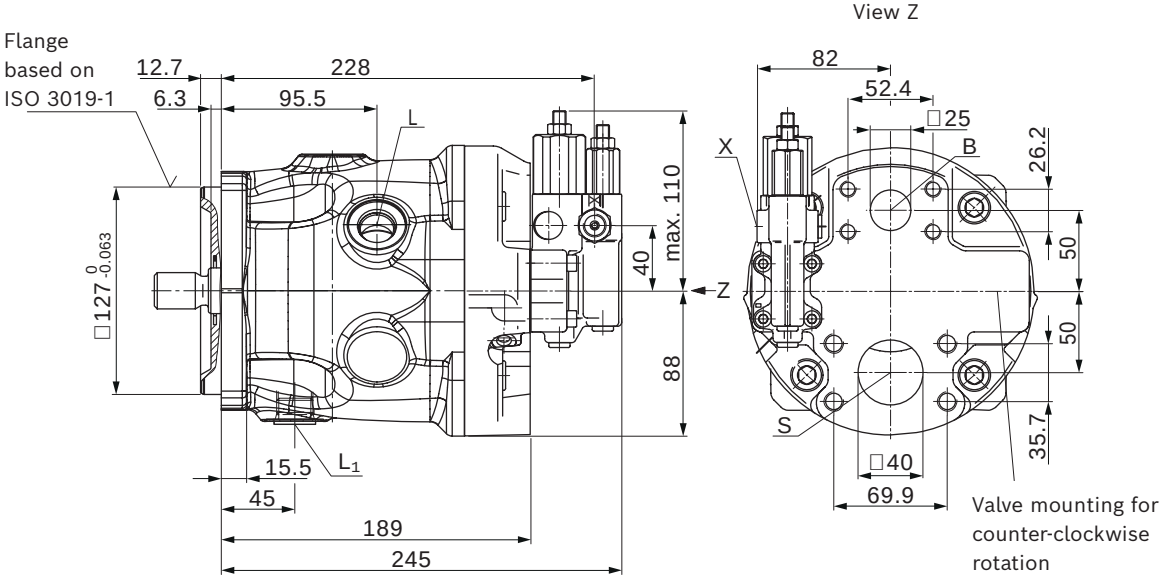
▼ **Port plate 12**





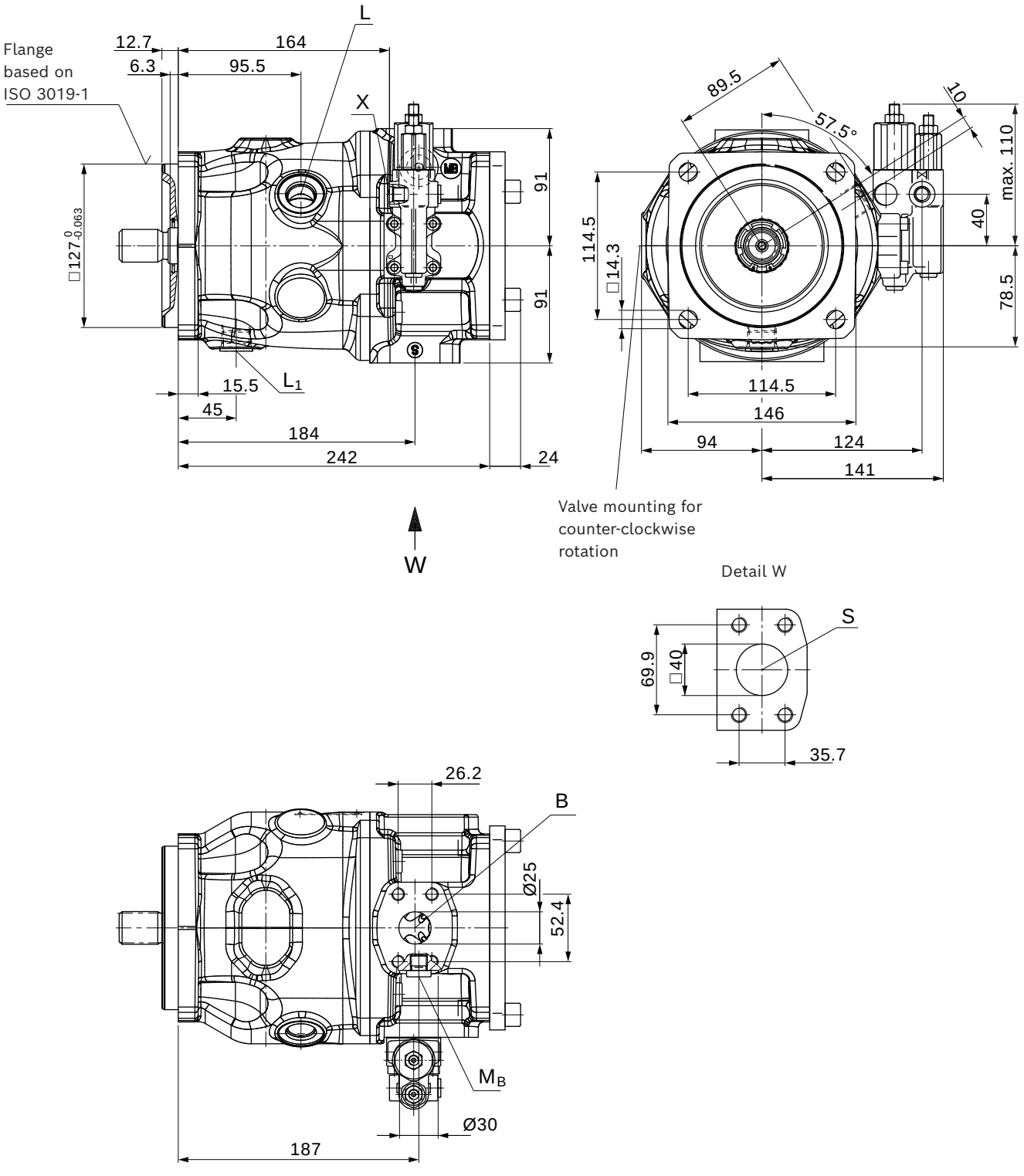


▼ **Port plate 11**



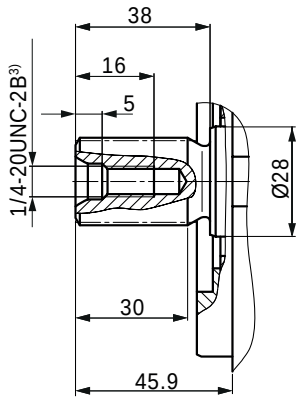
**DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-C; 127-4)**

▼ **Port plate 22/72 and 32/82**



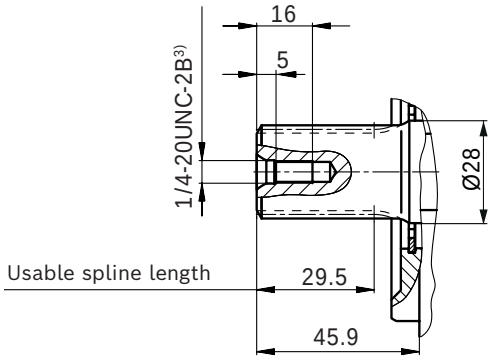
▼ **Splined shaft 1 in** (25-4, ISO 3019-1)

**S –** 15T 16/32DP[1)]



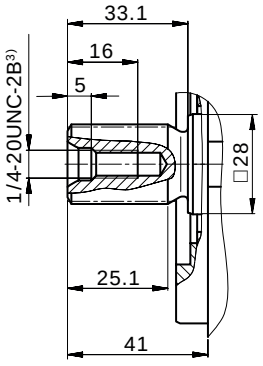

▼ **Splined shaft 1 in** (similar to ISO 3019-1)

**R –** 15T 16/32DP[1)2)]




▼ **Splined shaft 7/8 in** (22-4, ISO 3019-1)

**U –** 13T 16/32DP[1)]

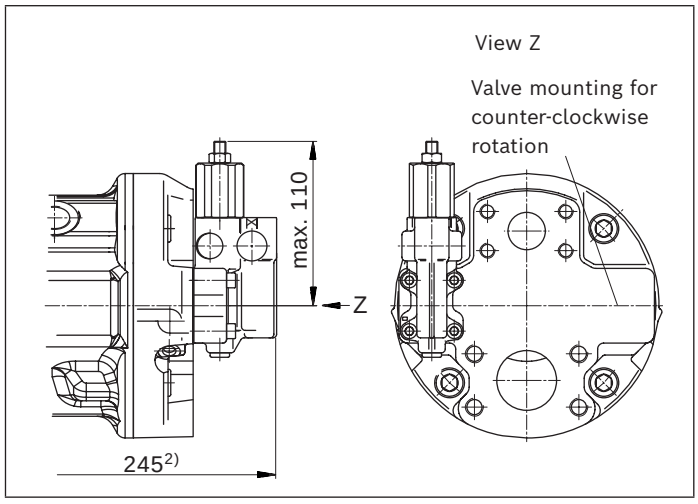



| **Port plate ports 11, 12, 22 and 32** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
|---|---|---|---|---|---|
| **B** | Working port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 1 in<br>M10 x 1.5; 17 (0.67) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 1 1/2 in<br>M12 x 1.75; 20 (0.79) deep | 10 (145) | O |
| **Port plate ports 72, 82** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **B** | Working port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 1 in<br>3/8-16 UNC-2B; 18 (0.71) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 1 1/2 in<br>1/2-13 UNC-2B; 22 (0.87) deep | 10 (145) | O |
| **Other ports** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **L** | Drain port | ISO 11926[5)] | 7/8-14UNF-2B; 17 (0.67) deep | 2 (30) | O[6)] |
| $\mathbf{L_1}$ | Drain port | ISO 11926[5)] | 7/8-14UNF-2B; 17 (0.67) deep | 2 (30) | X[6)] |
| **X** | Pilot pressure | ISO 11926 | 7/16-20 UNF-2B; 11.5 (0.45) deep | 350 (5100) | O |
| $\mathbf{M_B}$ | Measuring pressure **B**<br>(only with port plates 22/72 and 32/82) | DIN 3852-2[5)] | G 1/4 in; 12 (0.47) deep | 350 (5100) | X |

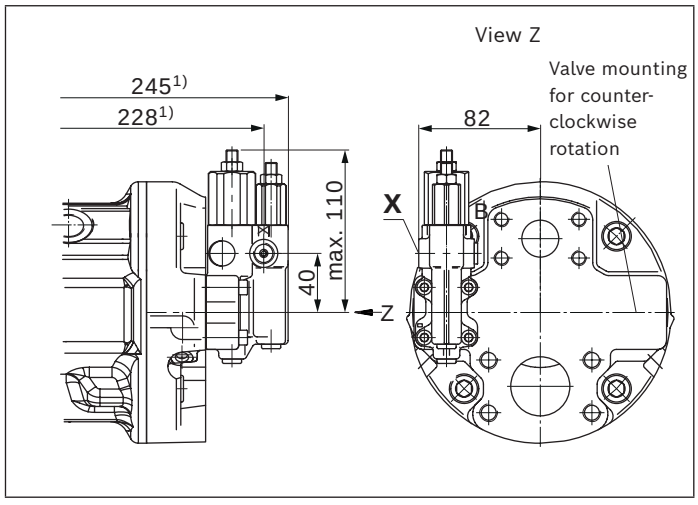
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

## Port plate 11

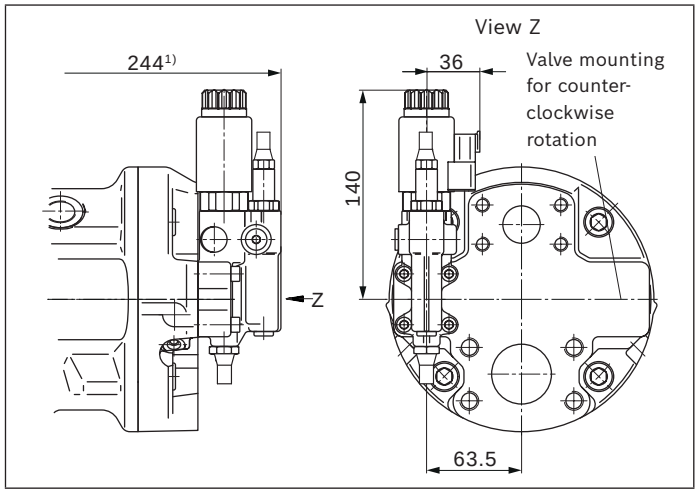
▼ **DR – Pressure controller; mounting flange C**



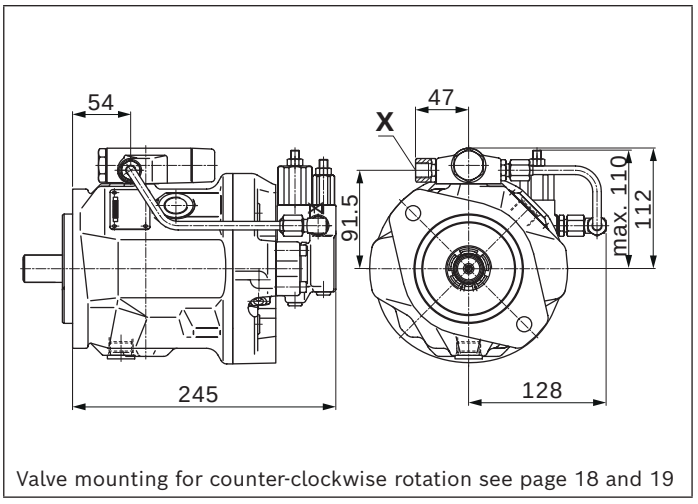

▼ **DRG – Pressure controller, remote controlled; mounting flange C**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange C**

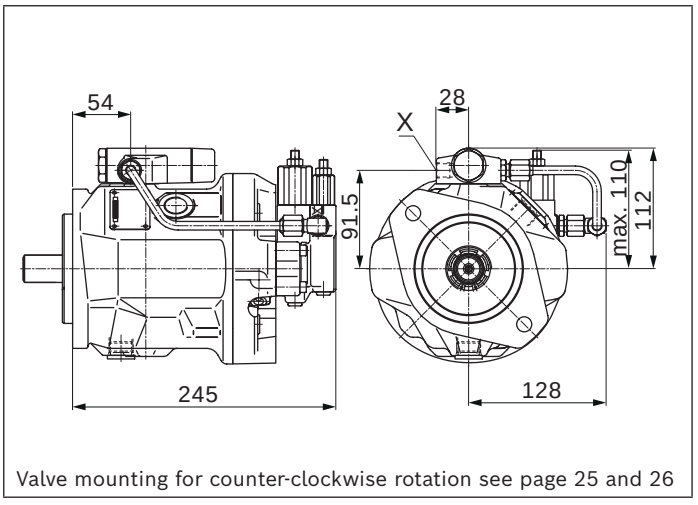



▼ **LA.DS – Pressure, flow and power controller; mounting flange C**




Valve mounting for counter-clockwise rotation see page 18 and 19

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange C**

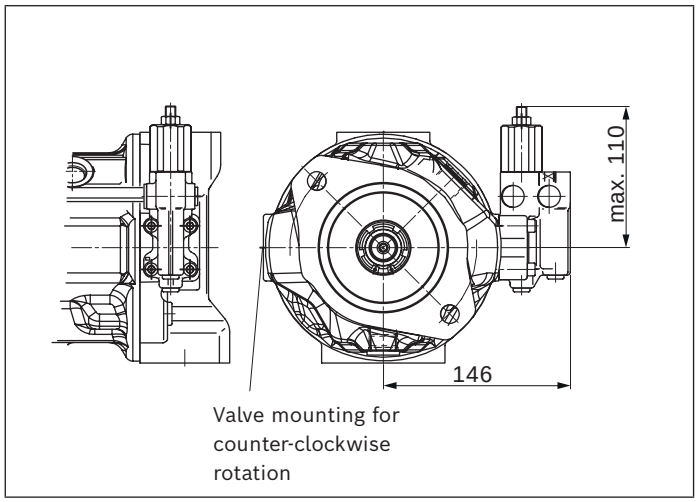



Valve mounting for counter-clockwise rotation see page 25 and 26

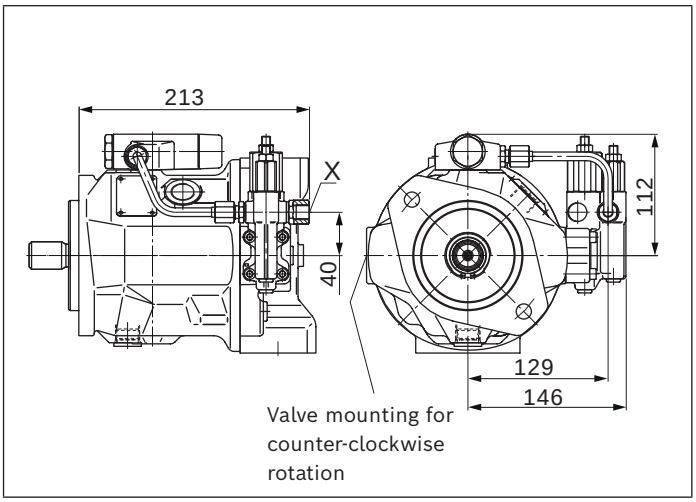
1) To mounting flange

## Port plate 12

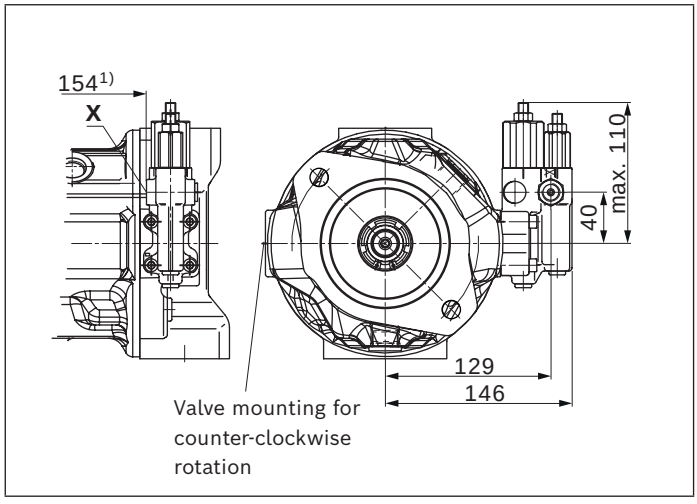
▼ **DR – Pressure controller; mounting flange C**



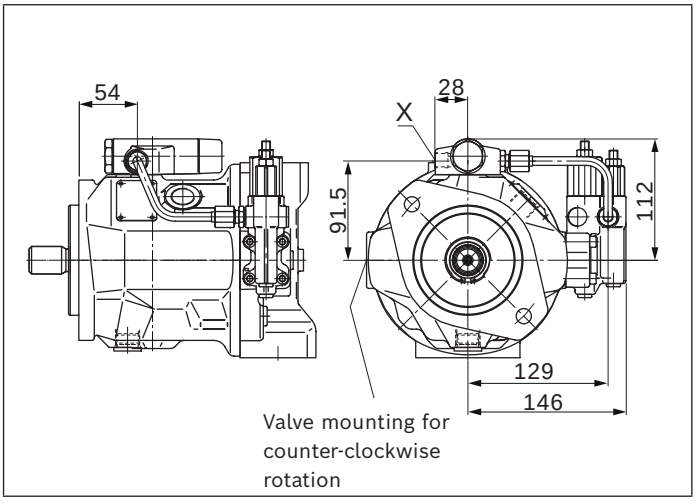

▼ **LA.DS – Pressure, flow and power controller; mounting flange C**



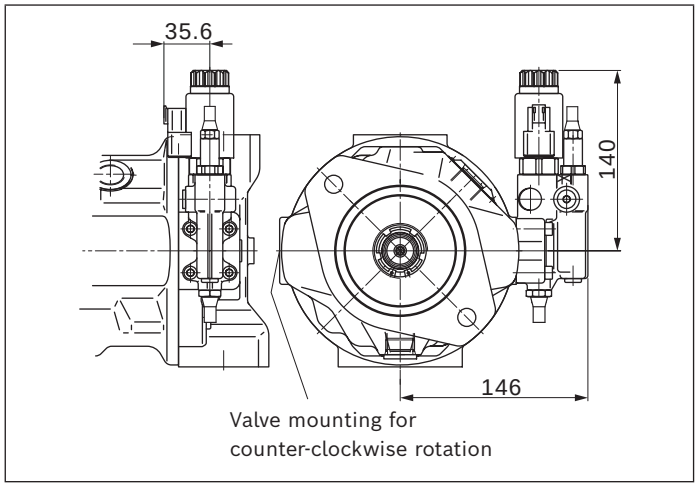

▼ **DRG – Pressure controller, remote controlled; mounting flange C**




▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange C**



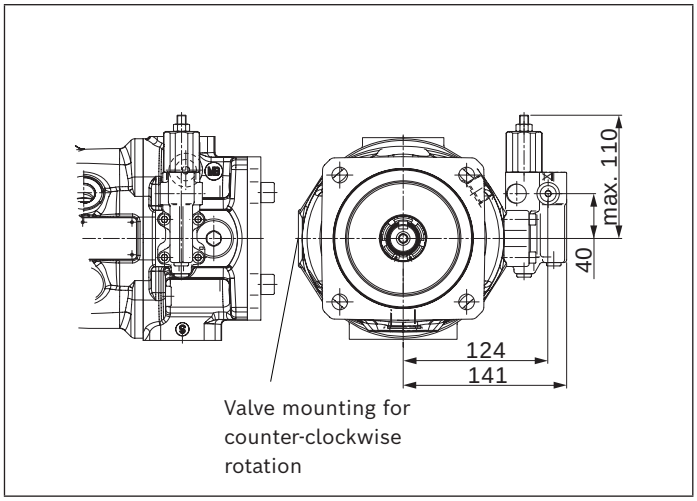

▼ **ED7./ER7. – Pressure controller, electric; mounting flange C**



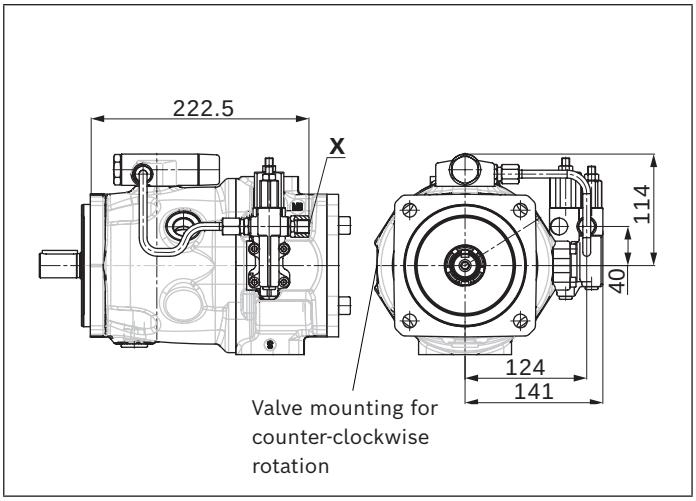

1) To mounting flange

## Port plate 22/72 and 32/82

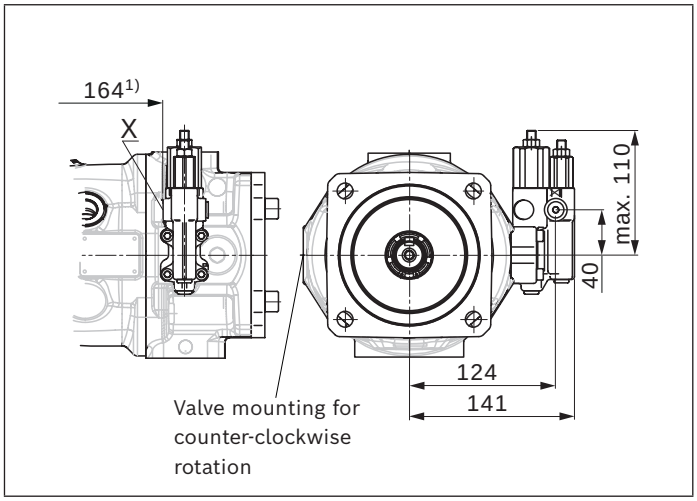
▼ **DR – Pressure controller; mounting flange D**



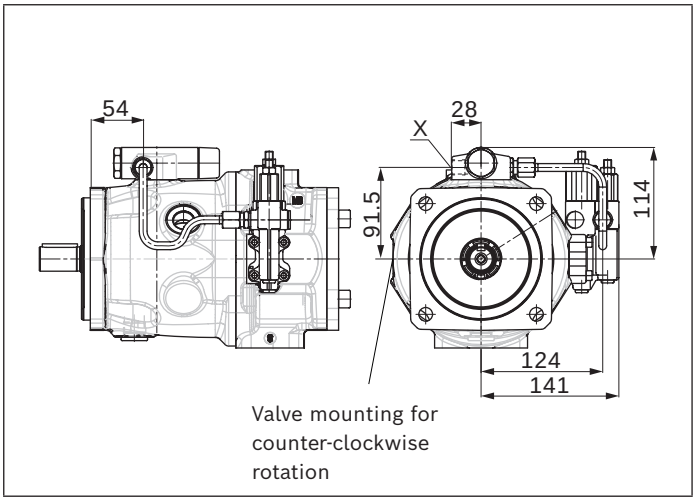

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



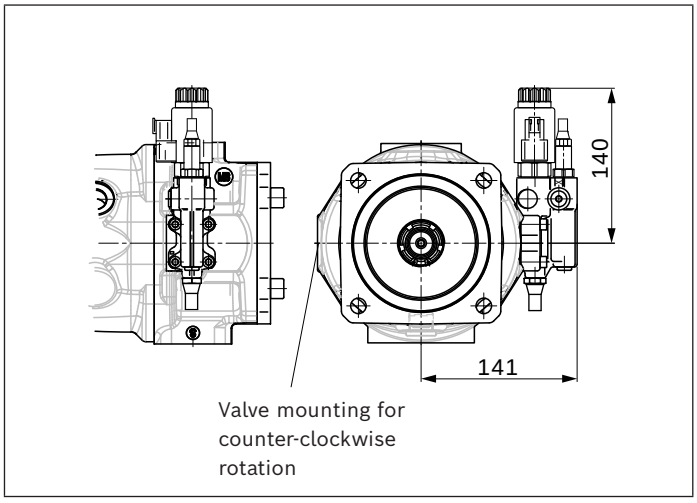

▼ **DRG – Pressure controller, remote controlled; mounting flange D**




▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**

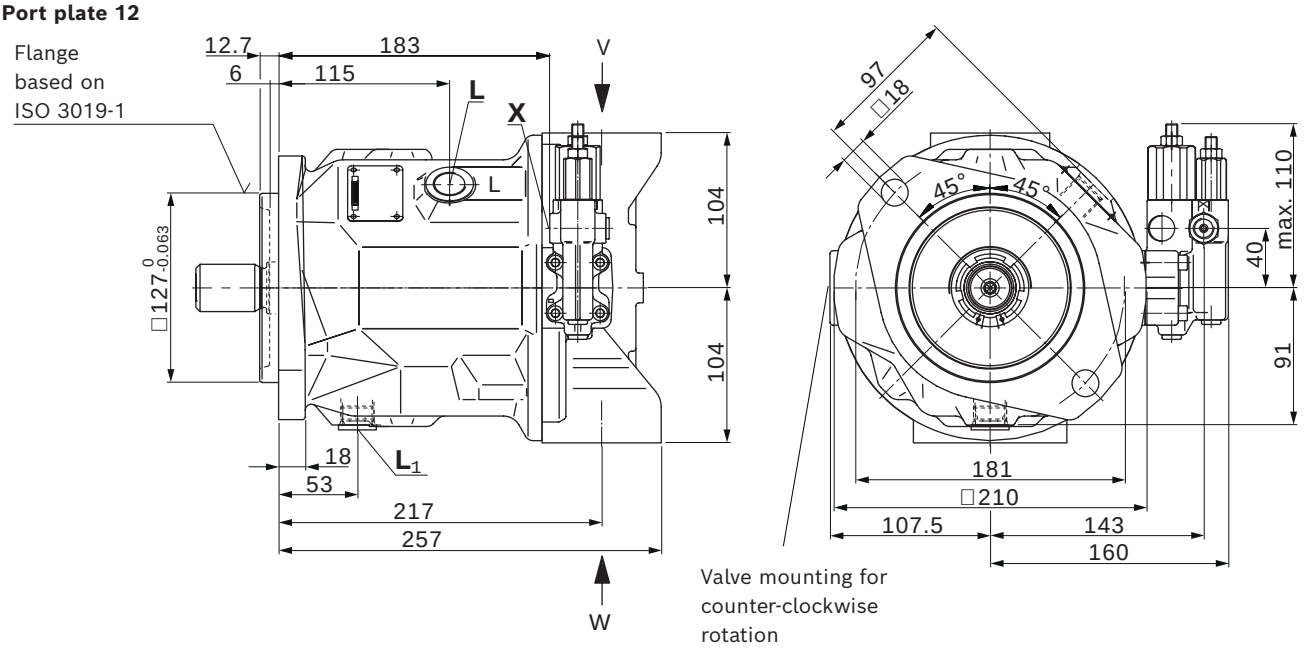


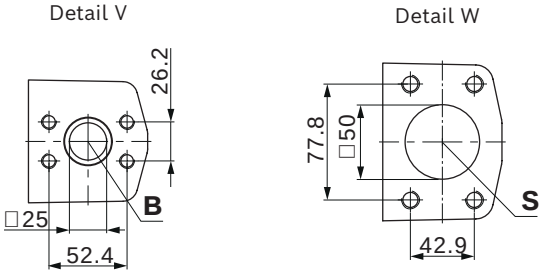

1) To mounting flange

## Dimensions, size 71

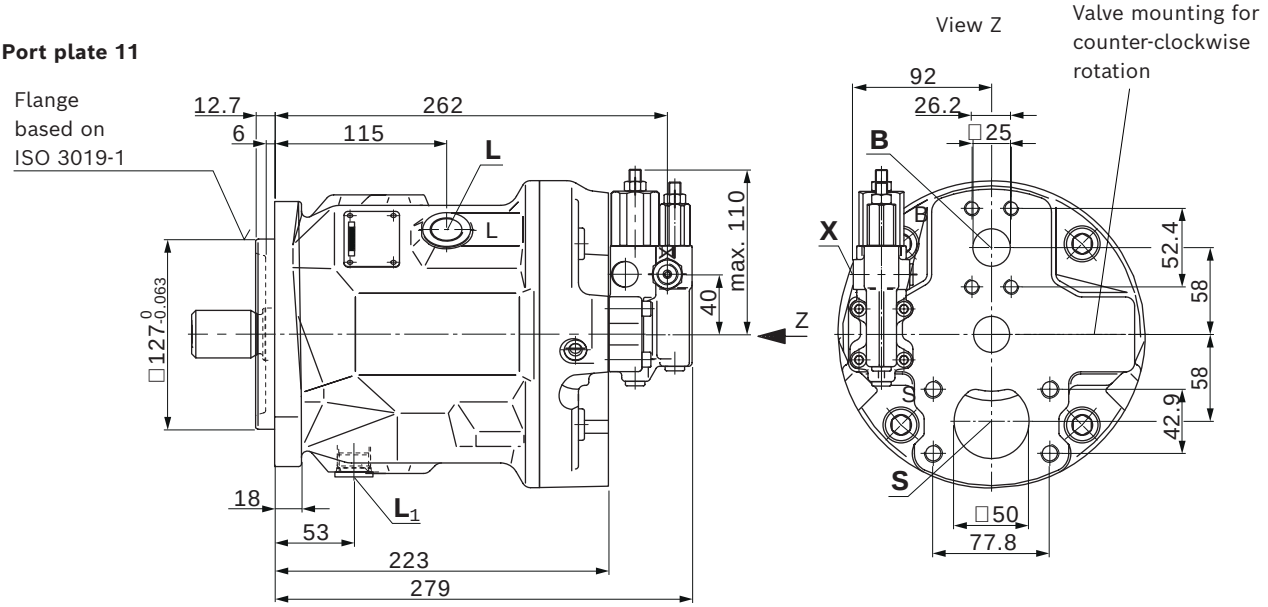
### DRF, DRS, DRSC – Pressure flow controller, port plate 11 and 12; mounting flange C (SAE-C; 127-2)

▼ **Port plate 12**



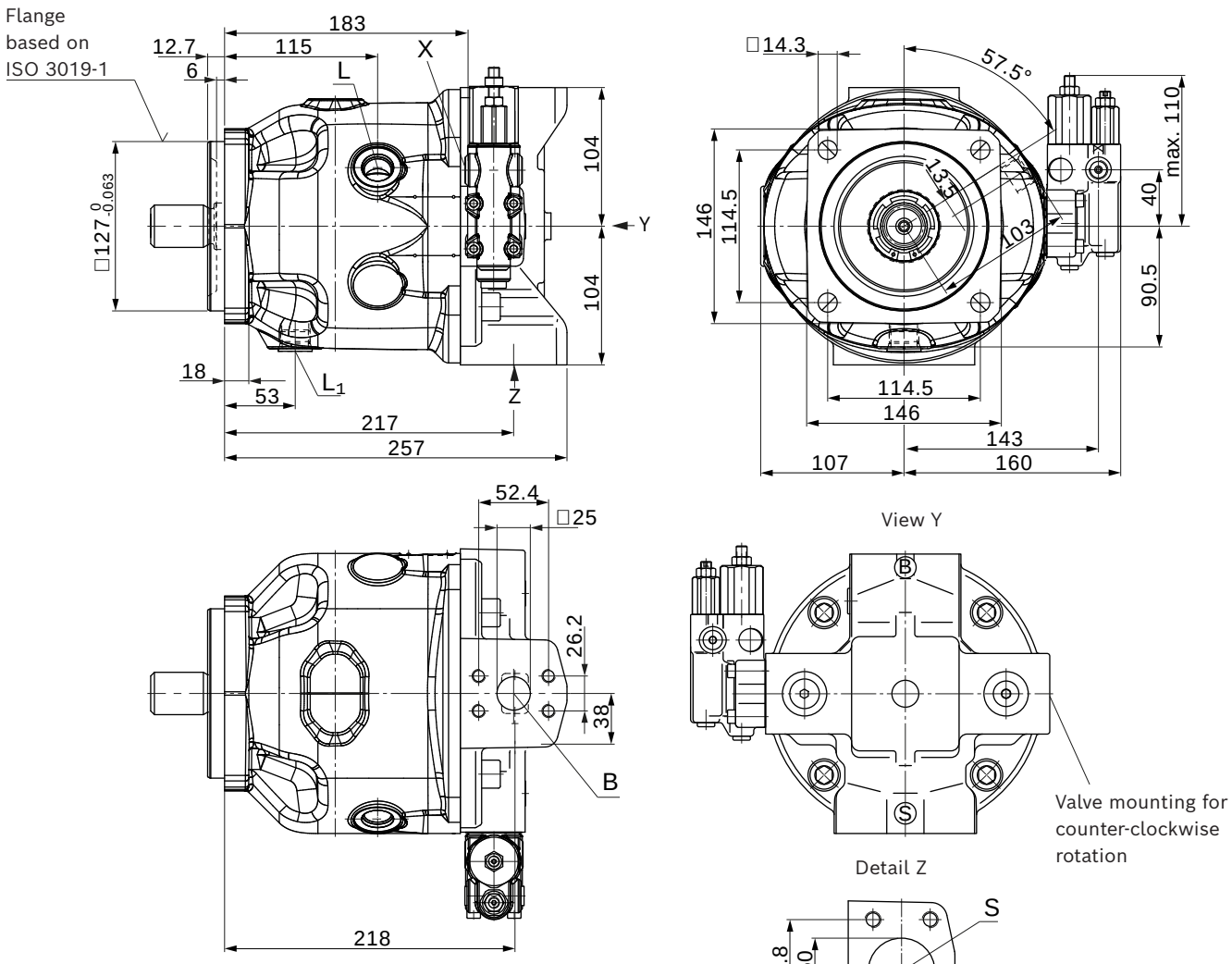




▼ **Port plate 11**

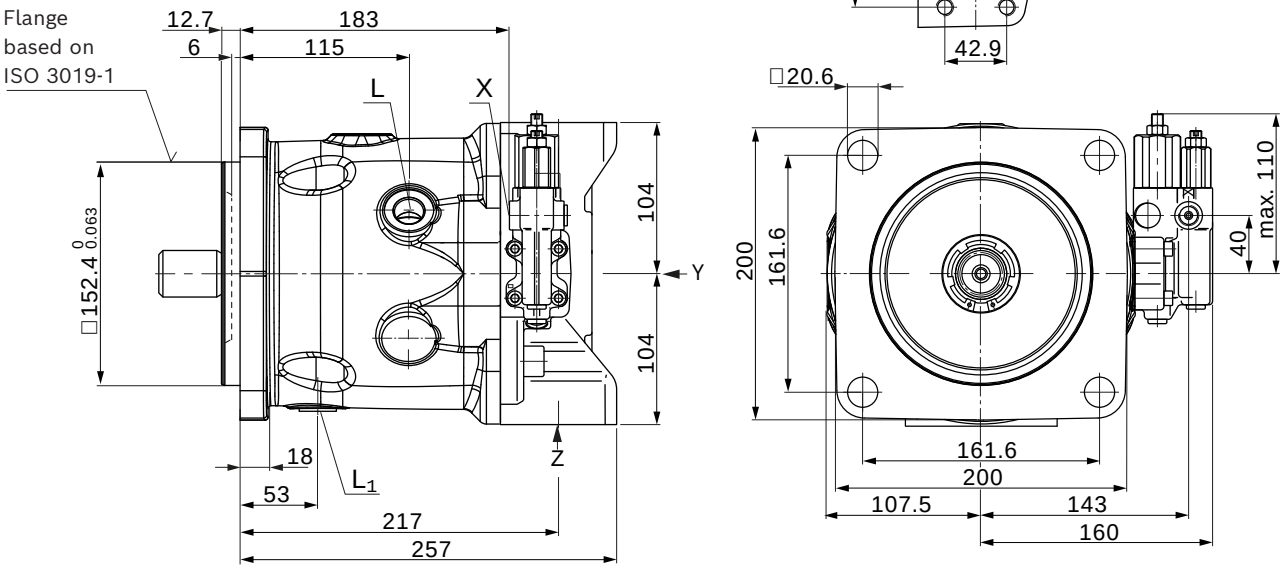


**DRF, DRS, DRSC – Pressure flow controller, port plate 12; mounting flange D (SAE-C; 127-4) and U (SAE-D; 152-4)**

▼ **Port plate 12; mounting flange D**

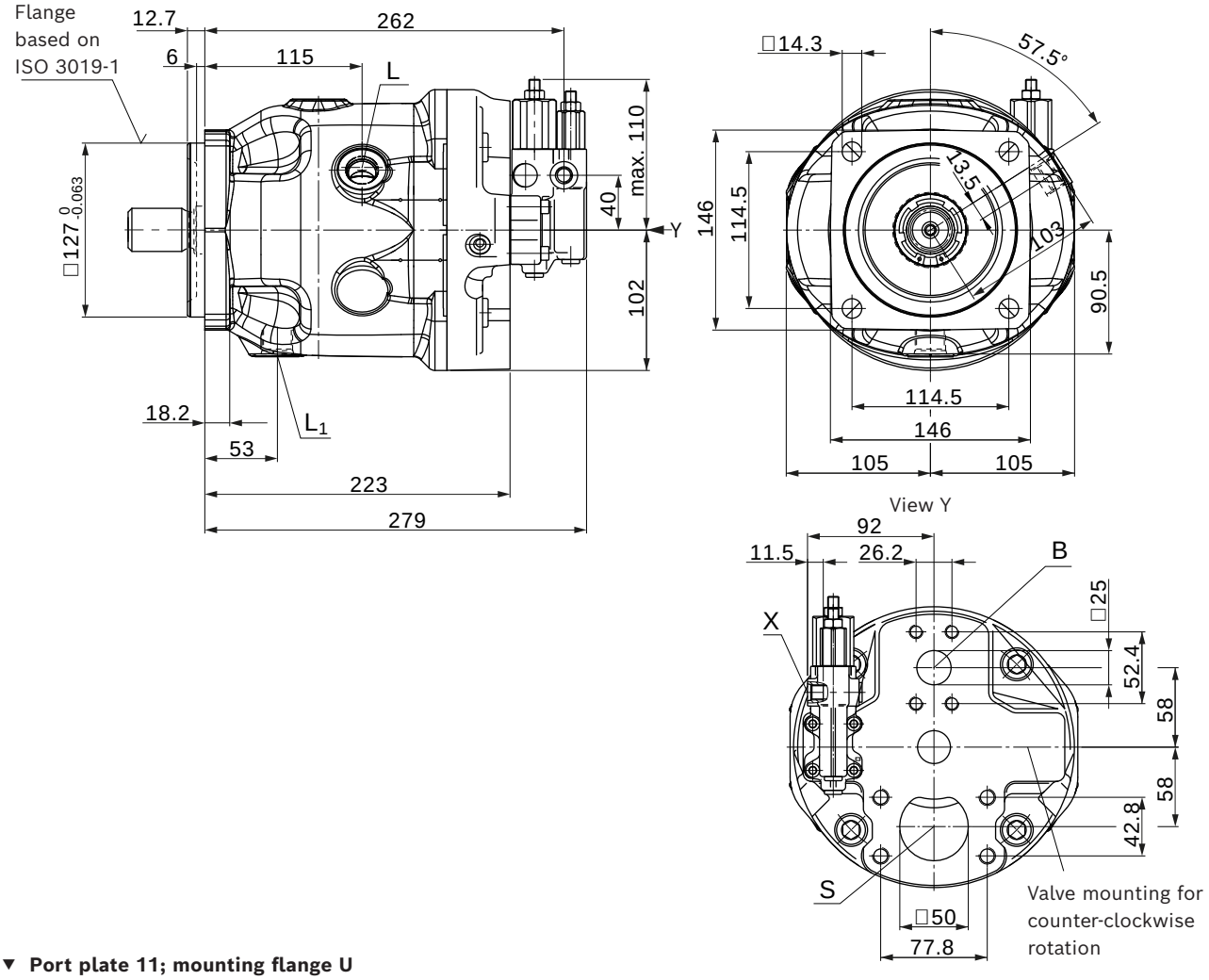



▼ **Port plate 12; mounting flange U**

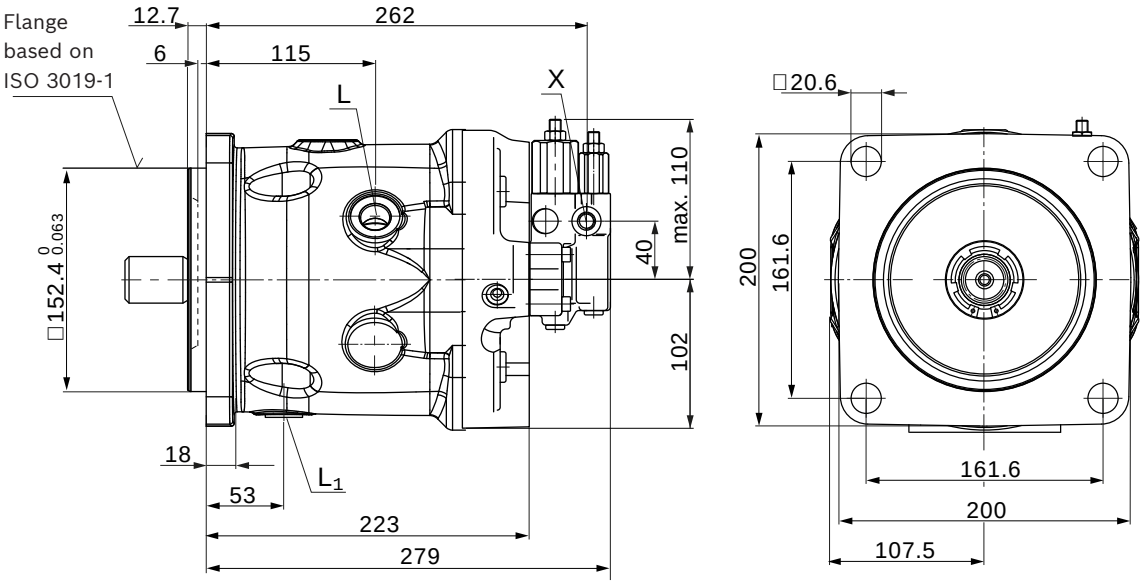


## DRF, DRS, DRSC – Pressure flow controller, port plate 11; mounting flange D (SAE-C; 127-4) and U (SAE-D; 152-4)

▼ **Port plate 11; mounting flange D**

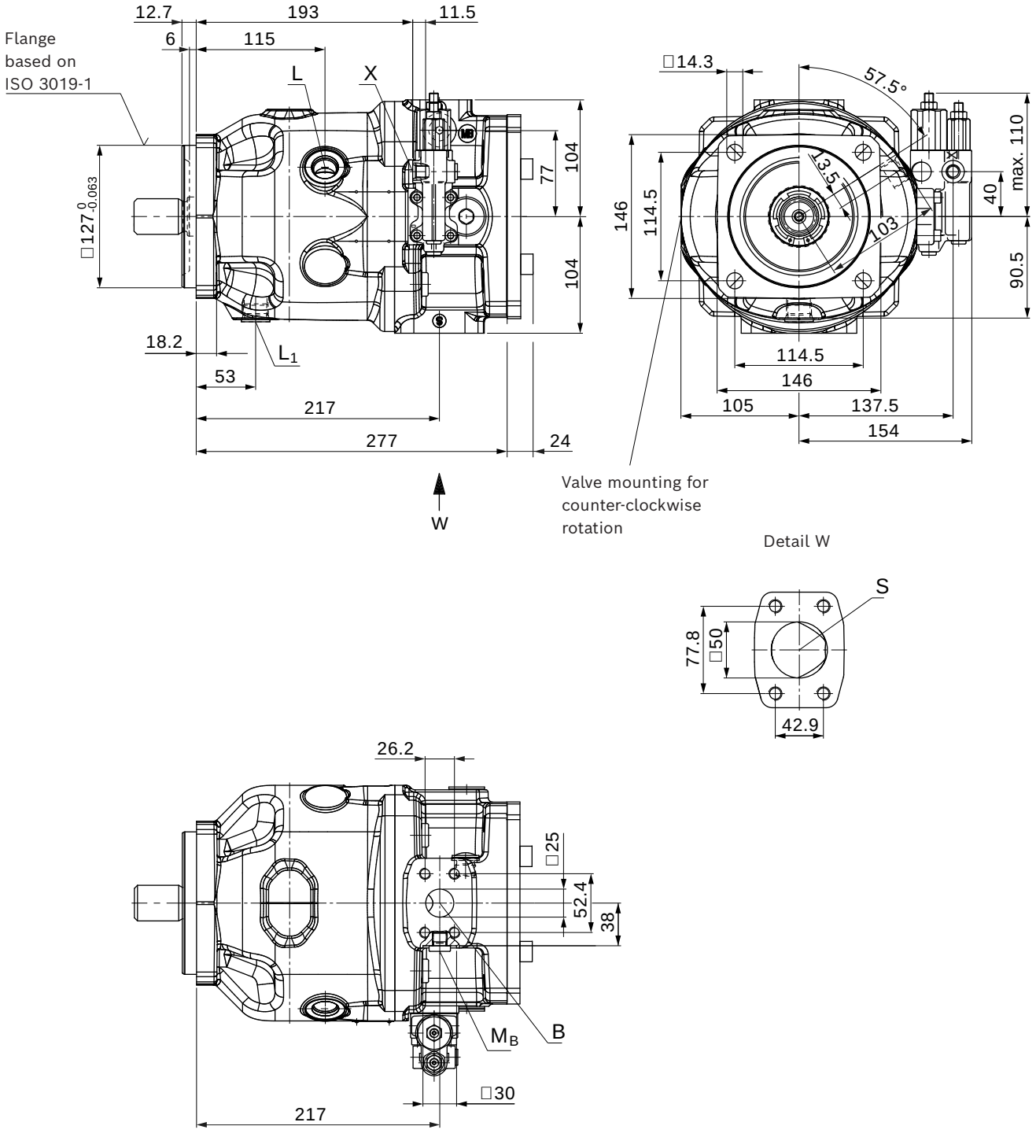



▼ **Port plate 11; mounting flange U**



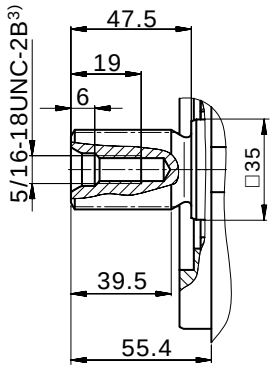
**DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-C; 127-4)**

▼ **Port plate 22/72 and 32/82**



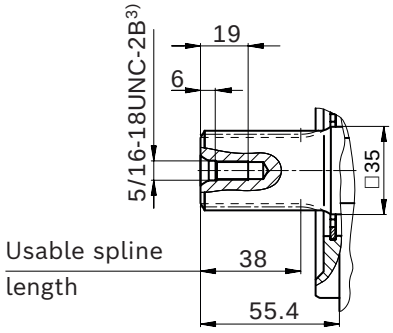
▼ **Splined shaft 1 1/4 in** (32-4, ISO 3019-1)

**S –** 14T 12/24DP[1)]



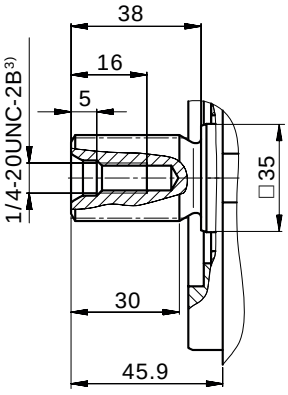

▼ **Splined shaft 1 1/4 in** (similar to ISO 3019-1)

**R –** 14T 12/24DP[1)2)]



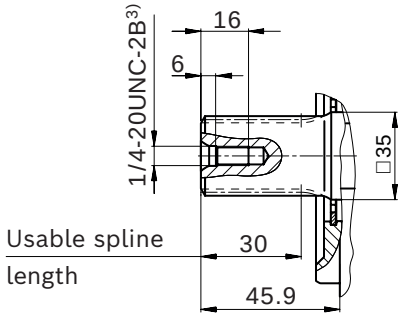

▼ **Splined shaft 1 in** (25-4, ISO 3019-1)

**U –** 15T 16/32DP[1)]




▼ **Splined shaft 1 in** (similar to ISO 3019-1)

**W –** 15T 16/32DP[1)2)]

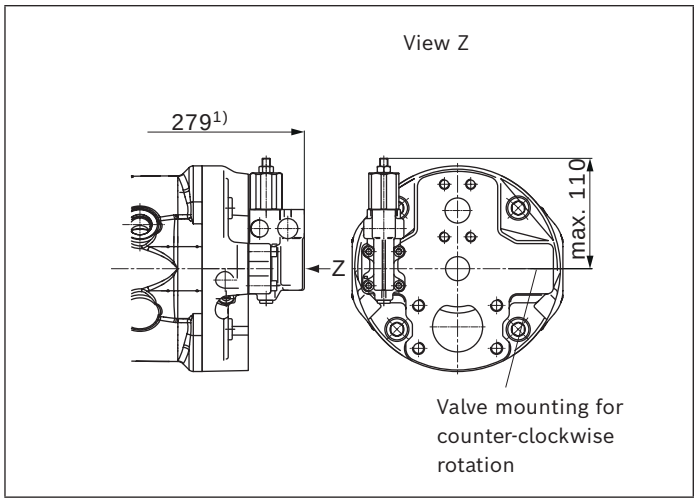



| **Port plate ports 11, 12, 22 and 32** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
|---|---|---|---|---|---|
| **B** | Working port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 1 in<br>M10 x 1.5; 17 (0.67) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 2 in<br>M12 x 1.75; 20 (0.79) deep | 10 (145) | O |
| **Port plate ports 72, 82** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **B** | Working port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 1 in<br>3/8-16 UNC-2B; 18 (0.71) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 2 in<br>1/2-13 UNC-2B; 20 (0.79) deep | 10 (145) | O |
| **Other ports** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **L** | Drain port | ISO 11926[5)] | 7/8-14UNF-2B; 17 (0.67) deep | 2 (30) | O[6)] |
| $\mathbf{L_1}$ | Drain port | ISO 11926[5)] | 7/8-14UNF-2B; 17 (0.67) deep | 2 (30) | X[6)] |
| **X** | Pilot pressure | ISO 11926 | 7/16-20 UNF-2B; 11.5 (0.45) deep | 350 (5100) | O |
| $\mathbf{M_B}$ | Measuring pressure **B**<br>(only for port plate 22/72 and 32/82) | DIN 3852-2[5)] | G 1/4 in; 12 (0.47) deep | 350 (5100) | X |

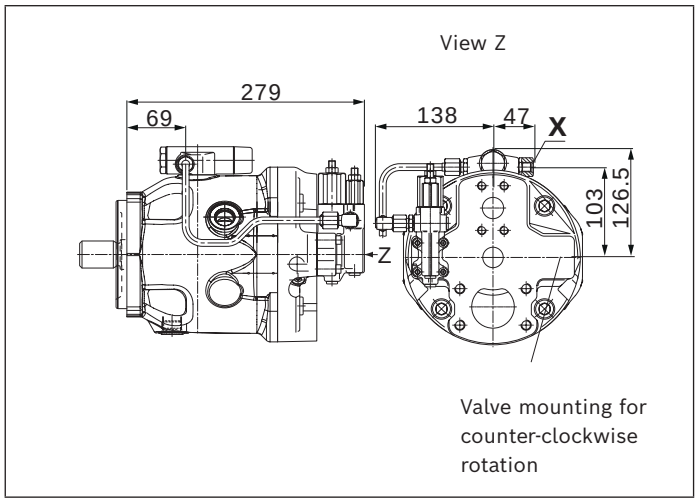
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

## Port plate 11

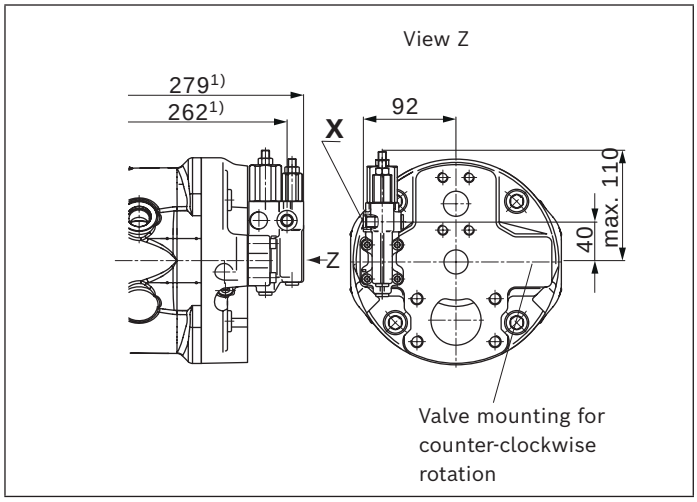
▼ **DR – Pressure controller; mounting flange D**



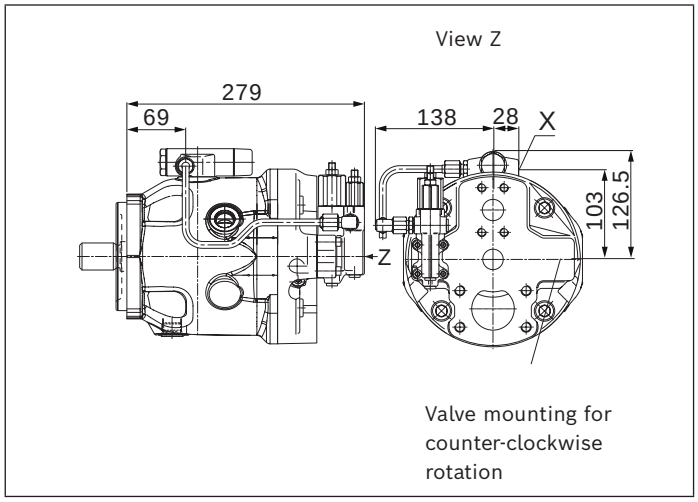

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



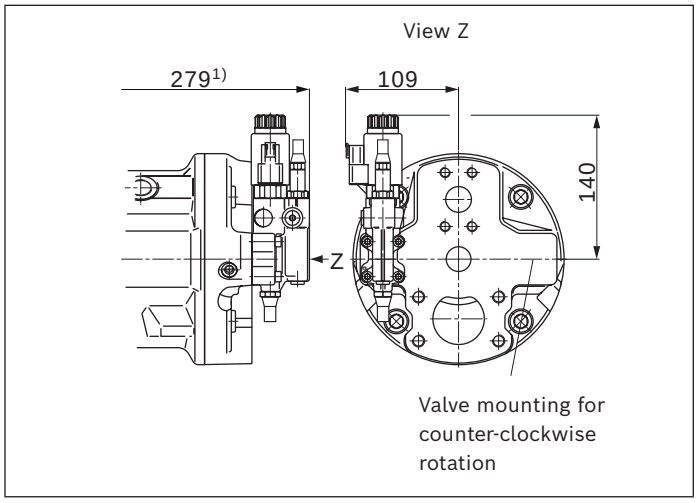

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



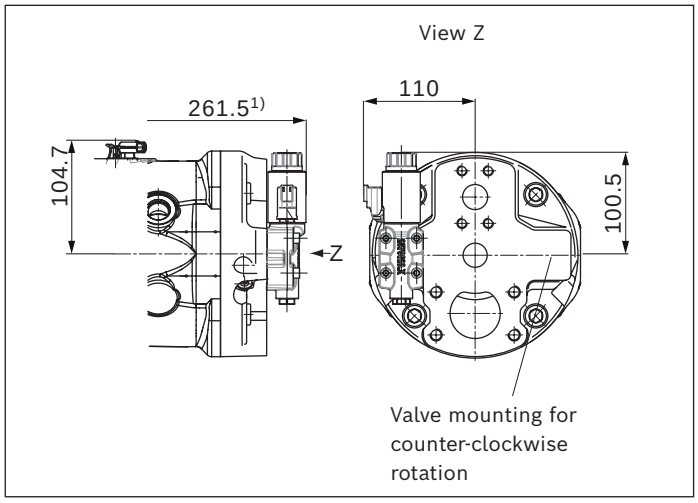

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



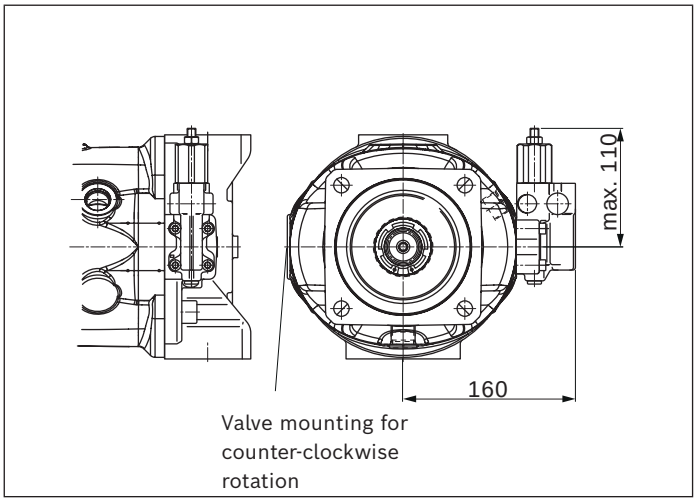

▼ **EC4/EB4 – Electrohydraulic control valve**



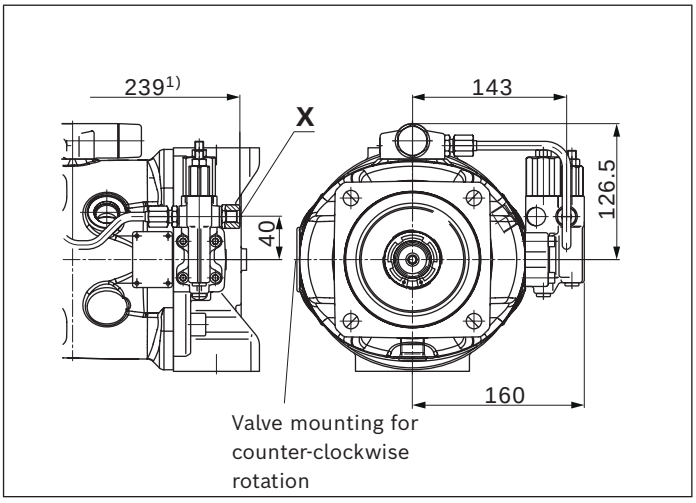

1) To mounting flange

## Port plate 12

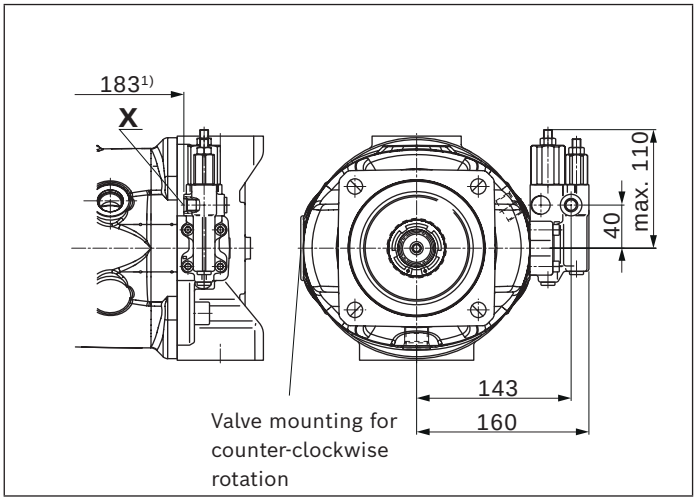
▼ **DR – Pressure controller; mounting flange D**



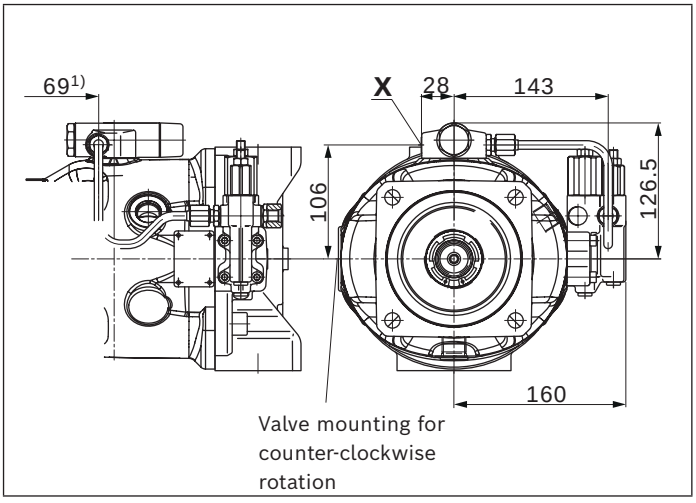

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



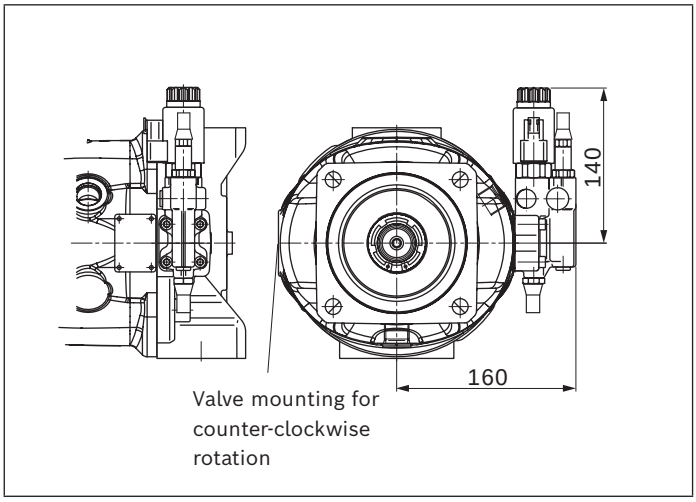

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



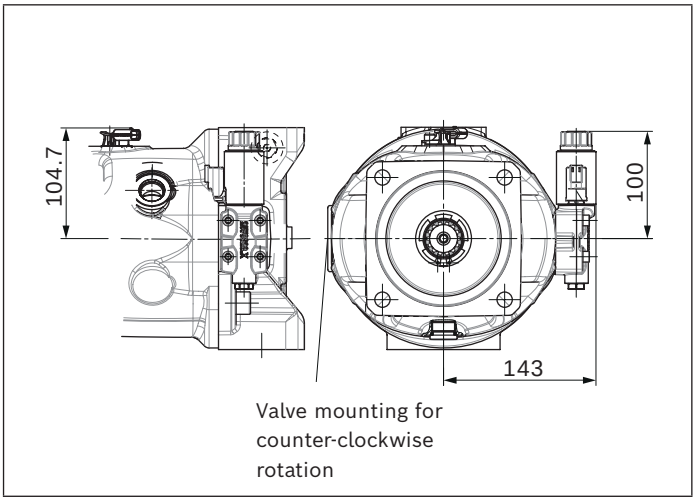

▼ **LA.DG – Pressure, with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



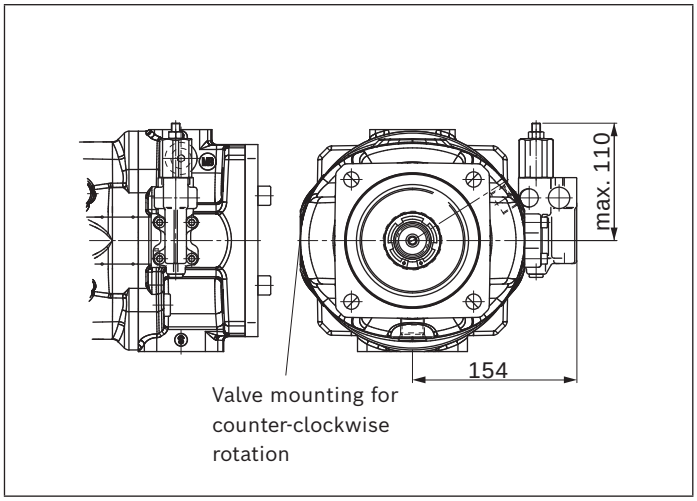

▼ **EC4/EB4 – Electrohydraulic control valve**



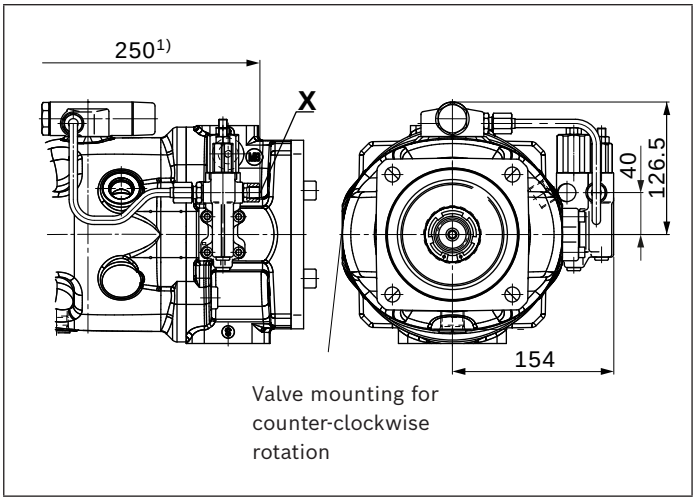

1) To mounting flange

## Port plate 22/72 and 32/82

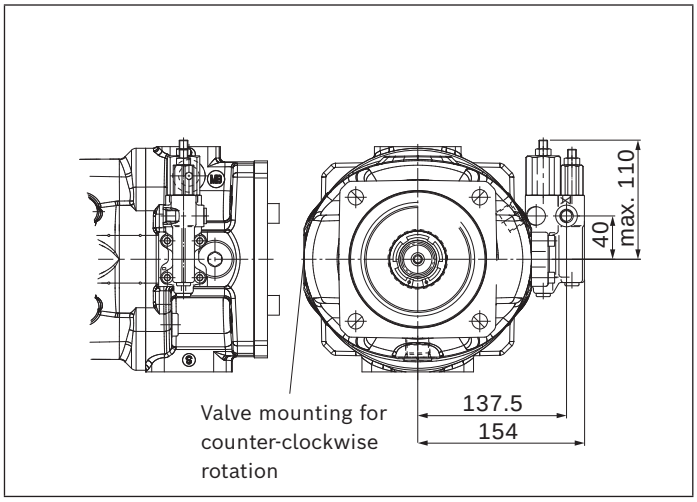
▼ **DR – Pressure controller; mounting flange D**



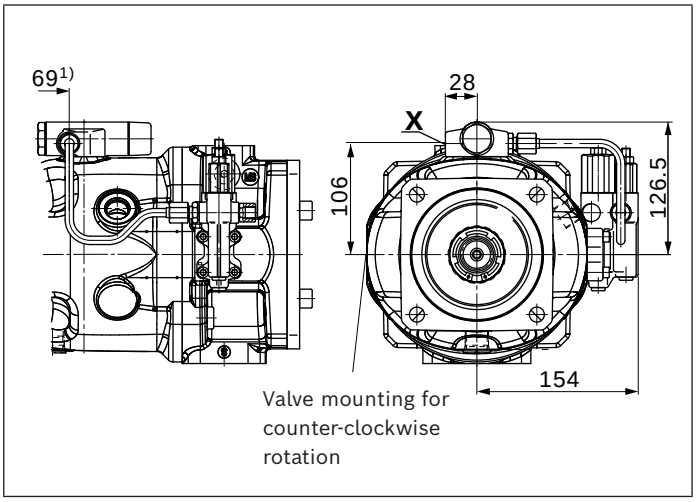

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



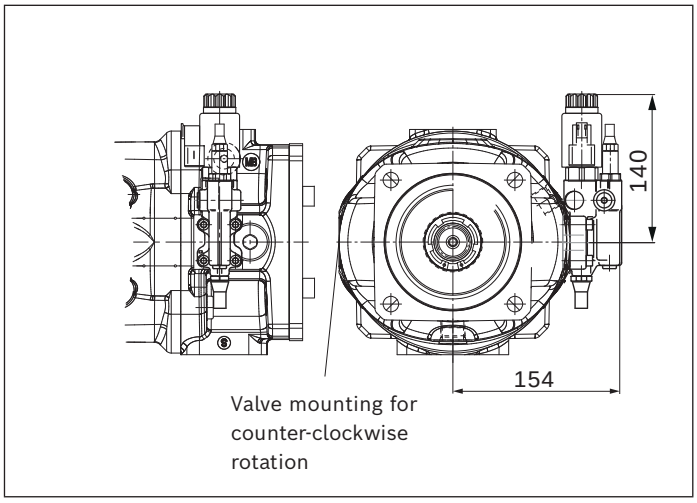

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



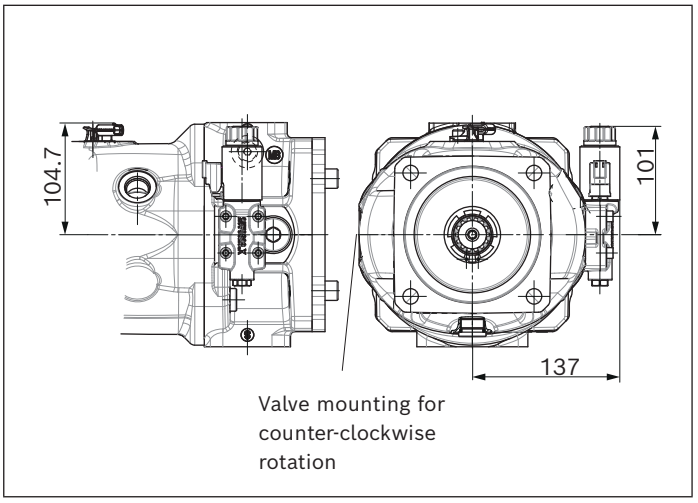

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**




▼ **EC4/EB4 – Electrohydraulic control valve**

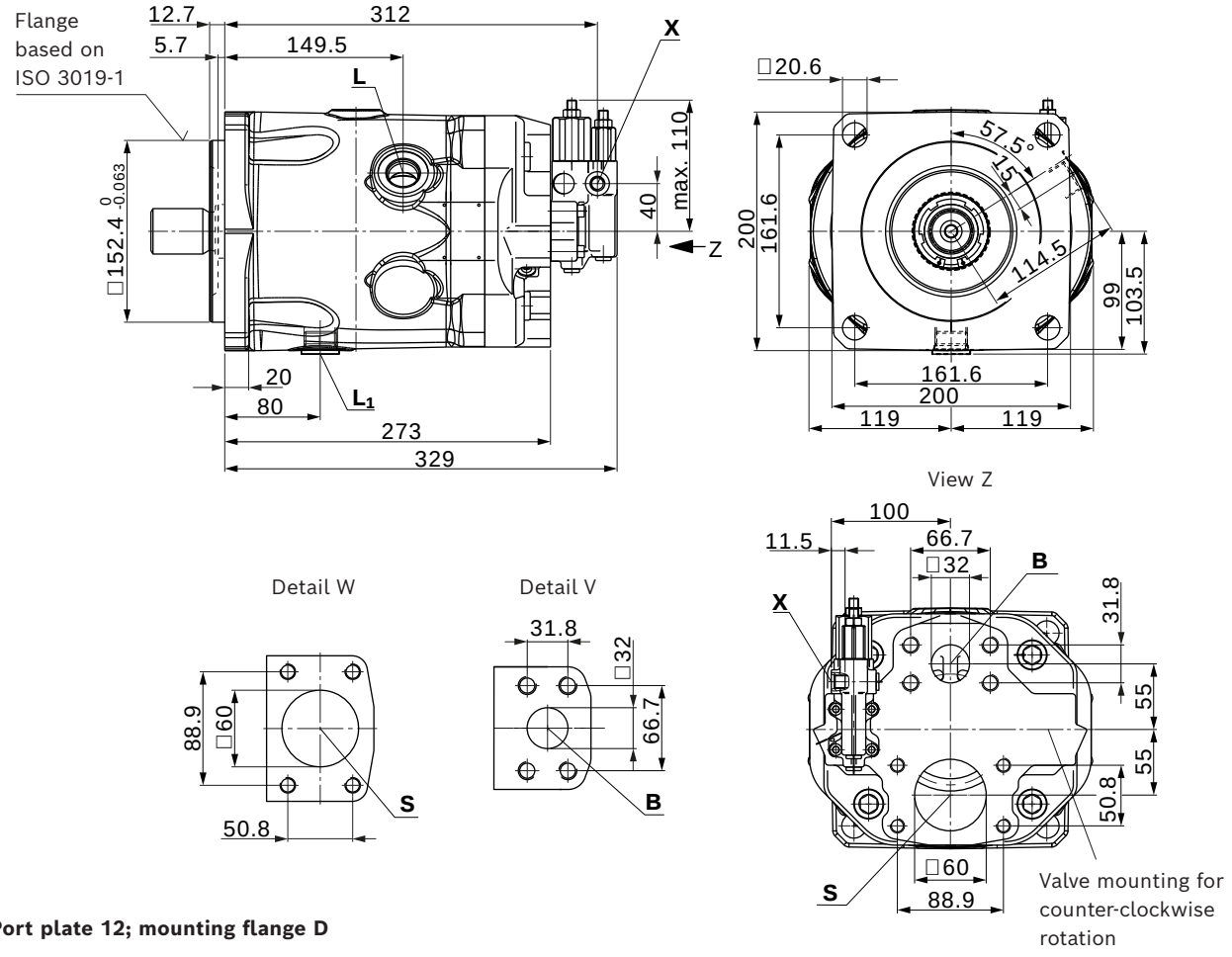



1) To mounting flange

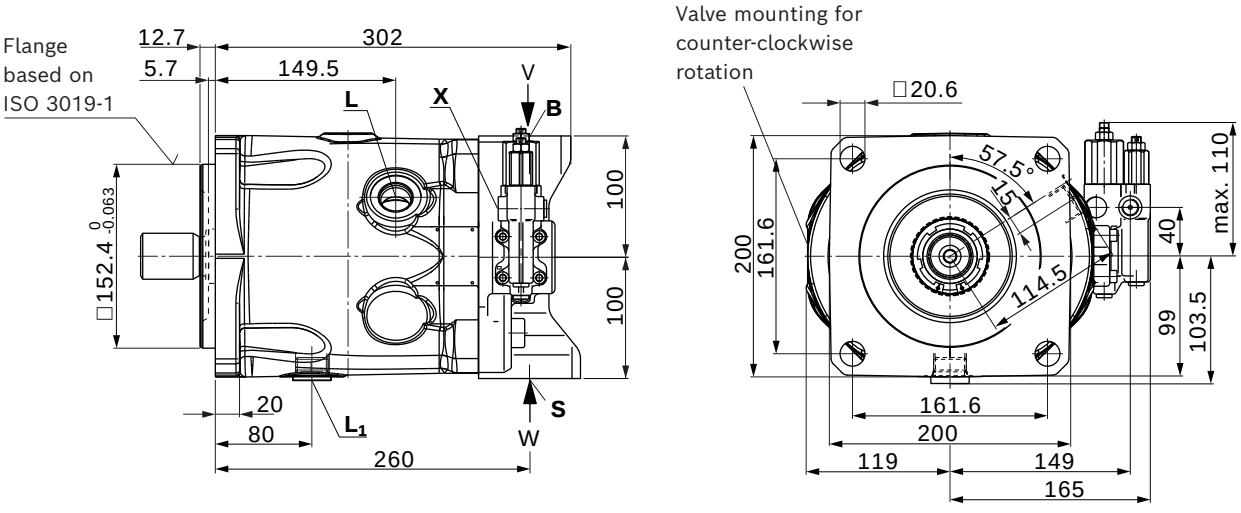
## Dimensions, size 100

### DRF, DRS, DRSC – Pressure flow controller, port plate 11, 12; mounting flange D (SAE-D; 152-4)

▼ **Port plate 11; mounting flange D**



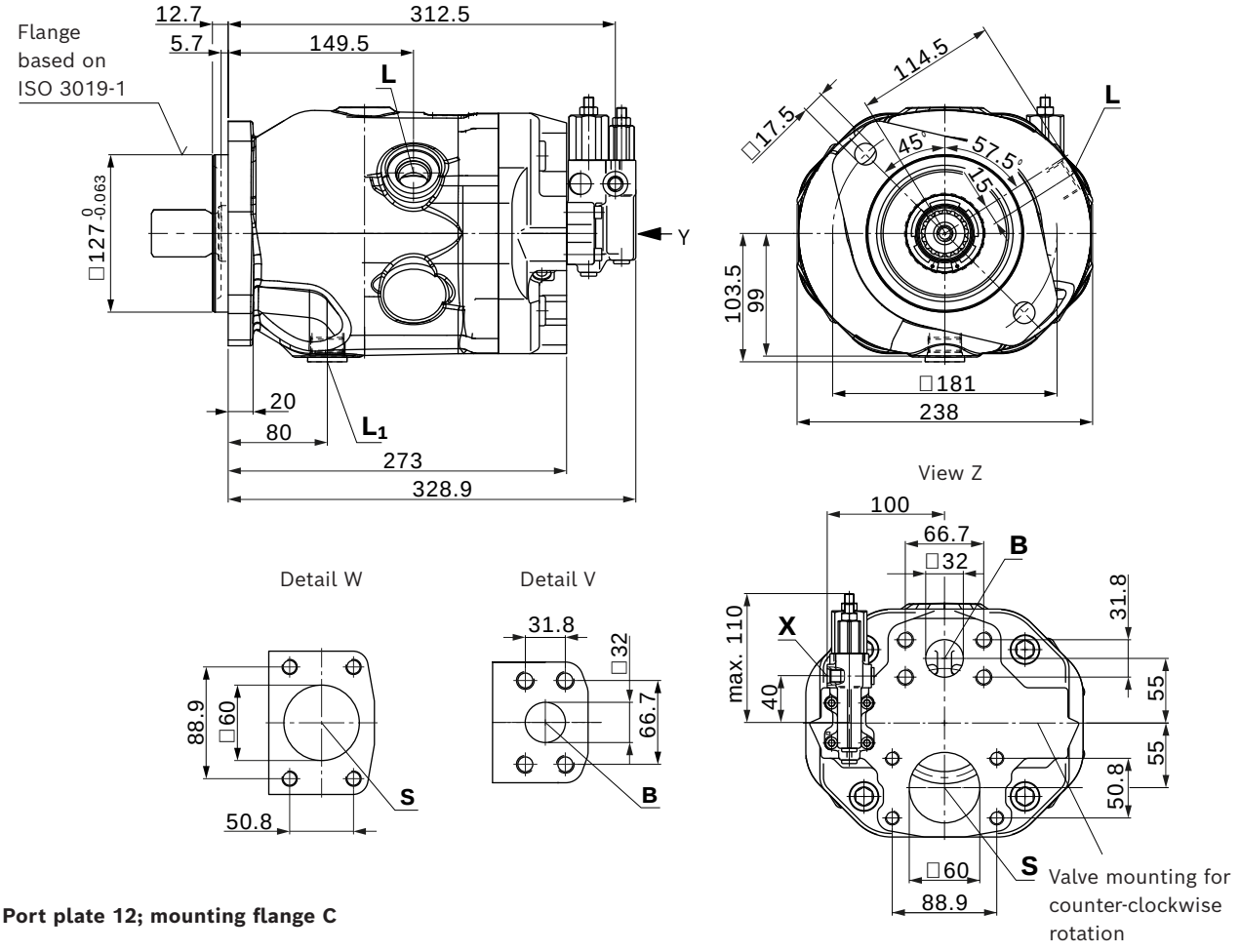

▼ **Port plate 12; mounting flange D**



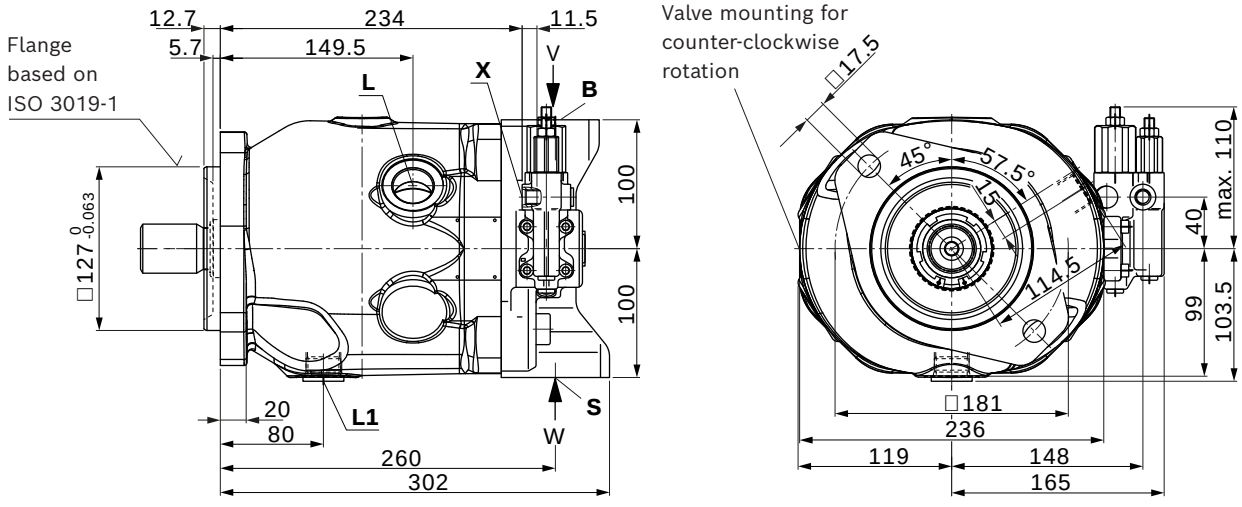
## Dimensions, size 100

### DRF, DRS, DRSC – Pressure flow controller, port plate 11, 12; mounting flange C (SAE-C; 127-2)

▼ **Port plate 11; mounting flange C**

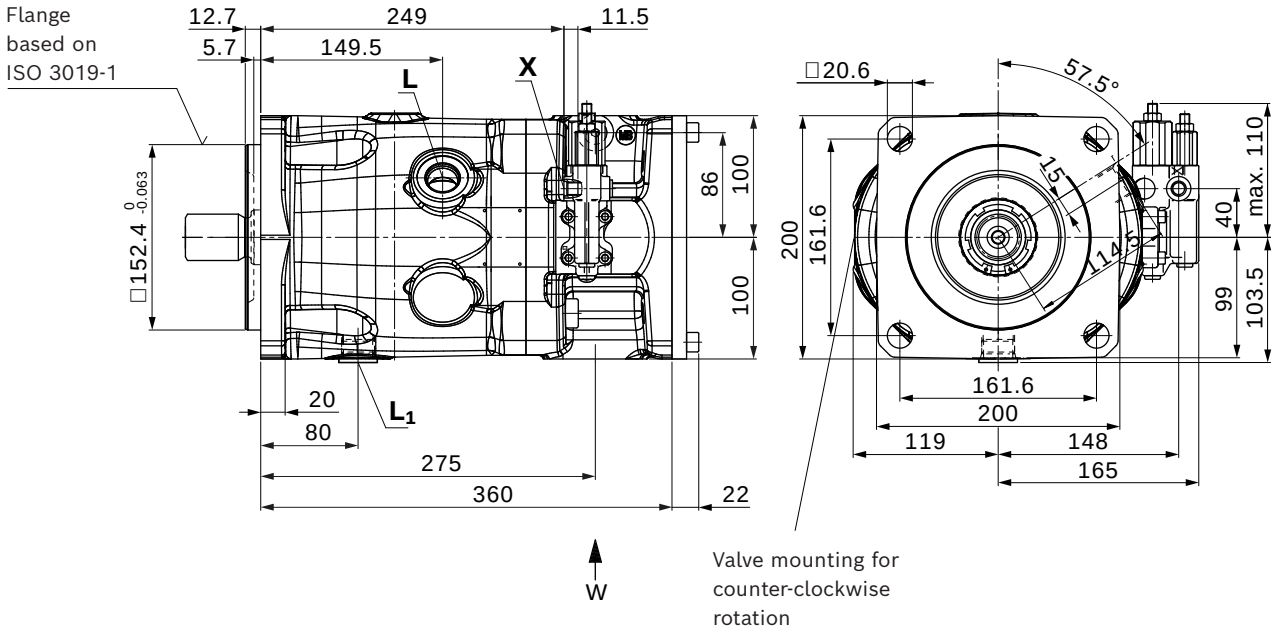



▼ **Port plate 12; mounting flange C**

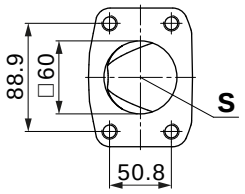


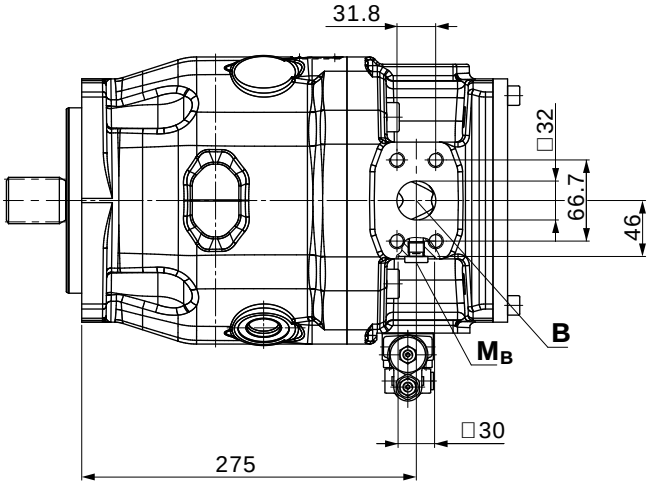
## DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22/72 and 32/82**



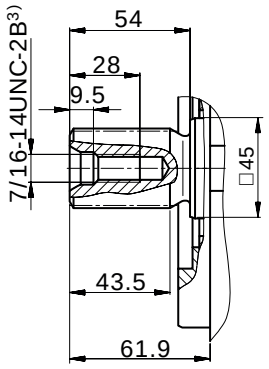

Detail W



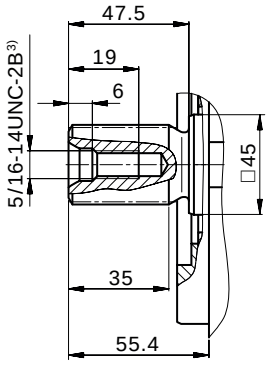
▼ **Splined shaft 1 1/2 in** (38-4, ISO 3019-1)

**S –** 17T 12/24DP[1)]



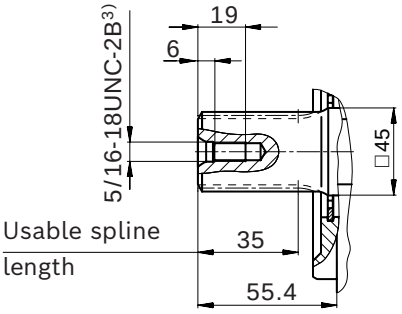

▼ **Splined shaft 1 1/4 in** (32-4, ISO 3019-1)

**U –** 14T 12/24DP[1)]




▼ **Splined shaft 1 1/4 in** (similar to ISO 3019-1)

**W –** 14T 12/24DP[1)2)]

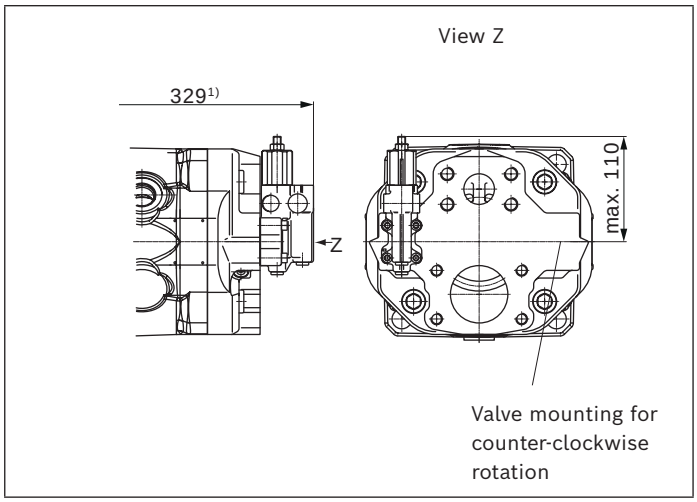



| **Port plate ports 11, 12, 22 and 32** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
|---|---|---|---|---|---|
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>DIN 13 | 1 1/4 in<br>M14 x 2[8)]; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 2 1/2 in<br>M12 x 1.75; 17 (0.67) deep | 10 (145) | O |
| **Port plate ports 72, 82** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>ASME B1.1 | 1 1/4 in<br>1/2-13 UNC-2B; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 2 1/2 in<br>1/2-13 UNC-2B; 24 (0.94) deep | 10 (145) | O |
| **Other ports** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **L** | Drain port | ISO 11926[5)] | 1 1/16-12 UNF-2B; 20 (0.79) deep | 2 (30) | O[6)] |
| **$L_1$** | Drain port | ISO 11926[5)] | 1 1/16-12 UNF-2B; 20 (0.79) deep | 2 (30) | X[6)] |
| **X** | Pilot pressure | ISO 11926 | 7/16-20 UNF-2B; 11.5 (0.45) deep | 350 (5100) | O |
| **$M_B$** | Measuring pressure **B**<br>(only with port plates 22/72 and 32/82) | DIN 3852-2[5)] | G 1/4 in; 12 (0.47) deep | 350 (5100) | X |

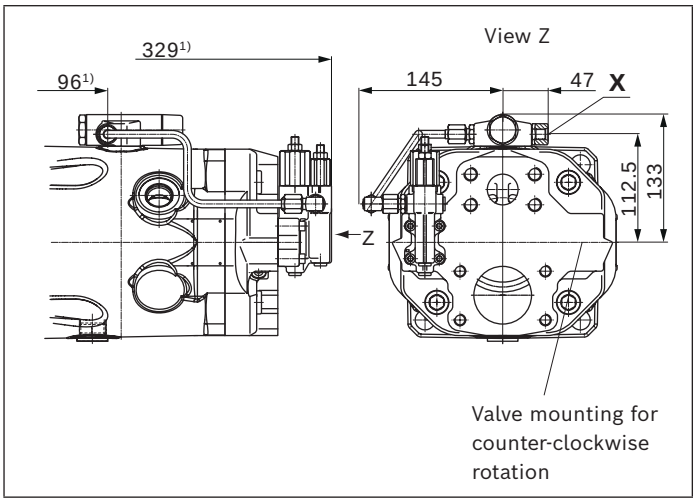
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard ISO 3019-1.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or **$L_1$** must be connected (also see installation instructions on page73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
8) Fastening thread M14 deviating from standard ISO 6162-2.

## Port plate 11

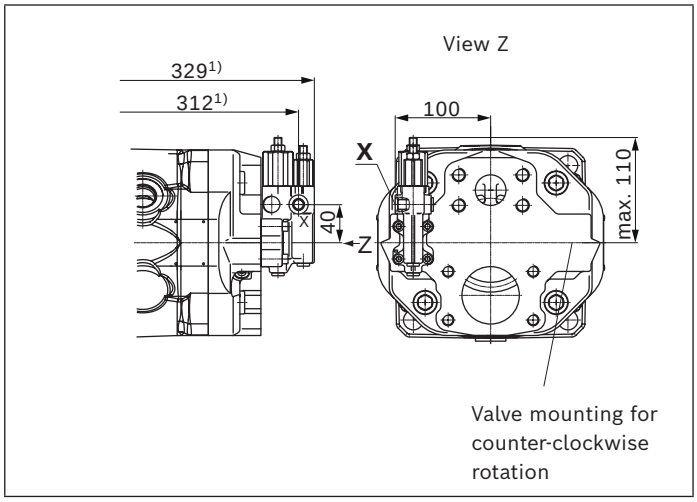
▼ **DR – Pressure controller; mounting flange D**



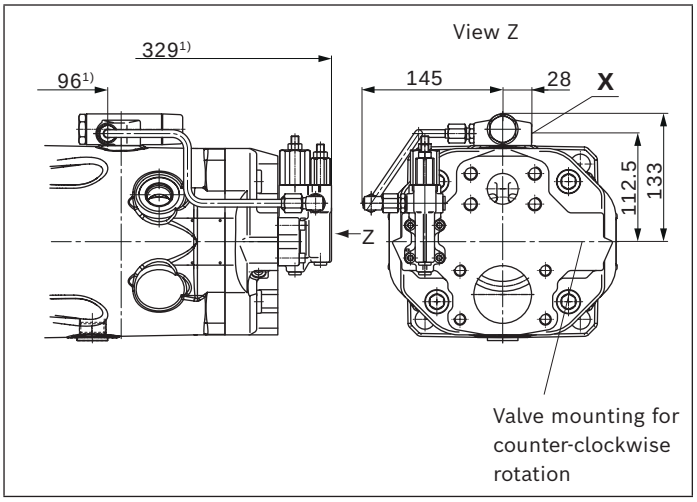

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



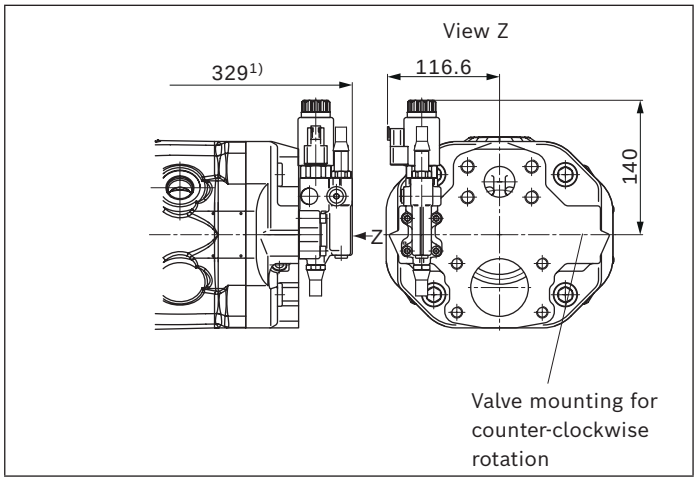

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



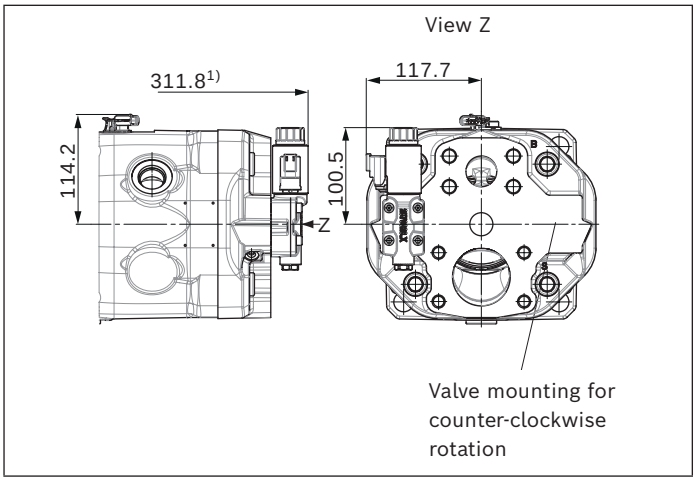

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



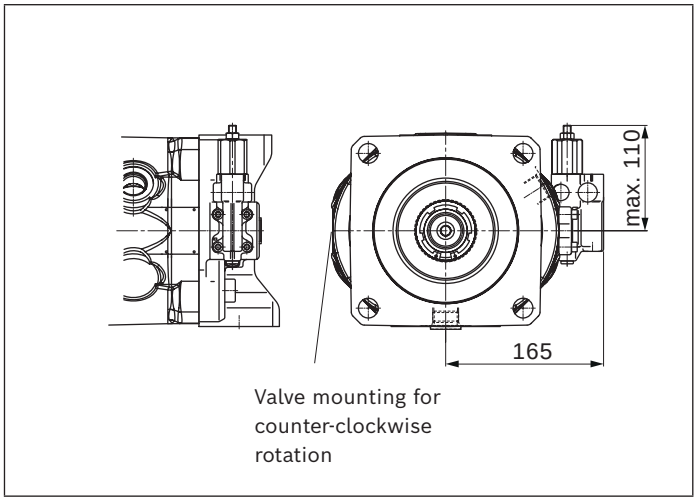

▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



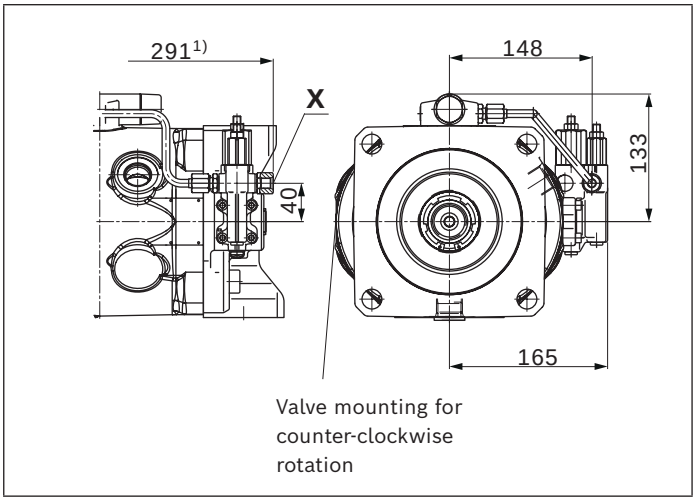

1) To mounting flange

## Port plate 12

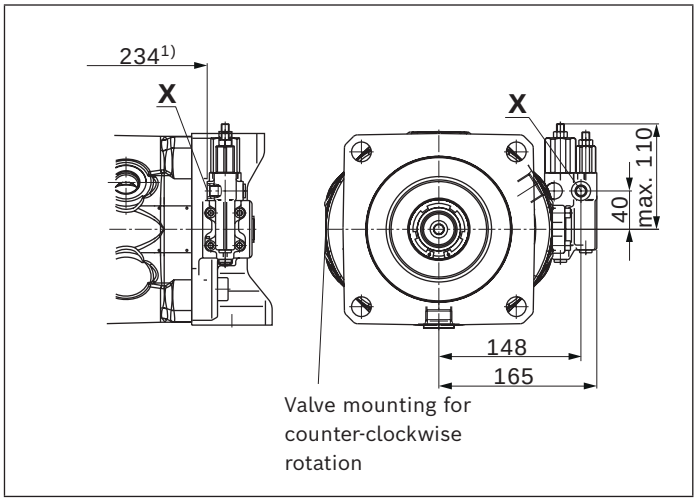
▼ **DR – Pressure controller; mounting flange D**



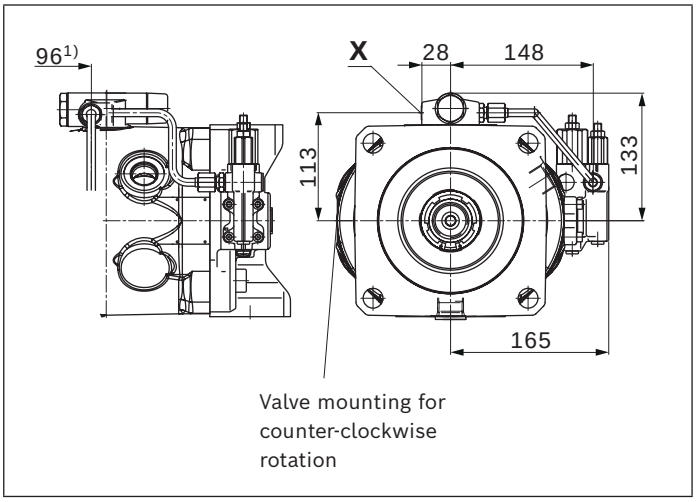

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



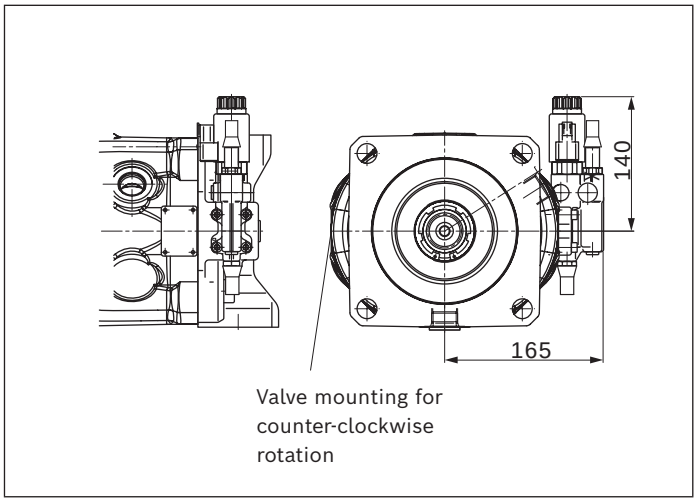

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



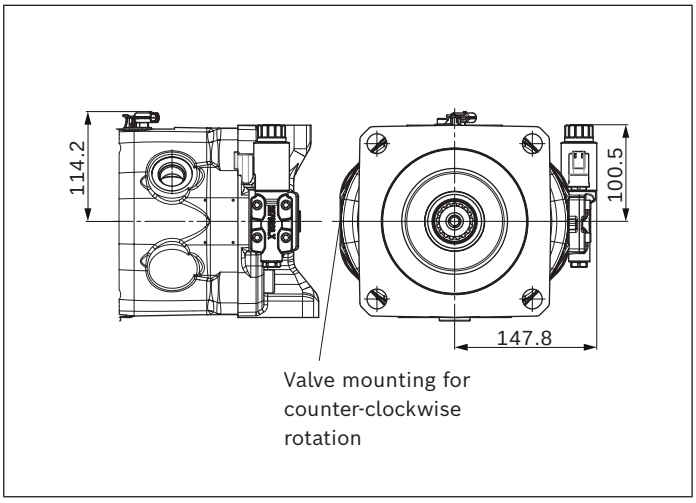

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



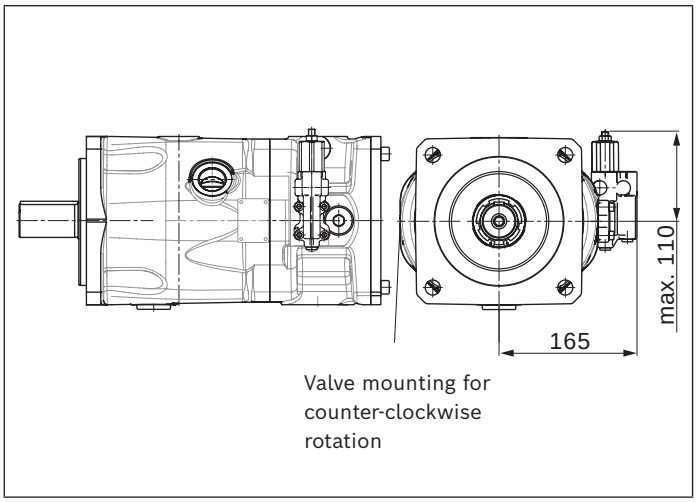

▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



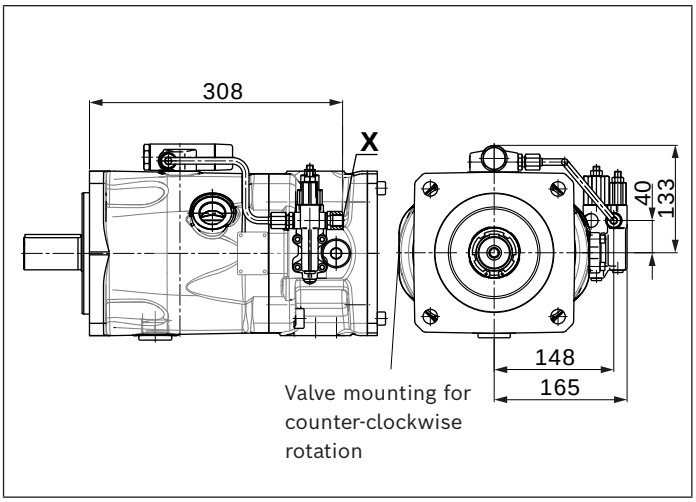

1) To mounting flange

## Port plate 22/72 and 32/82

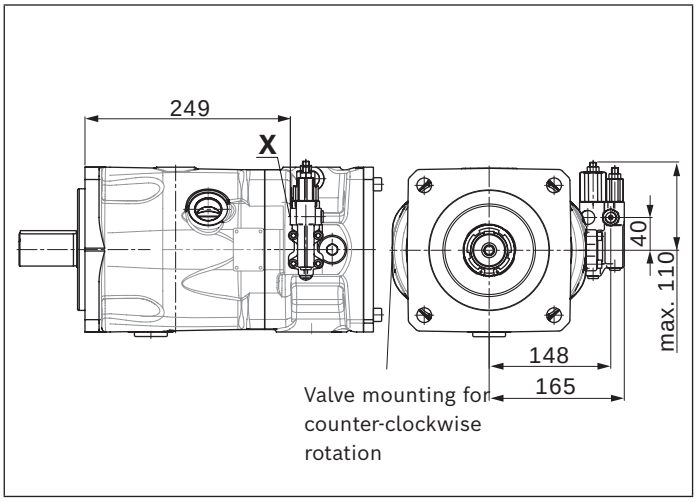
▼ **DR – Pressure controller; mounting flange D**



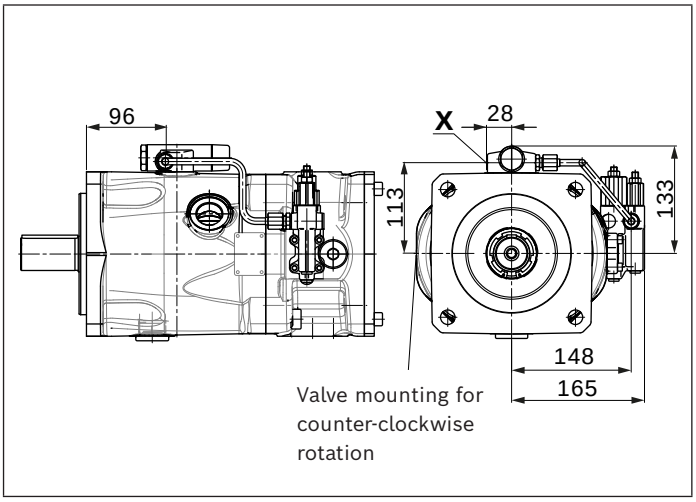

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



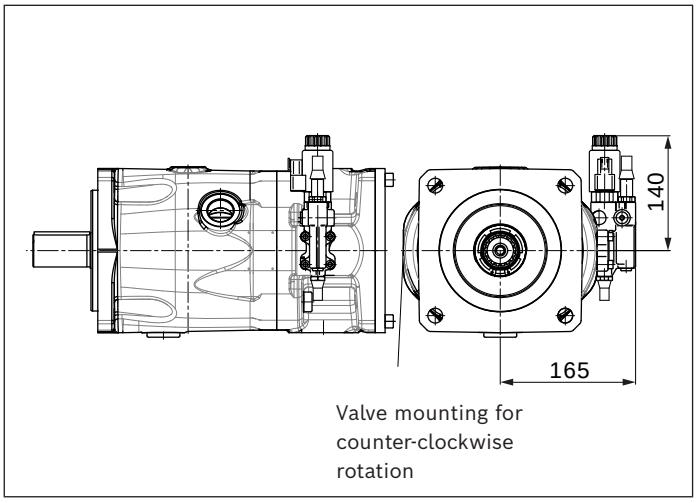

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



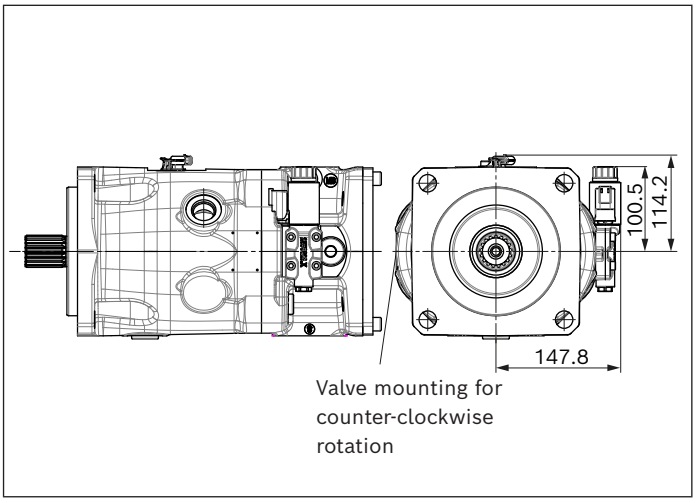

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



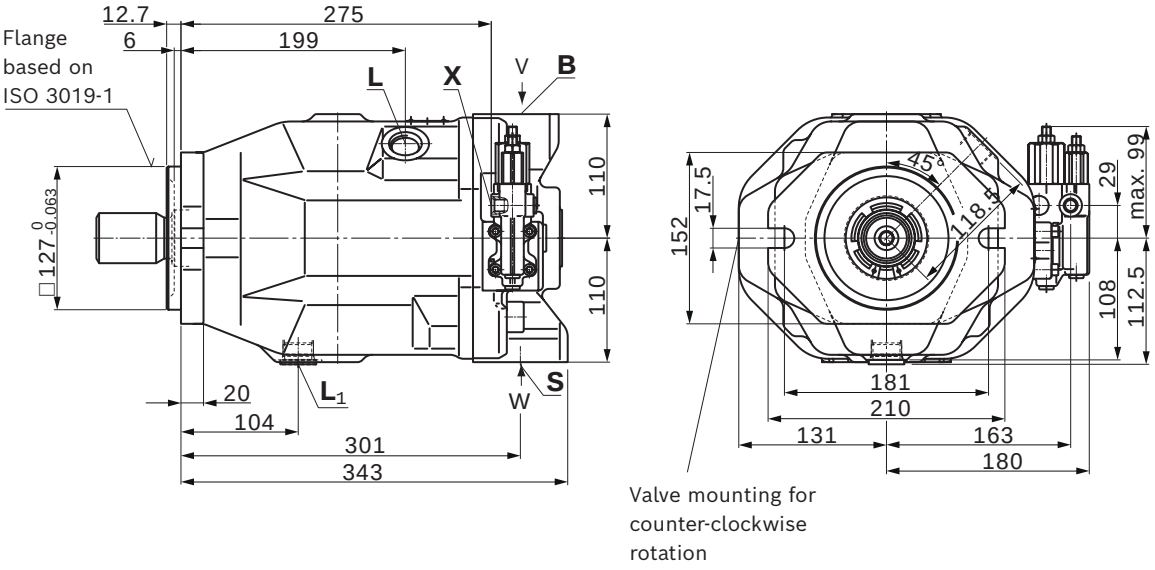

▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



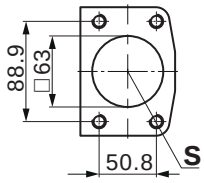
## Dimensions, size 140

### DRF, DRS, DRSC – Pressure flow controller, port plate 11/61 and 12/62; mounting flange C (SAE-C; 127-2)

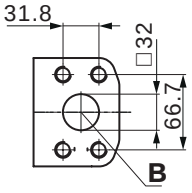
▼ **Port plate 12/62; mounting flange C**




Detail W

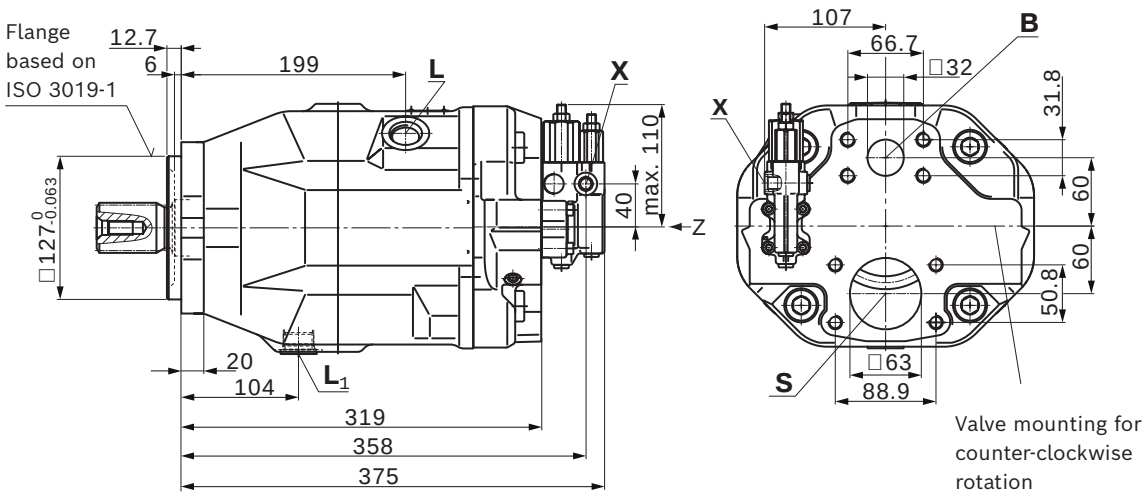



Detail V



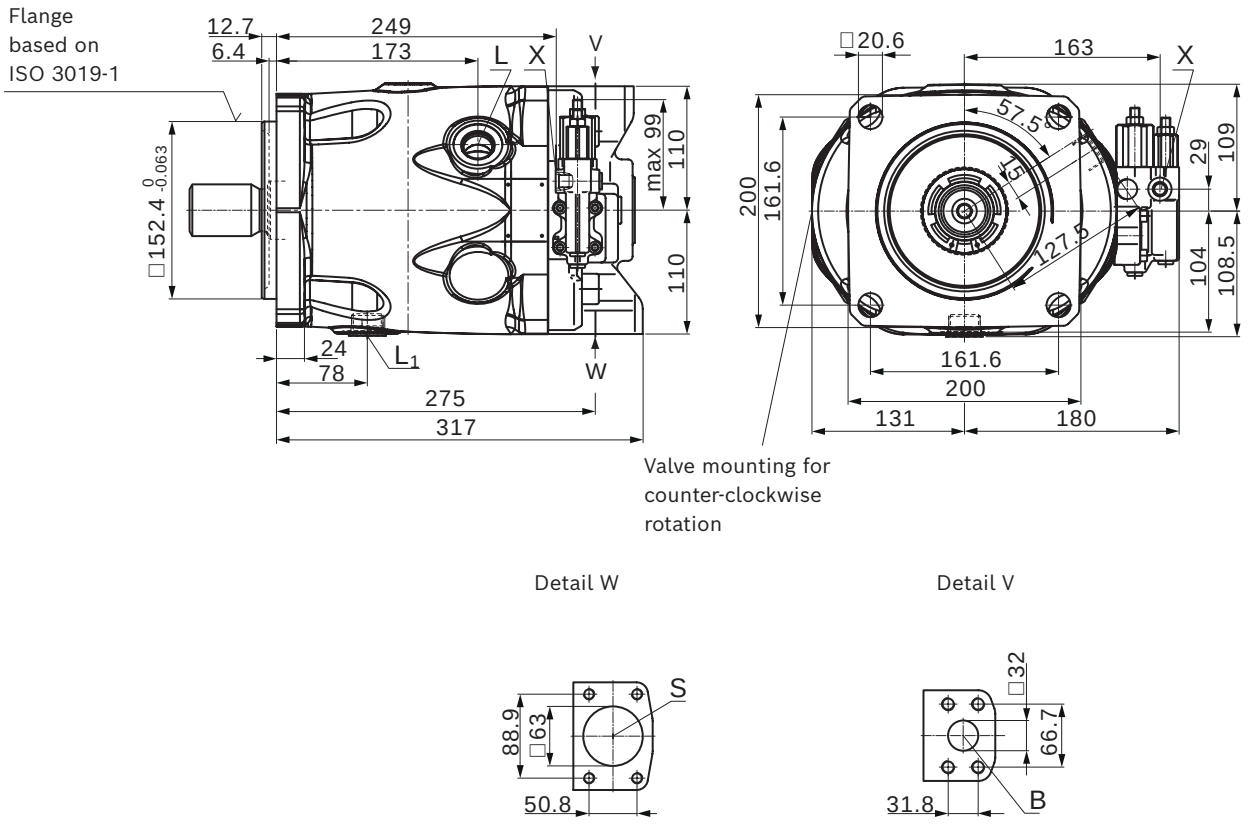

▼ **Port plate 11/61; mounting flange C**

View Z

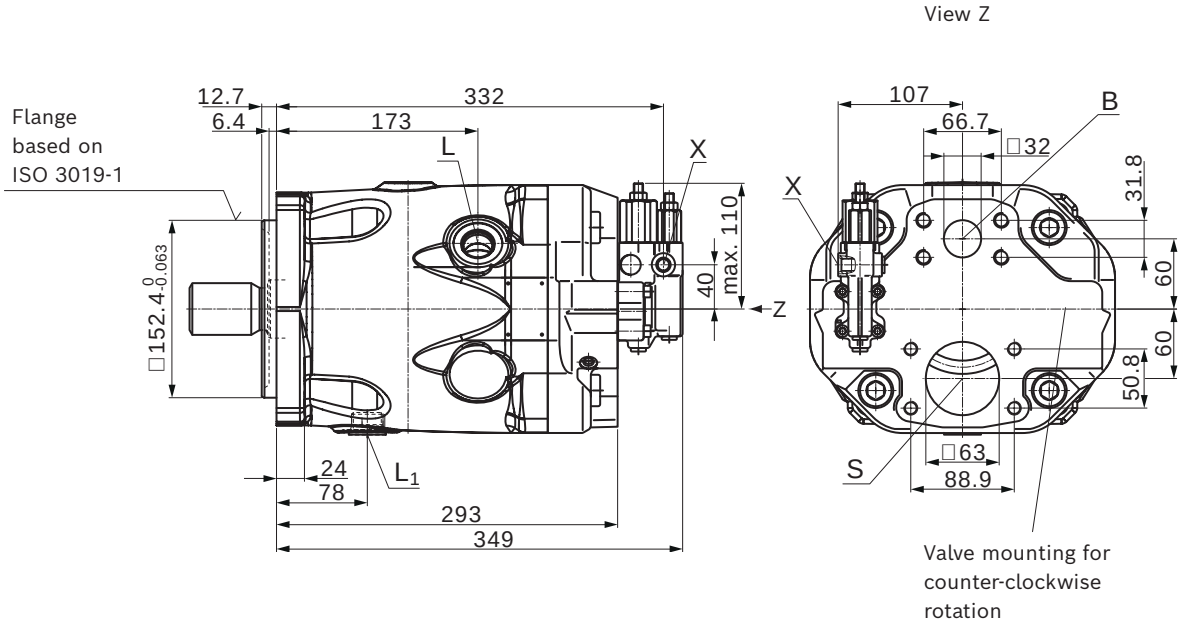


## DRF, DRS, DRSC – Pressure flow controller, port plate 11/61 and 12/62; mounting flange D (SAE-D; 152-4)

▼ **Port plate 12/62; mounting flange D**

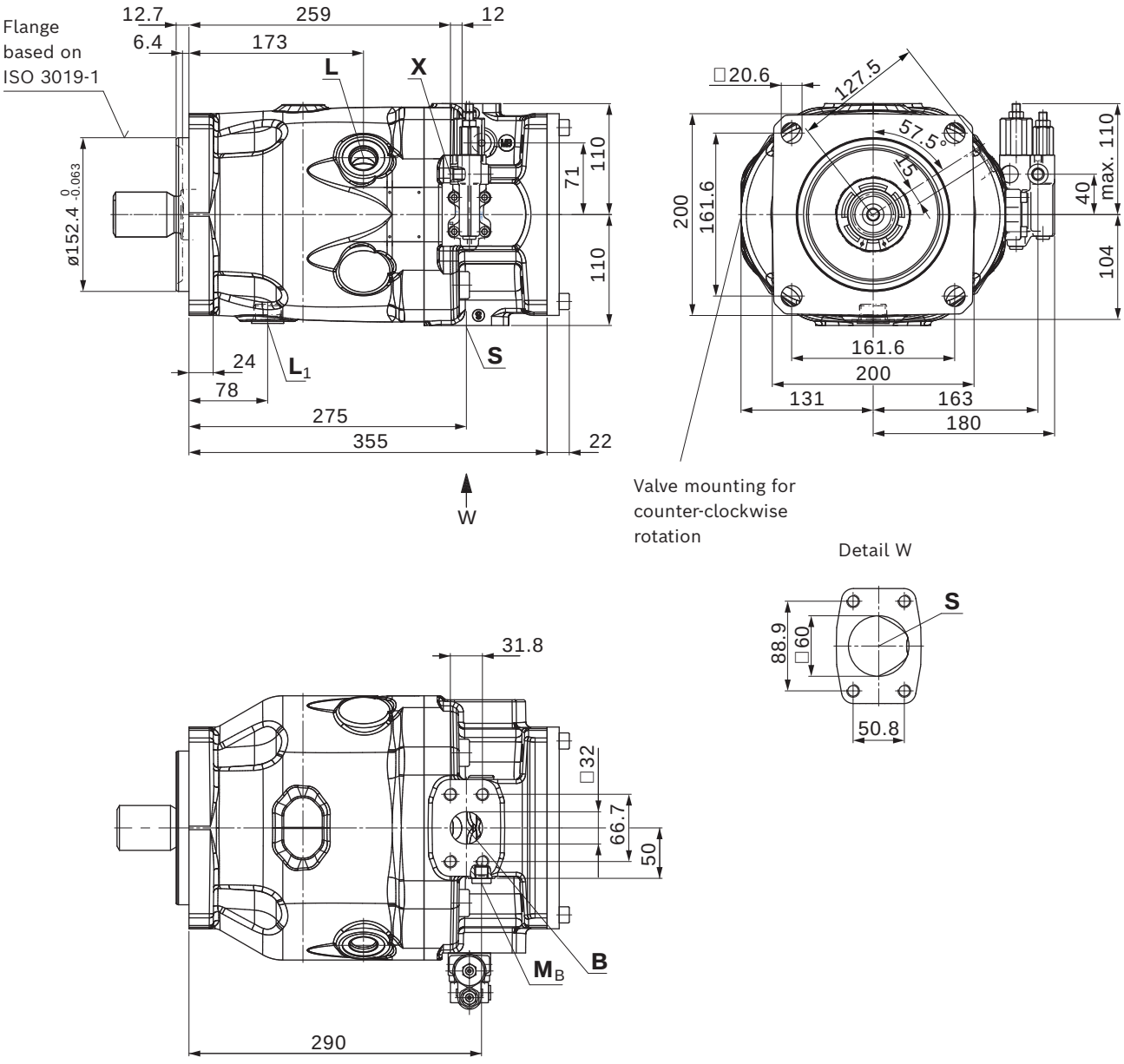



▼ **Port plate 11/61; mounting flange D**



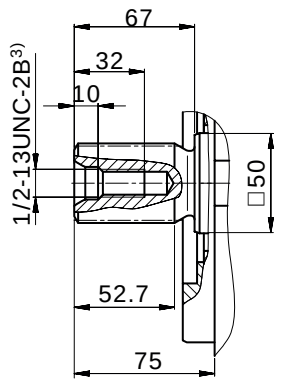
## DRF, DRS, DRSC – Pressure flow controller, port plate 22/72; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22/72; mounting flange D**



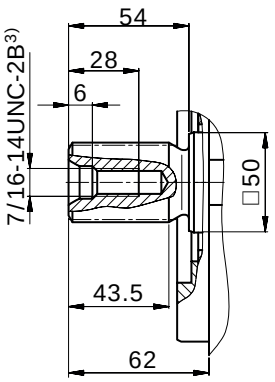
▼ **Splined shaft 1 3/4 in** (44-4, ISO 3019-1)

**S –** 13T 8/16DP[1)]



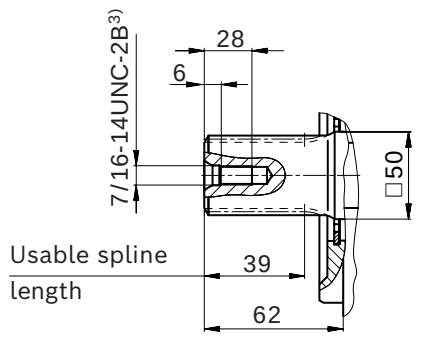

▼ **Splined shaft 1 1/2 in** (38-4, ISO 3019-1)

**U –** 17T 12/24DP[1)]




▼ **Splined shaft 1 1/2 in** (38-4, ISO 3019-1)

**W –** 17T 12/24DP[1)2)]

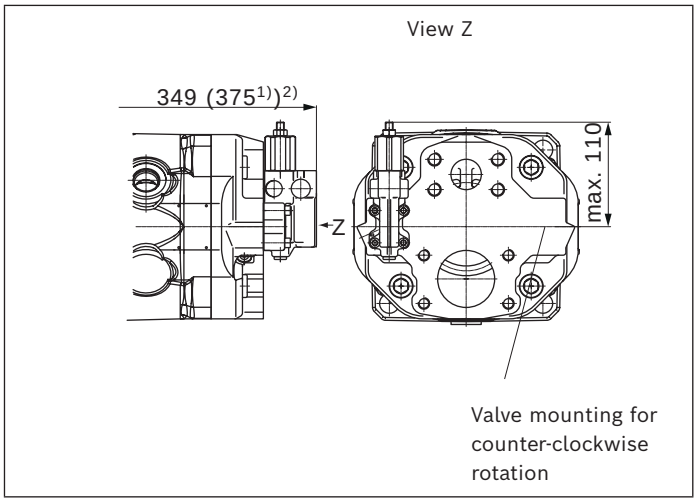



| **Port plate ports 11, 12 and 22** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
|---|---|---|---|---|---|
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>DIN 13 | 1 1/4 in<br>M14 x 2[8)]; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 2 1/2 in<br>M12 x 1.75; 17 (0.67) deep | 10 (145) | O |
| **Port plate ports 61, 62 and 72** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>ASME B1.1 | 1 1/4 in<br>1/2-13 UNC-2B; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 2 1/2 in<br>1/2-13 UNC-2B; 24 (0.94) deep | 10 (145) | O |
| **Other ports** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **L** | Drain port | ISO 11926[5)] | 1 1/16-12 UNF-2B; 20 (0.79) deep | 2 (30) | O[6)] |
| $\mathbf{L_1}$ | Drain port | ISO 11926[5)] | 1 1/16-12 UNF-2B; 20 (0.79) deep | 2 (30) | X[6)] |
| **X** | Pilot pressure | ISO 11926 | 7/16-20 UNF-2B; 11.5 (0.45) deep | 350 (5100) | O |
| $\mathbf{M_B}$ | Measuring pressure **B**<br>(only with port plates 22/72 and 32/82) | DIN 3852-2[5)] | G 1/4 in; 12 (0.47) deep | 350 (5100) | X |

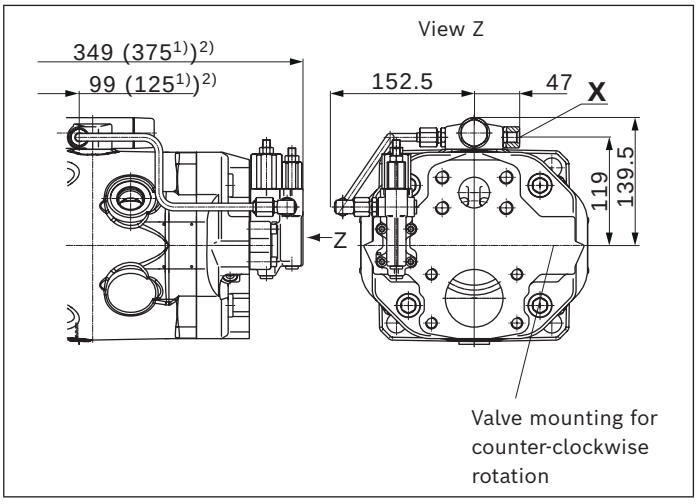
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, **L** or $\mathbf{L_1}$ must be connected (also see installation instructions on page73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
8) Fastening thread M14 deviating from standard ISO 6162-2.

## Port plate 11/61

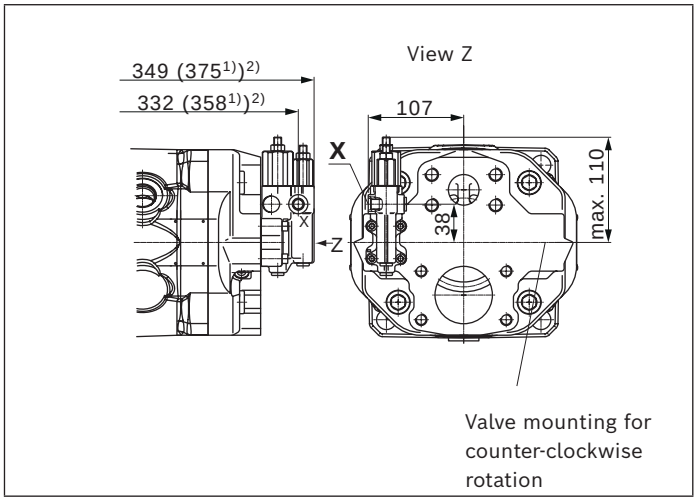
▼ **DR – Pressure controller; mounting flange D**



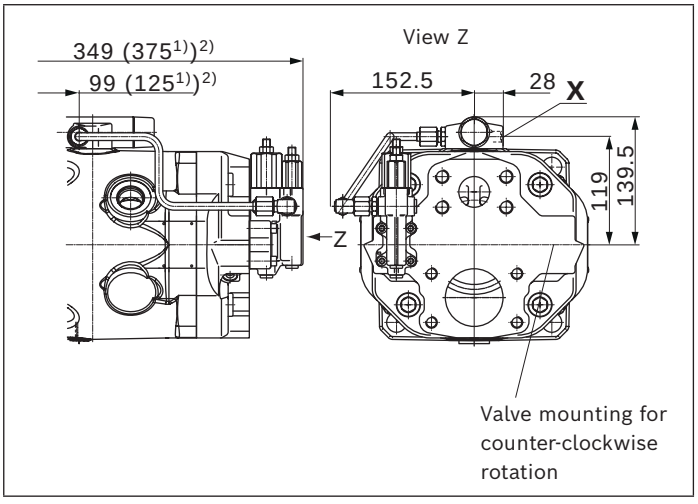

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



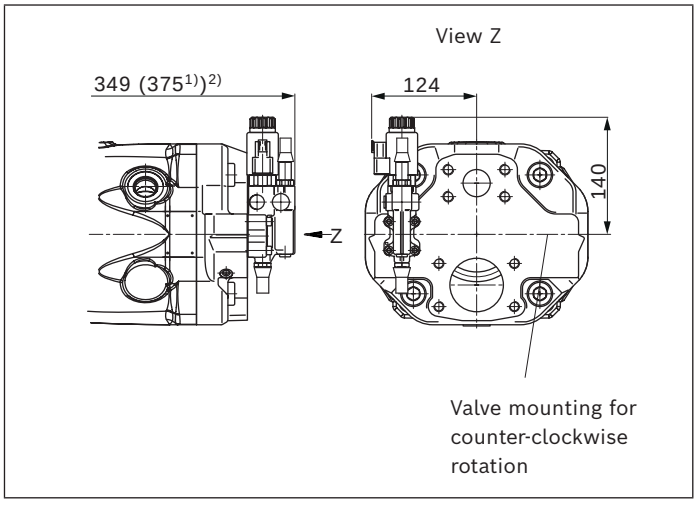

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



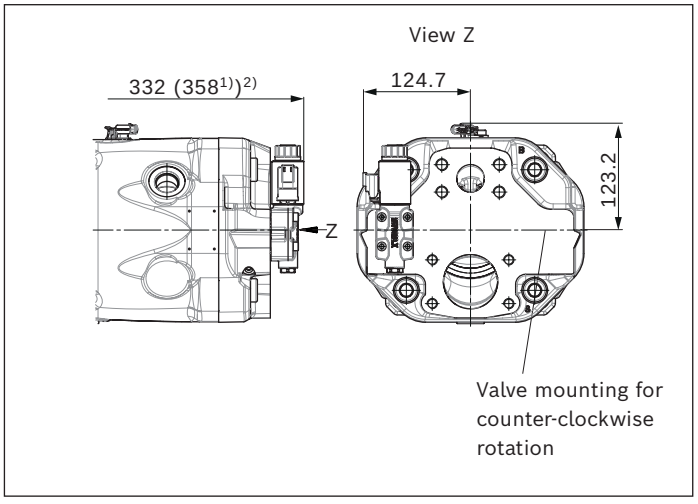

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



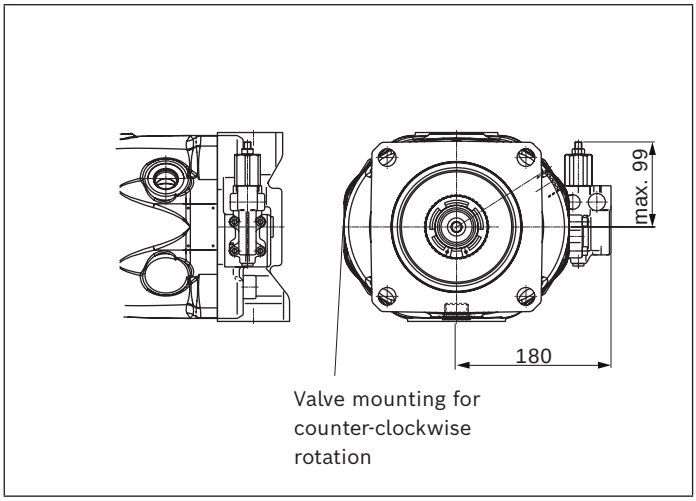

▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



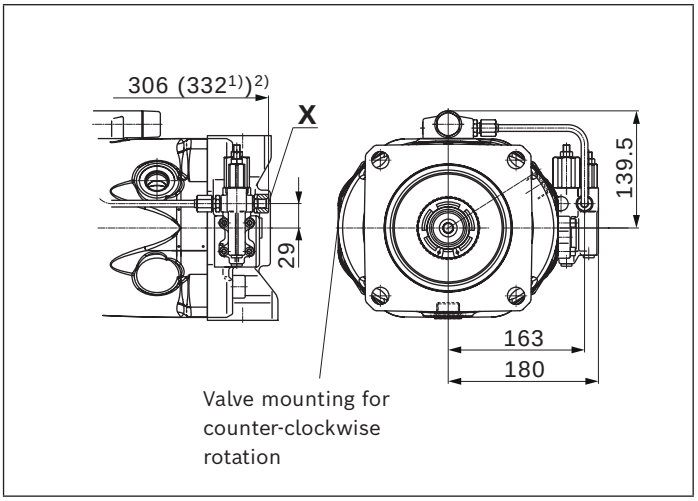

1) Dimension of mounting flange C
2) To mounting flange

## Port plate 12/62

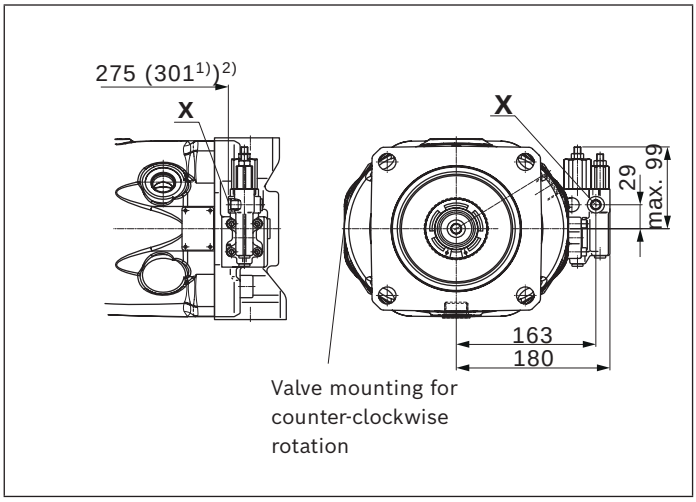
▼ **DR – Pressure controller; mounting flange D**



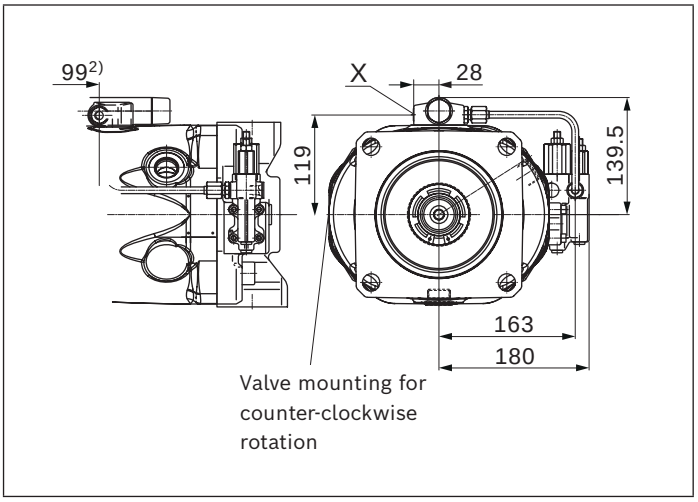

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



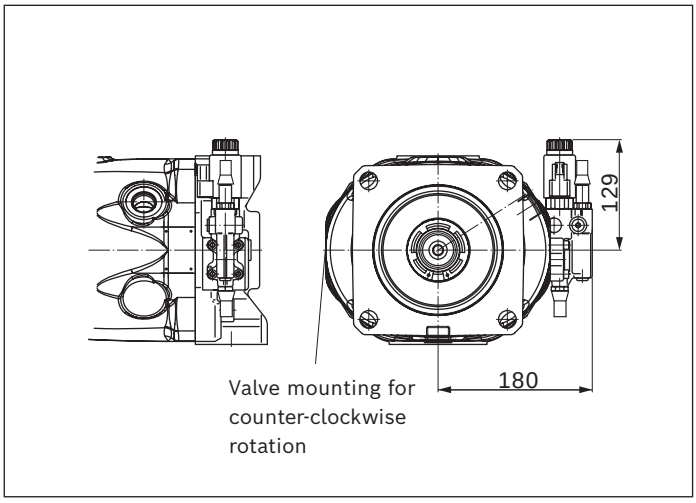

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



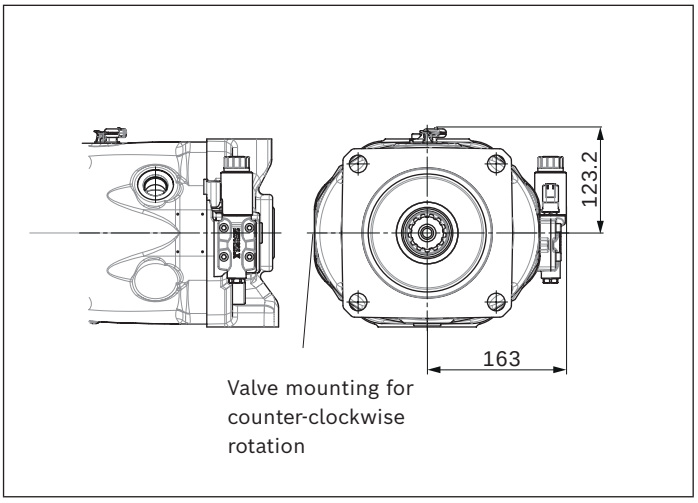

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**



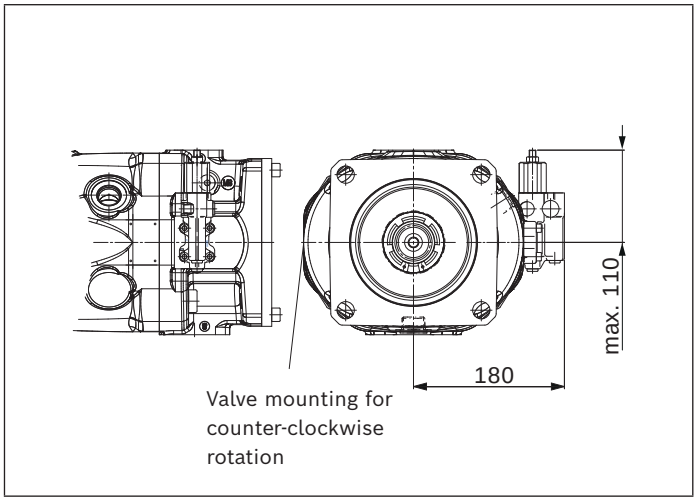

▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**



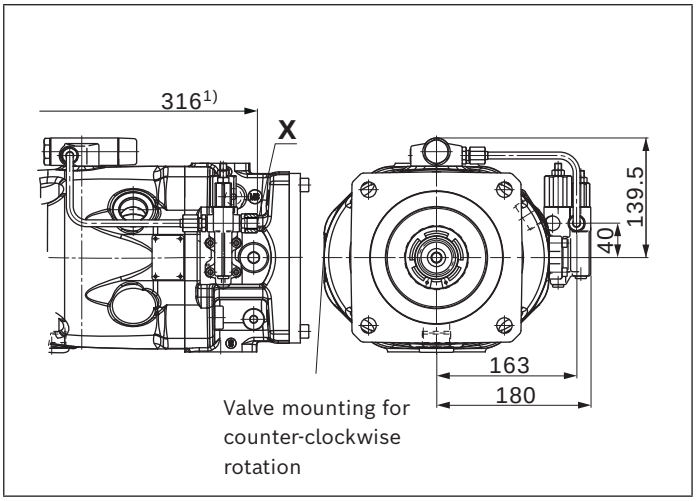

1) Dimension of mounting flange C
2) To mounting flange

## Port plate 22/72

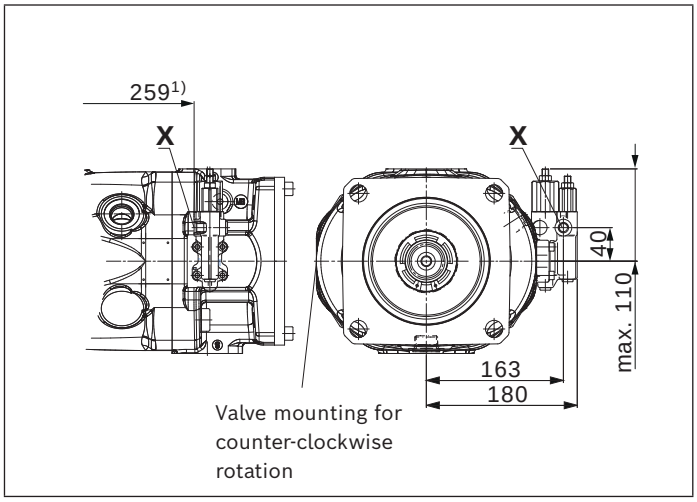
▼ **DR – Pressure controller; mounting flange D**



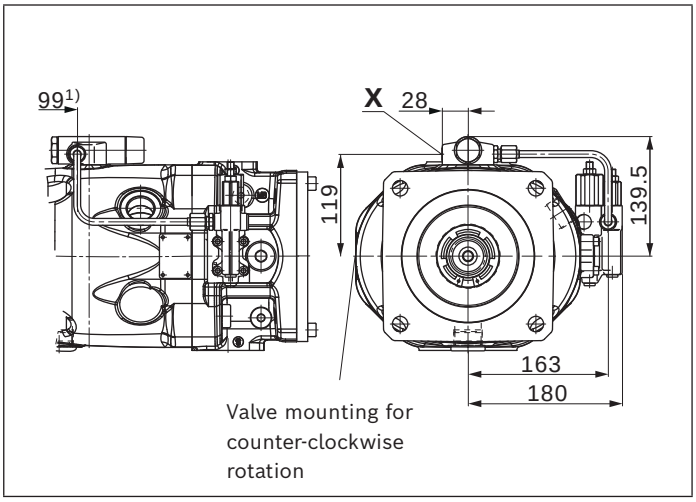

▼ **LA.DS – Pressure, flow and power controller; mounting flange D**



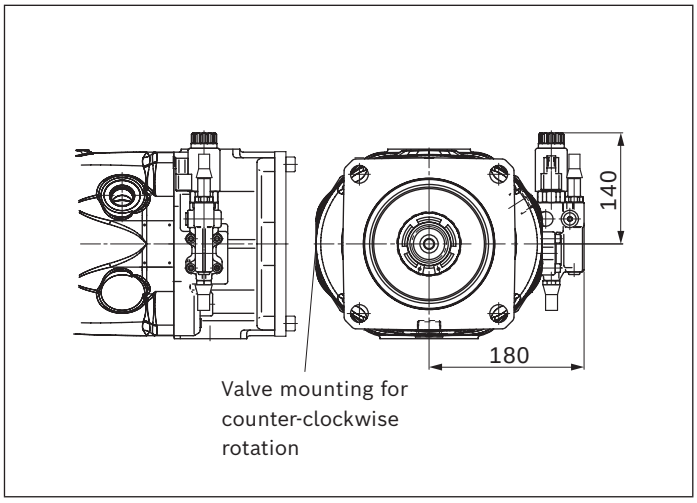

▼ **DRG – Pressure controller, remote controlled; mounting flange D**



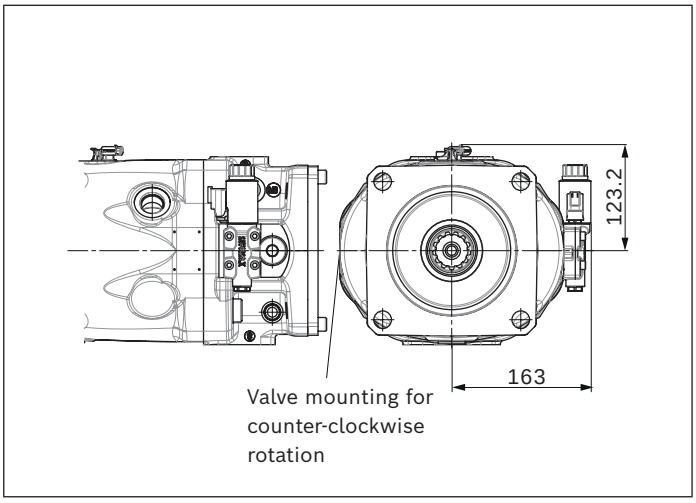

▼ **LA.DG – Power controller; with pressure cut-off, remote controlled; mounting flange D**




▼ **ED7./ER7. – Pressure controller, electric; mounting flange D**




▼ **EC4/EB4 – Electro-hydraulic control valve; mounting flange D**

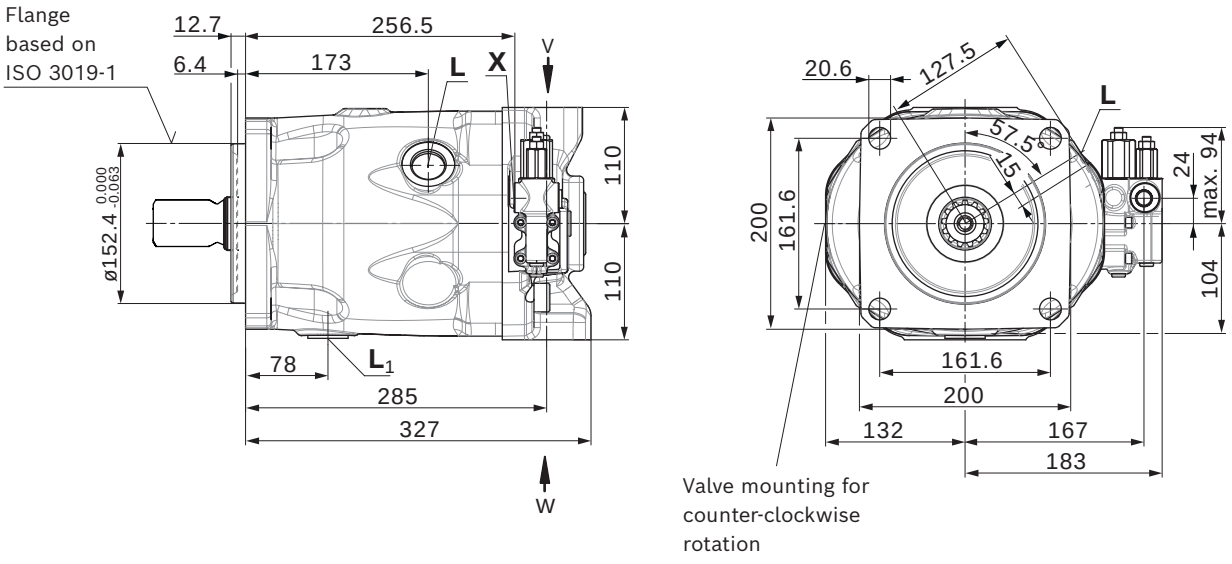


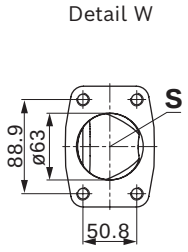

1) To mounting flange

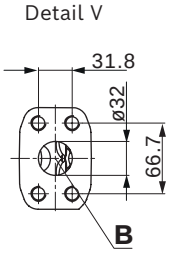
## Dimensions, size 180

### DRF, DRS, DRSC – Pressure flow controller, port plate 11/61, 12/62; mounting flange D (SAE-D; 152-4)

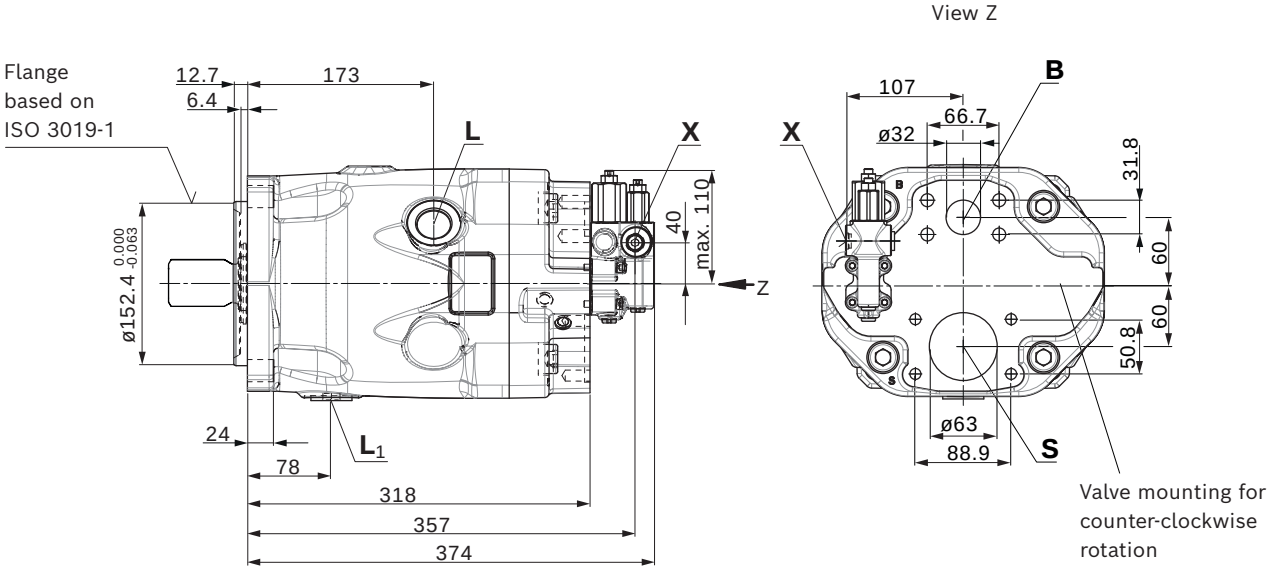
▼ **Port plate 12/62**



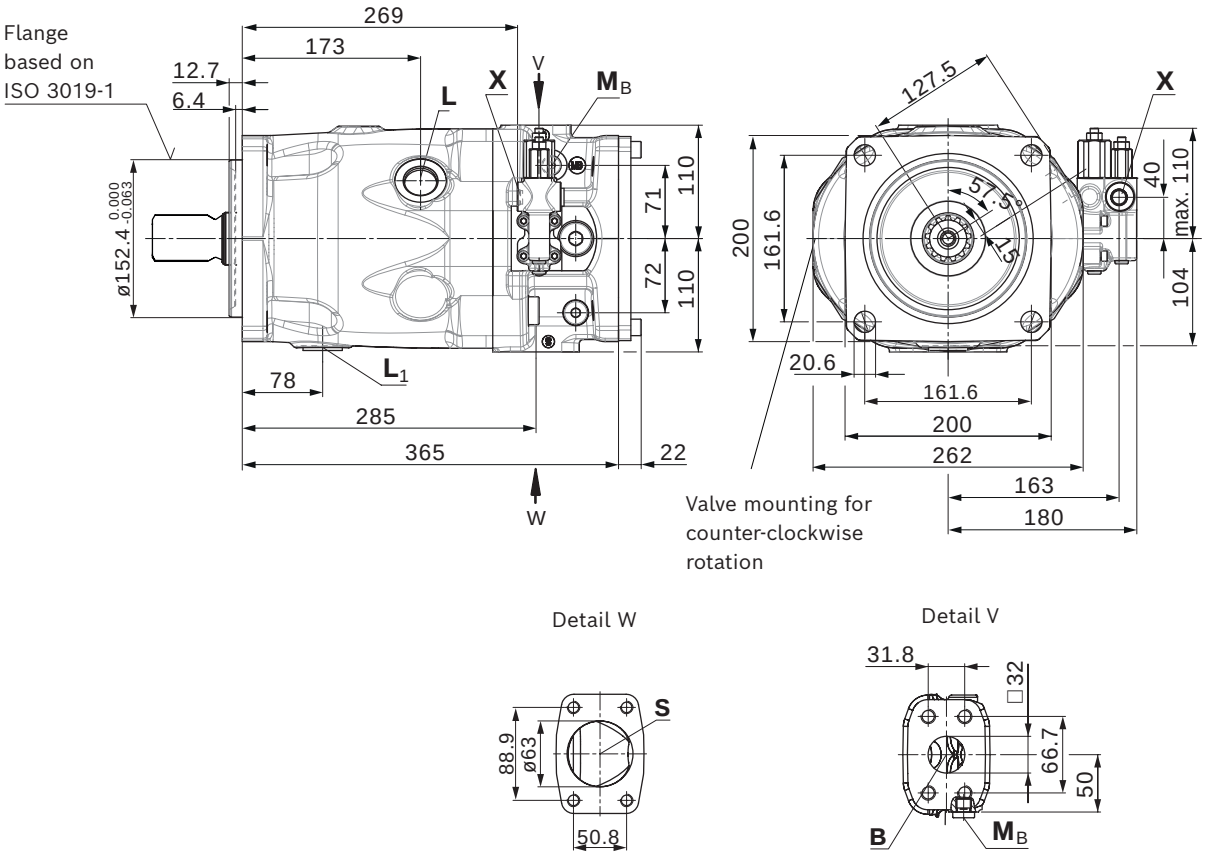

▼ **Port plate 11/61**



## Dimensions, size 180

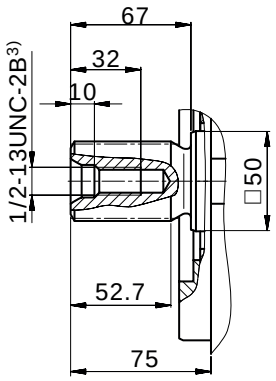
### DRF, DRS, DRSC – Pressure flow controller, port plate 22/72 and 32/82; mounting flange D (SAE-D; 152-4)

▼ **Port plate 22/72 and 32/82**



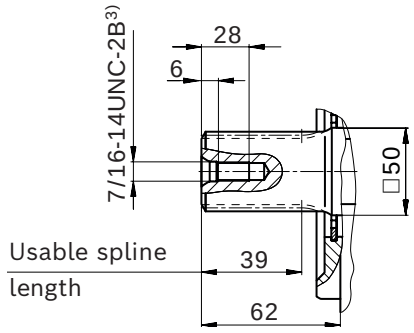
▼ **Splined shaft 1 3/4 in** (44-4, ISO 3019-1)

**S –** 13T 8/16DP[1)]




▼ **Splined shaft 1 1/2 in** (38-4, ISO 3019-1)

**W –** 17T 12/24DP[1)2)]

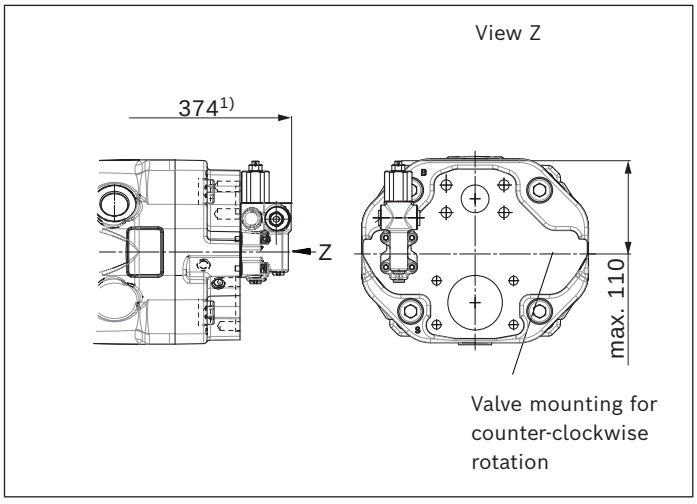



| **Port plate ports 11, 12, 22 and 32** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
|---|---|---|---|---|---|
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>DIN 13 | 1 1/4 in<br>M14 x 2[8)]; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>DIN 13 | 2 1/2 in<br>M12 x 1.75; 17 (0.67) deep | 10 (145) | O |
| **Port plate ports 61, 62, 72 and 82** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **B** | Working port (high-pressure series)<br>Fastening thread | ISO 6162-2<br>ASME B1.1 | 1 1/4 in<br>1/2-13 UNC-2B; 19 (0.75) deep | 350 (5100) | O |
| **S** | Suction port (standard pressure series)<br>Fastening thread | ISO 6162-1<br>ASME B1.1 | 2 1/2 in<br>1/2-13 UNC-2B; 24 (0.94) deep | 10 (145) | O |
| **Other ports** | | **Standard** | **Size** | $p_{max}$ **[bar (psi)]**[4)] | **State**[7)] |
| **L** | Drain port | ISO 11926[5)] | 1 5/16-12 UN-2B; 20 (0.79) deep | 2 (30) | O[7)] |
| **$L_1$** | Drain port | ISO 11926[5)] | 1 5/16-12 UN-2B; 20 (0.79) deep | 2 (30) | X[7)] |
| **X** | Pilot pressure | ISO 11926 | 7/16-20 UNF-2B; 11.5 (0.45) deep | 350 (5100) | O |
| **$M_B$** | Measuring pressure **B**<br>(only with port plates 22/72 and 32/82) | DIN 3852-2[5)] | G 1/4 in; 12 (0.47) deep | 350 (5100) | X |

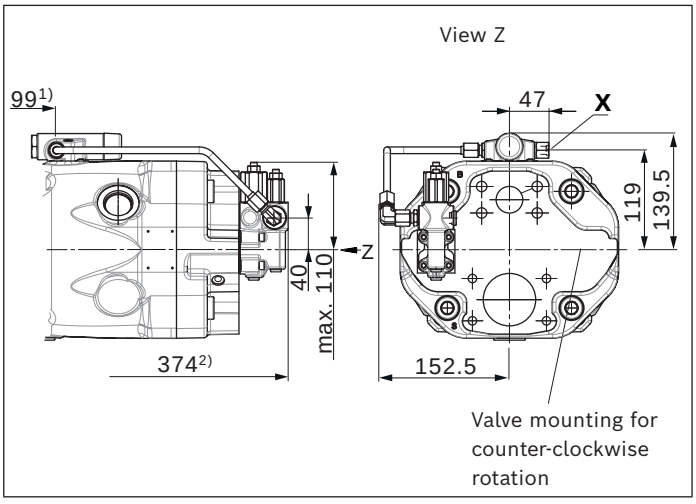
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, spline runout is a deviation from standard SAE J744.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, L or $L_1$ must be connected (also see installation instructions starting on page 73).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
8) Fastening thread M14 deviating from standard ISO 6162-2.

## Port plate 11/61

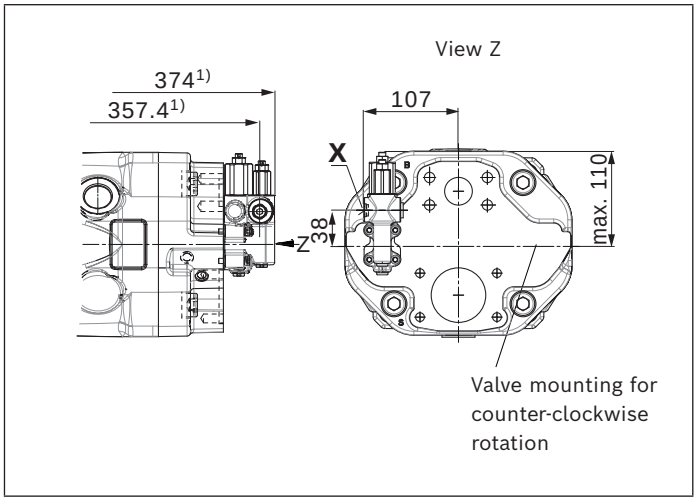
▼ **DR – Pressure controller**



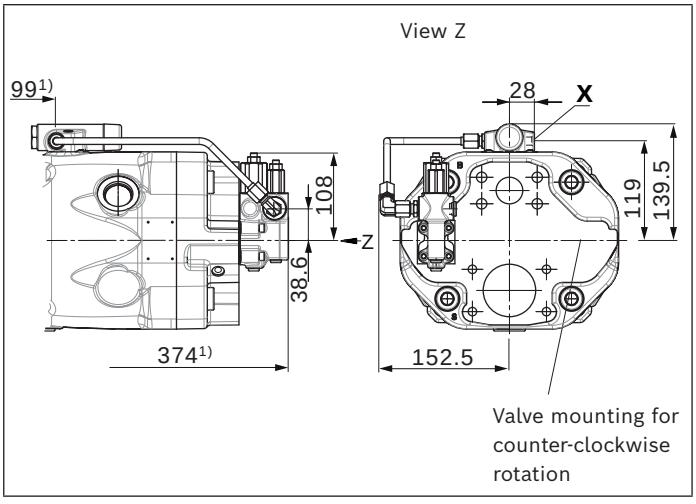

▼ **LA.DS – Pressure, flow and power controller**



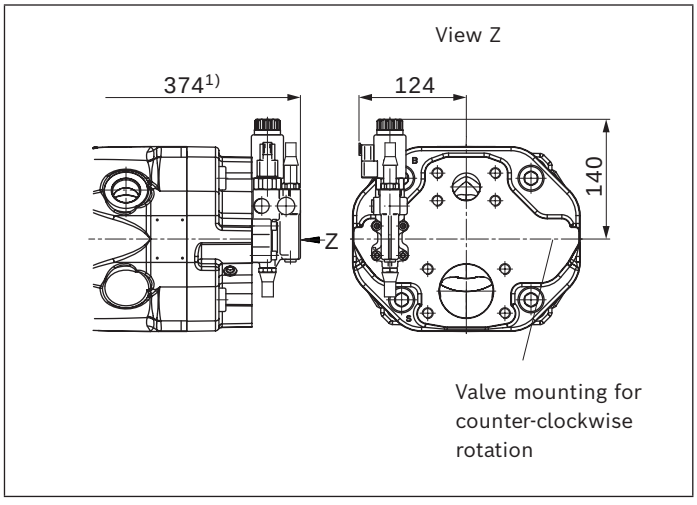

▼ **DRG – Pressure controller, remote controlled**




▼ **LA.DG – Power controller; with pressure cut-off, remote controlled**



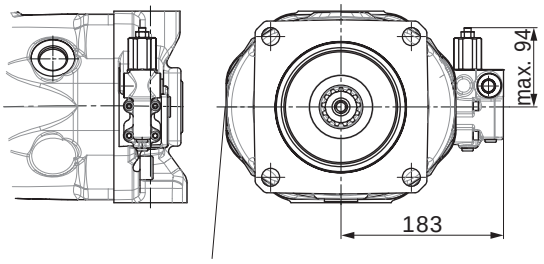

▼ **ED7./ER7. – Pressure controller, electric**



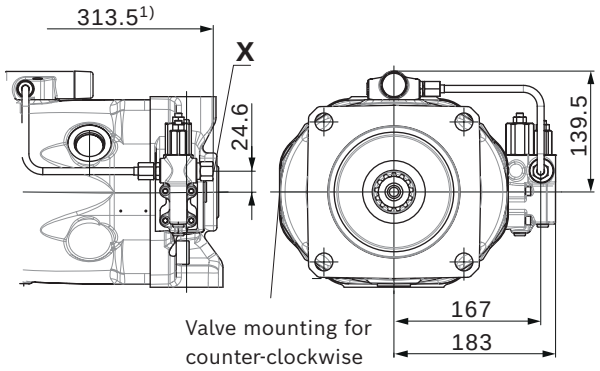

1) To mounting flange

## Port plate 12/62

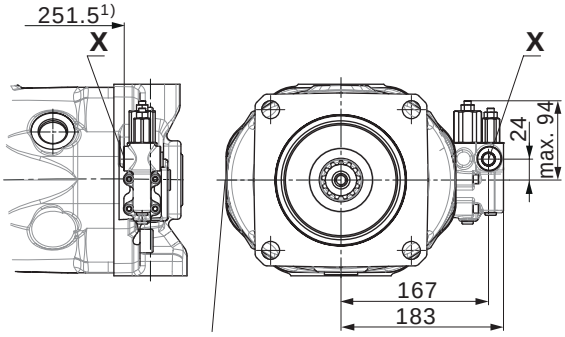
▼ **DR – Pressure controller**



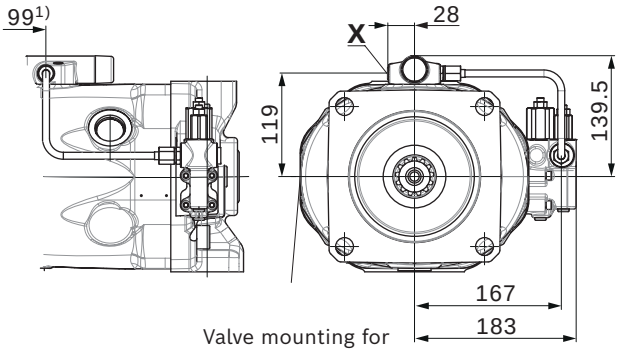

▼ **LA.DS – Pressure, flow and power controller**



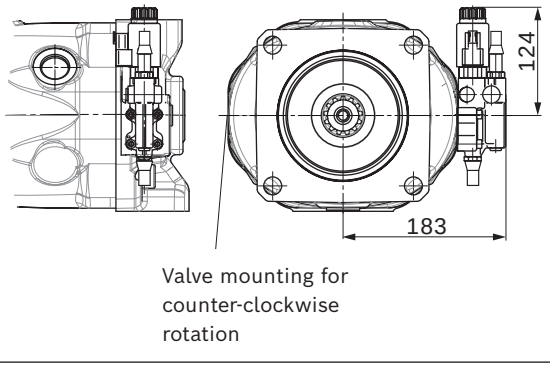

▼ **DRG – Pressure controller, remote controlled**




▼ **LA.DG – Power controller; with pressure cut-off, remote controlled**



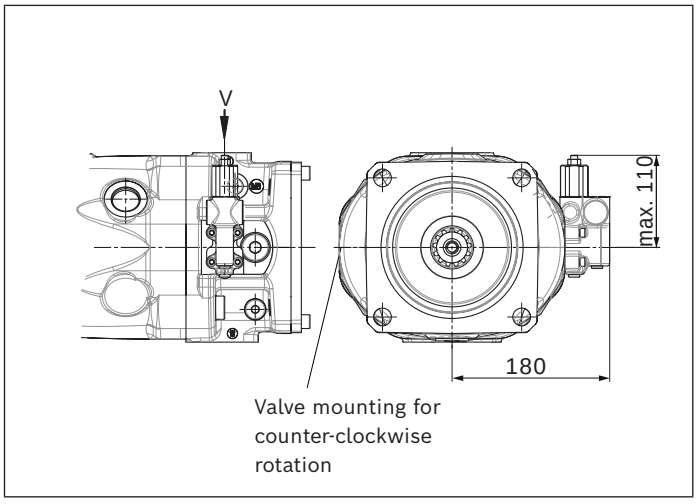

▼ **ED7./ER7. – Pressure controller, electric**



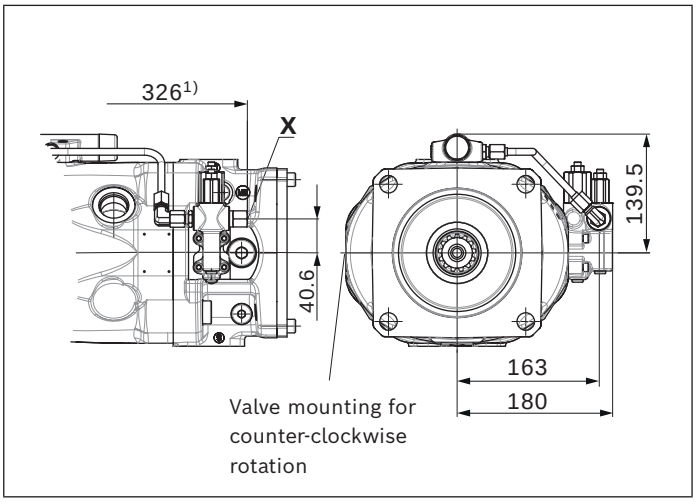

1) To mounting flange

## Port plate 22/72 and 32/82

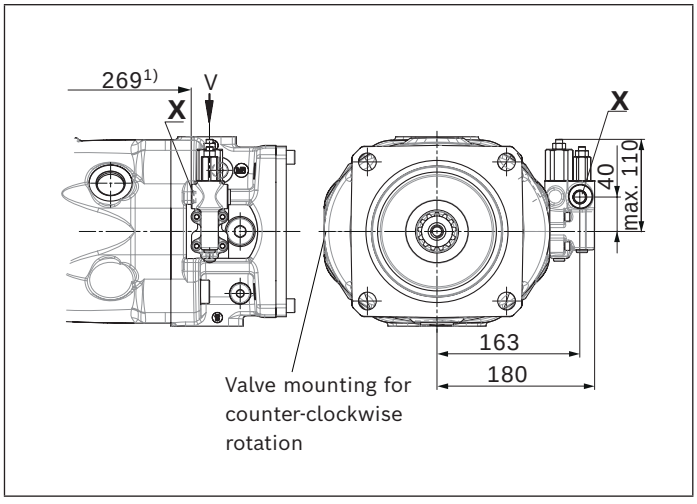
▼ **DR – Pressure controller**



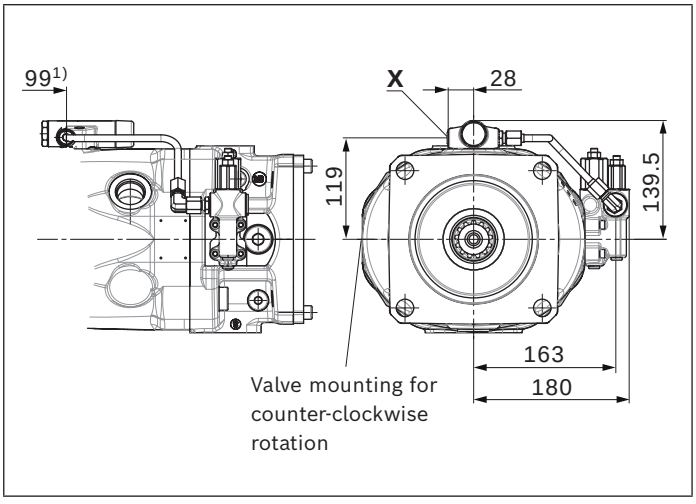

▼ **LA.DS – Pressure, flow and power controller**



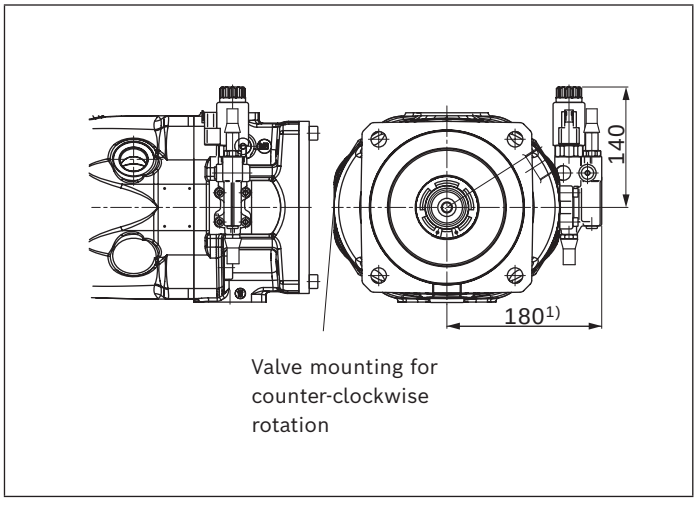

▼ **DRG – Pressure controller, remote controlled**




▼ **LA.DG – Power controller; with pressure cut-off, remote controlled**




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




1) To mounting flange

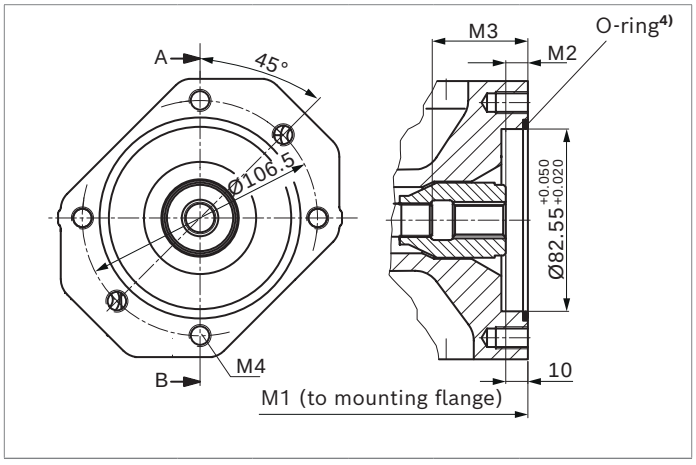
## Dimensions for through drives

### For flanges and shafts according to ISO 3019-1

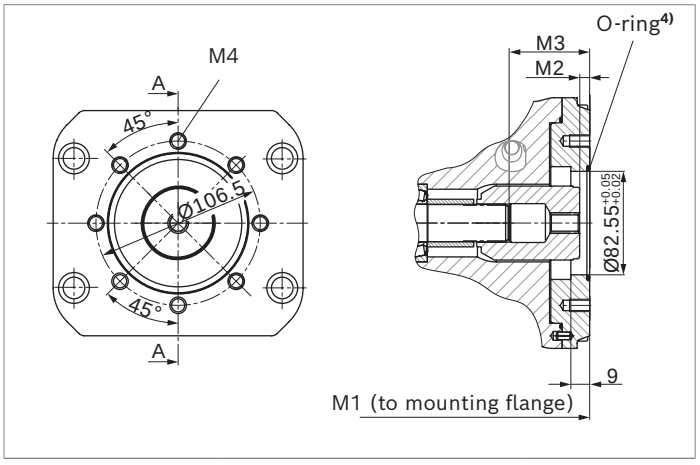
| Flange | | Hub for splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 82-2 (A) | ⚷, ☍, ⚯ | 5/8 in | 9T 16/32DP | ● | ● | ● | ● | – | K01 |
| | ⚷, ☍, ⚯ | 5/8 in | 9T 16/32DP | ○ | ● | ● | ● | ● | U01 |

● = Available ○ = On request – = Not available

▼ **82-2 (A)**




▼ **82-2 (A)**




| K01 (16-4 (A)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 229 | 10.1 | 52.7 | M10; |
| | | (9.02) | (0.49) | (2.07) | 16 (0.63) deep |
| | 71 | 267 | 11.2 | 60.6 | M10; |
| | | (10.5) | (0.44) | (2.39) | 20 (0.79) deep |
| | 100 | 338 | 8.8 | 33.1 | M10; |
| | | (13.31) | (0.35) | (1.30) | 16 (0.63) deep |
| | 140[5] | 350 | 10.1 | 76.6 | M10; |
| | | (13.78) | (0.49) | (3.01) | 16 (0.63) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U01 (16-4 (A)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 71 | 299 | 8.4 | 60.6 | M10; |
| | | (11.78) | (0.33) | (2.37) | 16 (0.63) deep |
| | 100 | 360 | 9.2 | 33.5 | M10; |
| | | (14.17) | (0.36) | (1.32) | 16 (0.63) deep |
| | 140 | 377 | On request | | |
| | | (14.84) | | | |
| | 180 | 387 | 10.8 | 77.1 | M10; |
| | | (15.23) | (0.42) | (3.04) | 16 (0.63) deep |

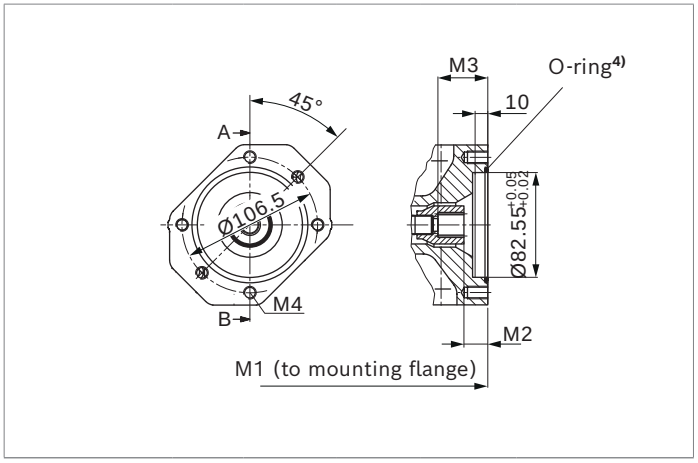
1) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top.
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

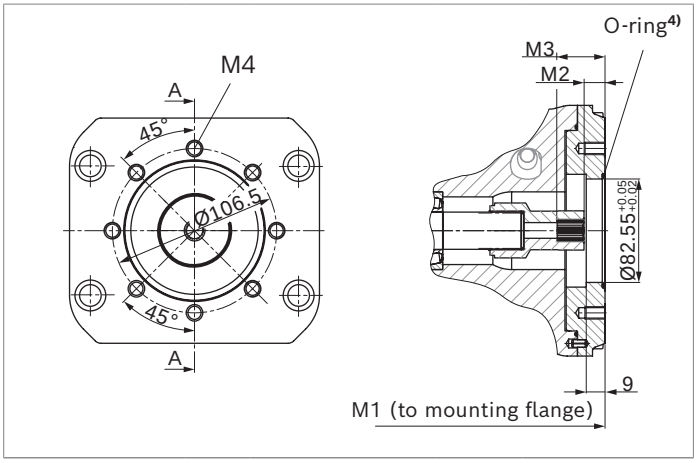
| Flange | | Hub for splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 82-2 (A) | ⚷, ☍, ⚯ | 3/4 in | 11T 16/32DP | ● | ● | ● | ● | – | K52 |
| | ⚷, ☍, ⚯ | 3/4 in | 11T 16/32DP | ● | ● | ● | ● | ● | U52 |

● = Available ○ = On request – = Not available

▼ **82-2 (A)**




▼ **82-2 (A)**




| K52 (19-4 (A-B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 229 | 18.4 | 38.8 | M10; |
| | | (9.02) | (0.72) | (1.53) | 16 (0.63) deep |
| | 71 | 267 | 20.8 | 41.2 | M10; |
| | | (10.51) | (0.82) | (1.62) | 20 (0.79) deep |
| | 100 | 338 | 18.6 | 39.6 | M10; |
| | | (13.31) | (0.73) | (1.56) | 16 (0.63) deep |
| | 140[5] | 350 | 18.4 | 39.4 | M10; |
| | | (13.78) | (0.72) | (1.55) | 16 (0.63) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U52 (19-4 (A-B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 264 | 19.0 | 39.4 | M10; |
| | | (10.39) | (0.75) | (1.55) | 16 (0.63) deep |
| | 71 | 299 | 20.8 | 41.2 | M10; |
| | | (11.77) | (0.82) | (1.62) | 20 (0.79) deep |
| | 100 | 360 | 19.0 | 40.0 | M10; |
| | | (14.17) | (0.75) | (1.58) | 16 (0.63) deep |
| | 140 | 377 | 18.6 | 39.6 | M10; |
| | | (14.84) | (0.73) | (1.56) | 20 (0.79) deep |
| | 180 | 387 | 18.9 | 39.9 | M10; |
| | | (15.24) | (0.74) | (1.57) | 16 (0.63) deep |

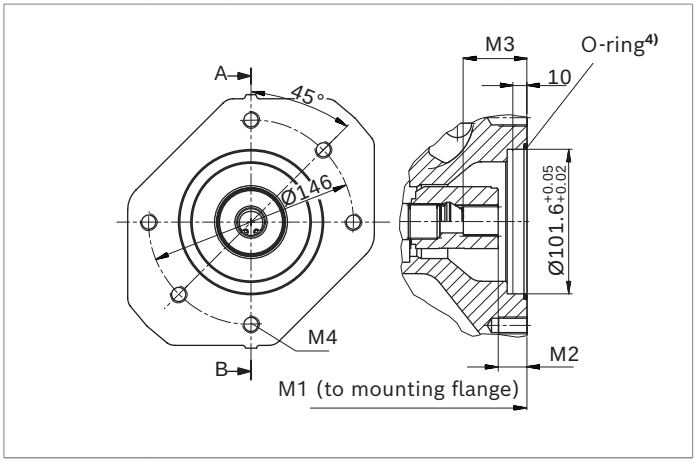
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top.
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

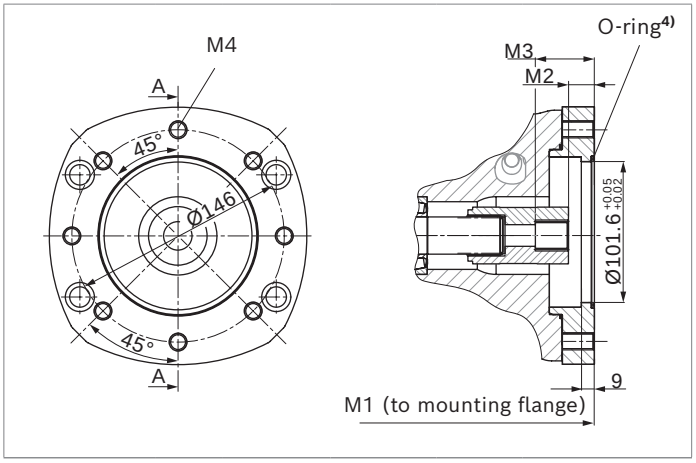
| Flange | | Hub for splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 101-2 (B) | ⚷, ☍, ⚯ | 7/8 in | 13T 16/32DP | ● | ● | ● | ● | – | K68 |
| | ⚷, ☍, ⚯ | 7/8 in | 13T 16/32DP | ● | ● | ● | ● | ● | U68 |

● = Available ○ = On request – = Not available

▼ **101-2 (B)**




▼ **101-2 (B)**




| K68 (22-4 (B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 229 | 17.4 | 41.8 | M12; |
| | | (9.02) | (0.68) | (1.64) | 18 (0.71) deep |
| | 71 | 267 | 19.8 | 44.2 | M12; |
| | | (10.5) | (0.78) | (1.74) | 20 (0.79) deep |
| | 100 | 338 | 17.6 | 41.9 | M12; |
| | | (13.31) | (0.69) | (1.65) | 20 (0.79) deep |
| | 140[5] | 350 | 17.4 | 41.7 | M12; |
| | | (13.78) | (0.68) | (1.63) | 20 (0.79) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U68 (22-4 (B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 264 | 18.0 | 42.4 | M12; |
| | | (10.39) | (0.71) | (1.67) | 22 (0.87) deep |
| | 71 | 299 | 19.8 | 44.2 | M12; |
| | | (11.77) | (0.78) | (1.74) | 22 (0.87) deep |
| | 100 | 360 | 18.0 | 42.3 | M12; |
| | | (14.17) | (0.71) | (1.66) | 22 (0.87) deep |
| | 140 | 377 | 17.6 | 41.9 | M12; |
| | | (14.84) | (0.69) | (1.65) | 22 (0.87) deep |
| | 180 | 387 | 17.9 | 42.2 | M12; |
| | | (15.24) | (0.70) | (1.67) | 22 (0.87) deep |

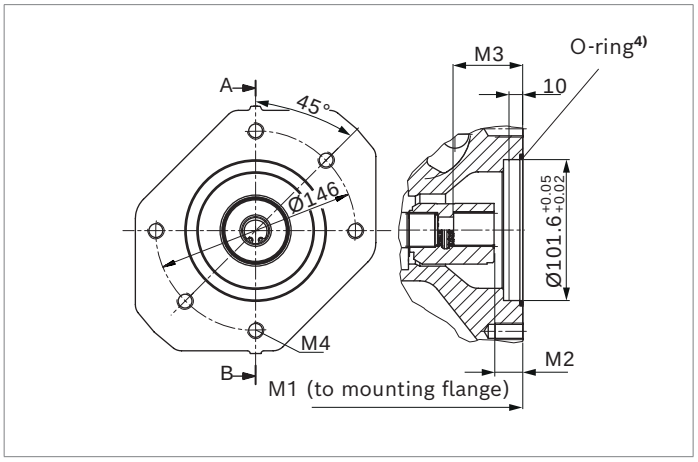
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

**For flanges and shafts according to ISO 3019-1**

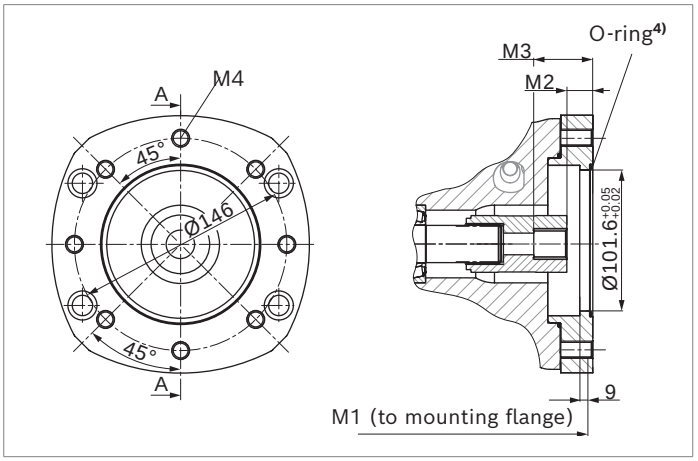
| Flange | | Splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 101-2 (B) | ⚷, ☍, ⚯ | 1 in | 15T 16/32DP | ● | ● | ● | ● | – | K04 |
| | ⚷, ☍, ⚯ | 1 in | 15T 16/32DP | ○ | ● | ● | ● | ● | U04 |

● = Available ○ = On request – = Not available

▼ **101-2 (B)**




▼ **101-2 (B)**




| K04 (25-4 (B-B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 45 | 229 | 17.9 | 47.4 | M12; |
| | | (9.02) | (0.70) | (1.87) | 18 (0.71) deep |
| | 71 | 267 | 20.3 | 49.2 | M12; |
| | | (10.5) | (0.80) | (1.94) | 20 (0.79) deep |
| | 100 | 338 | 17.8 | 46.6 | M12; |
| | | (13.31) | (0.69) | (1.83) | 20 (0.79) deep |
| | 140[5] | 350 | 17.9 | 47.4 | M12; |
| | | (13.78) | (0.70) | (1.87) | 20 (0.79) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U04 (25-4 (B-B)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 71 | 299 | 20.3 | 49.2 | M12; |
| | | (11.77) | (0.80) | (1.94) | 22 (0.87) deep |
| | 100 | 360 | 18.2 | 47.0 | M12; |
| | | (14.17) | (0.71) | (1.85) | 22 (0.87) deep |
| | 140 | 377 | 18.1 | 47.6 | M12; |
| | | (14.84) | (0.71) | (1.87) | 22 (0.87) deep |
| | 180 | 387 | 18.4 | 47.9 | M12; |
| | | (15.24) | (0.72) | (1.88) | 22 (0.87) deep |

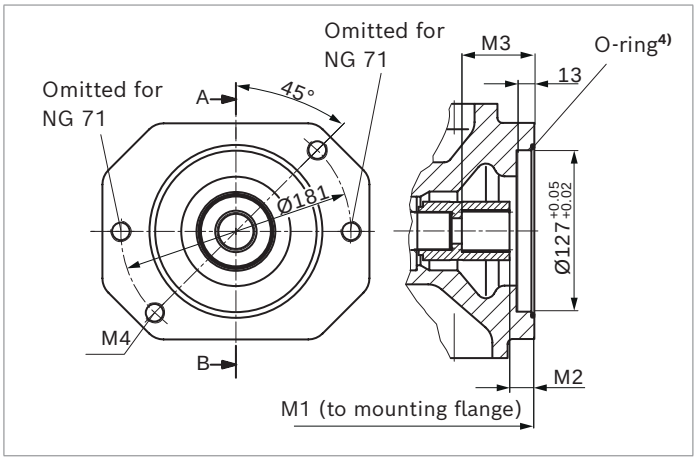
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

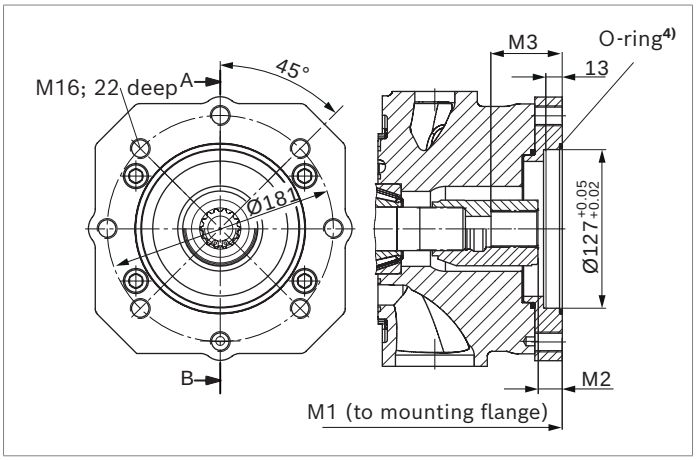
| Flange | | Splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 127-2 (C) | ⚬, ⚬ | 1 1/4 in | 14T 12/24DP | – | ● | ● | ● | – | K07 |
| | ⚬, ⚬, ⚬ | 1 1/4 in | 14T 12/24DP | – | ● | ● | ● | ● | U07 |

● = Available ○ = On request – = Not available

▼ **127-2 (C)**




▼ **127-2 (C)**




| K07 (32-4 (C)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 71 | 267 | 20.3 | 58.3 | M16; |
| | | (10.51) | (0.80) | (2.29) | continuous |
| | 100 | 338 | 19.1 | 57.1 | M16; |
| | | (13.31) | (0.75) | (2.27) | continuous |
| | 140[5] | 350 | 18.9 | 56.2 | M16; |
| | | (13.78) | (0.74) | (2.21) | 24 (0.94) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U07 (32-4 (C)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 71 | 299 | 20.3 | 58.3 | M16; |
| | | (11.77) | (0.80) | (2.29) | 22 (0.87) deep |
| | 100 | 360 | 19.5 | 57.5 | M16; |
| | | (14.17) | (077) | (2.26) | 22 (0.87) deep |
| | 140 | 377 | 19.1 | 56.4 | M16; |
| | | (14.84) | (0.75) | (2.22) | 22 (0.87) deep |
| | 180 | 387 | 19.4 | 56.7 | M16; |
| | | (15.24) | (0.76) | (2.23) | 22 (0.87) deep |

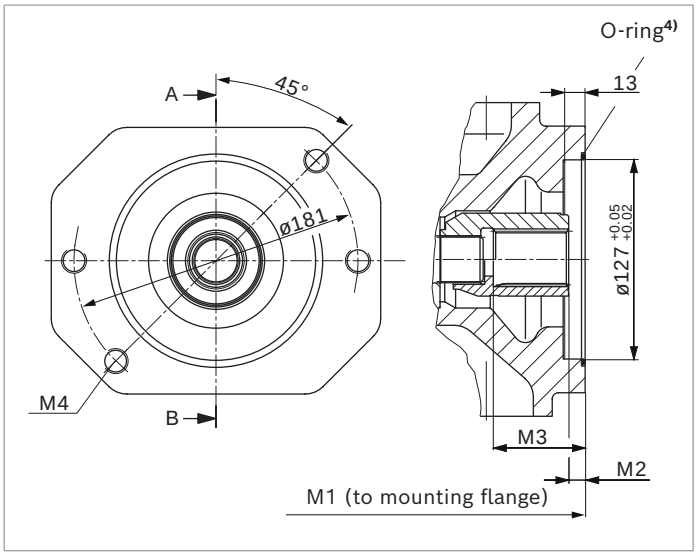
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

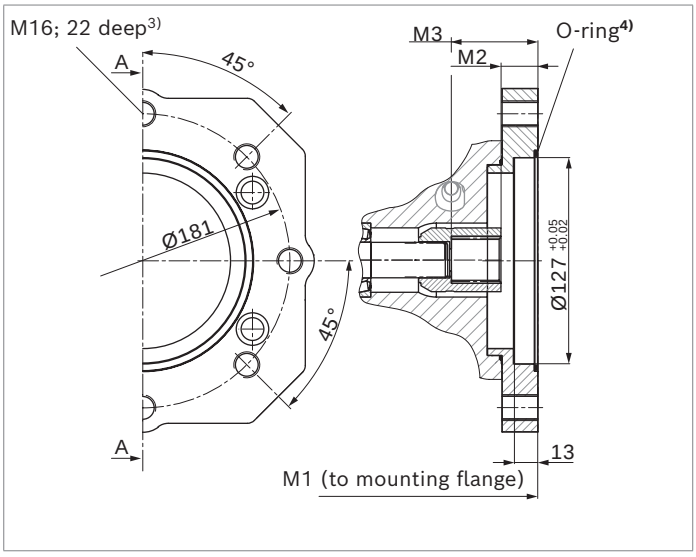
| Flange | | Splined shaft[1] | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | 45 | 71 | 100 | 140 | 180 | |
| 127-2 (C) | ☍, ⚯ | 1 1/2 in 17T 12/24DP | – | – | ● | ● | – | K24 |
| | ⚷, ☍, ⚯ | 1 1/2 in 17T 12/24DP | – | – | ● | ● | ● | U24 |

● = Available ○ = On request – = Not available

▼ **127-2 (C)**




▼ **127-2 (C)**




| K24 (38-4 (C-C)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 100 | 323 | 10.0 | 64.3 | M16; |
| | | (12.72) | (0.39) | (2.53) | continuous |
| | 140[5] | 350 | 9.4 | 68.4 | M16; |
| | | (13.78) | (0.37) | (2.69) | 24 (0.94) deep |
| | 140[6] | 376 | | | |
| | | (14.80) | | | |

| U24 (38-4 (C-C)) | NG | M1 | M2[7] | M3[7] | M4[3][8] |
|---|---|---|---|---|---|
| | 100 | 360 | 21.0 | 63.0 | M16; |
| | | (14.17) | (0.83) | (2.48) | 22 (0.87) deep |
| | 140 | 377 | 9.6 | 68.6 | M16; |
| | | (14.84) | (0.38) | (2.70) | 22 (0.87) deep |
| | 180 | 387 | 9.9 | 68.9 | M16; |
| | | (15.24) | (0.39) | (2.71) | 22 (0.87) deep |

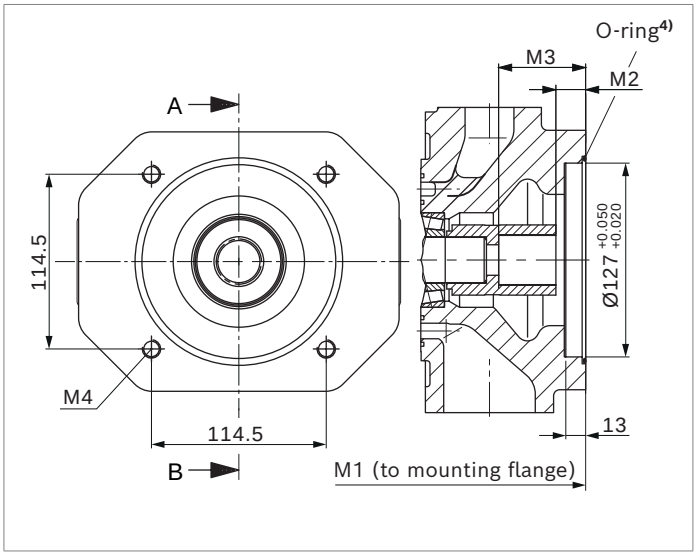
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) With D-flange
6) With C-flange
7) Minimum dimension
8) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

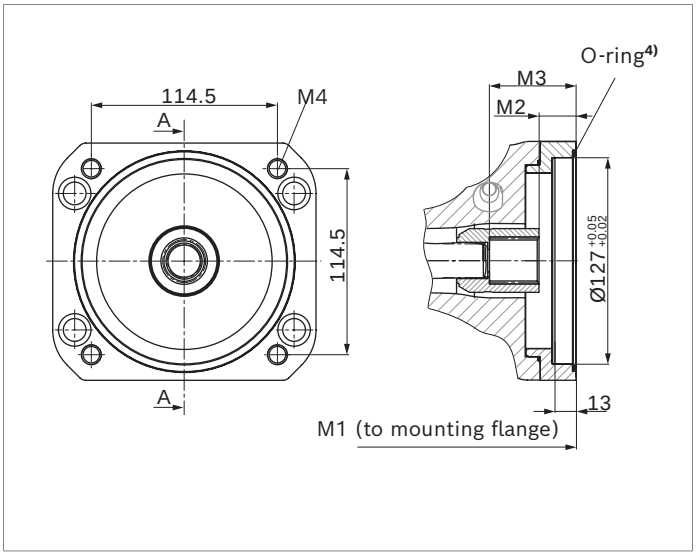
| Flange | | Splined shaft[1] | | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | | 45 | 71 | 100 | 140 | 180 | |
| 127-4 (C) | ⌘ | 1 1/4 in | 14T 12/24DP | – | ○ | ● | ● | – | K15 |
| | | 1 1/4 in | 14T 12/24DP | – | – | ● | ● | ● | U15 |

● = Available ○ = On request – = Not available

▼ **127-4 (C)**




▼ **127-4 (C)**




| K15 (32-4 (C)) | NG | M1 | M2[5] | M3[5] | M4[3][6] |
|---|---|---|---|---|---|
| | 100 | 338 | 19.1 | 57.1 | M12; |
| | | (13.31) | (0.75) | (2.25) | 22 (0.87) deep |
| | 140 | 350 | 18.9 | 56.2 | M12; |
| | | (13.78) | (0.74) | (2.21) | 22 (0.87) deep |

| U15 (32-4 (C)) | NG | M1 | M2[5] | M3[5] | M4[3][6] |
|---|---|---|---|---|---|
| | 100 | 360 | 19.5 | 57.5 | M12; |
| | | (14.17) | (0.77) | (2.26) | 22 (0.87) deep |
| | 140 | 377 | 19.1 | 56.4 | M12; |
| | | (14.84) | (0.75) | (2.22) | 22 (0.87) deep |
| | 180 | 387 | 19.4 | 56.7 | M12; |
| | | (15.24) | (0.76) | (2.23) | 22 (0.87) deep |

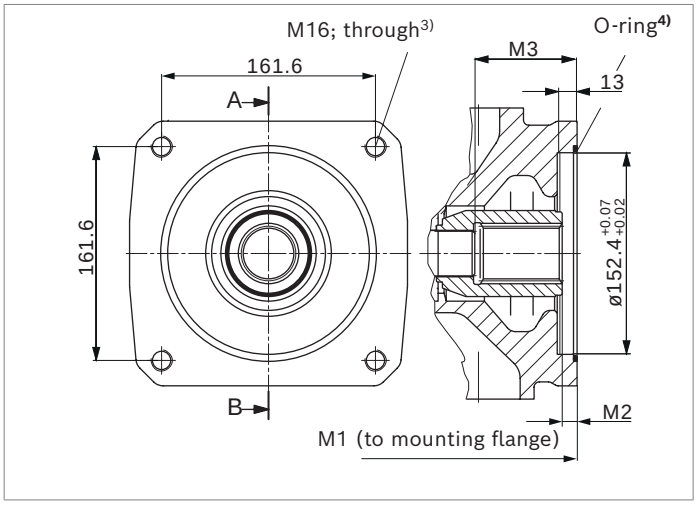
1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) Minimum dimensions
6) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## For flanges and shafts according to ISO 3019-1

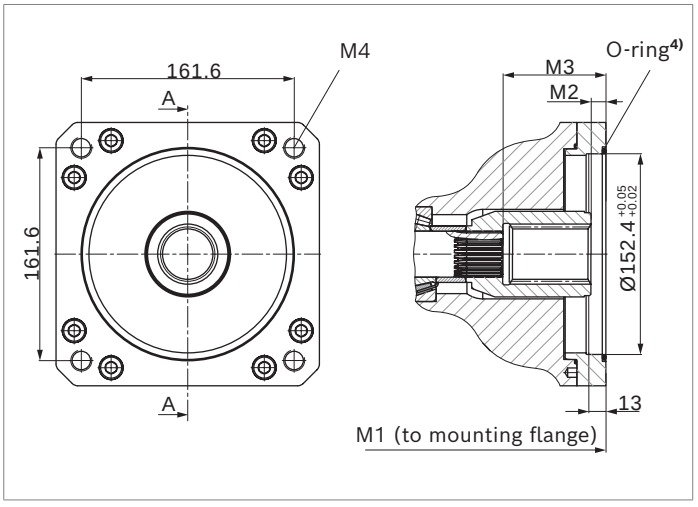
| Flange | | Splined shaft[1] | Availability across sizes | | | | | Code |
|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[2] | Diameter | 45 | 71 | 100 | 140 | 180 | |
| 152-4 (D) | ⌘ | 1 3/4 in 13T 8/16DP | – | – | – | ● | – | K17 |
| | | 1 3/4 in 13T 8/16DP | – | – | – | ● | ● | U17 |

● = Available ○ = On request – = Not available

▼ **152-4 (D)**




▼ **152-4 (D)**




| K17 (152-4 (D)) | NG | M1[5] | M2[5] | M3 |
|---|---|---|---|---|
| | 140 | 350 | 9.7 | 76.3 |
| | | (13.78) | (0.38) | (3.00) |

| U17 (152-4 (D)) | NG | M1 | M2[5] | M3[5] | M4[3)6)] |
|---|---|---|---|---|---|
| | 140 | 377 | 9.3 | 75.9 | M16; |
| | | (14.84) | (0.37) | (2.99) | 22 (0.87) deep |
| | 180 | 387 | 10.4 | 76.4 | M16; |
| | | (15.24) | (0.41) | (3.01) | 22 (0.87) deep |

1) Hub for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Mounting holes pattern viewed on through drive with control at top
3) Thread according to DIN 13.
4) O-ring included in the scope of delivery
5) Minimum dimensions
6) Design recommended according to VDI 2230, screw quality 8.8 according to ISO 898-1

## Overview of mounting options

| Through drive | | | Mounting options – 2nd pump | | | |
|---|---|---|---|---|---|---|
| **Flange (SAE) ISO 3019-1** | **Hub for splined shaft** | **Code[1)]** | **A10VO/31 and 32 NG (shaft)** | **A10VO/52 and 53 NG (shaft)** | **A10VO/60 NG (shaft)** | **External gear pump** |
| 82-2 (A) | 5/8 in | (K)(U)01 | 18 (U)/31 | 10 (U), 18 (U) | | Design F |
| | 3/4 in | (K)(U)52 | 18 (S, R)/31 | 10 (S) 18 (S, R) | | |
| 101-2 (B) | 7/8 in | (K)(U)68 | 28 (S, R)/31<br>45 (U, W) | 28 (S, R)<br>45 (U, W) | 45 (S4) | Design N/G |
| | 1 in | (K)(U)04 | 45 (S, R) | 45 (S, R)<br>60, 63 (U, W)[2)]<br>72 (U, W)[2)] | 45 (S5) | – |
| 127-2 (C) | 1 1/4 in | (K)(U)07 | 71 (S, R)<br>88 (S, R)/31<br>100 (U)[3)] | 60, 63 (S, R)<br>72 (S, R)<br>85 (U)<br>100 (U)[3)] | | – |
| | 1 1/2 in | (K)(U)24 | 100 (S)<br>140 (W)/32 | 85 (S)<br>100 (S) | | – |
| 127-4 (C) | 1 in | UE2 | 45 (S, R)/32 | 60, 63 (U, W)<br>72 (U, W) | | – |
| | 1 1/4 in | (K)(U)15 | 71 (S, R)/32 | 60, 63 (S, R)<br>72 (S, R)<br>85 (U)<br>100 (U) | | – |
| 152-4 (D) | 1 3/4 in | (K)(U)17 | 140 (S); 180 (S)/32 | – | | – |

Mounting flange C, D and U (see order item 09 in the type code) and port plate with a K.. or U.. Through drive (see or items 10 and 11 in the type code) directly connected by the static and dynamic loading when installed.

The following table shows the version to be selected:

| **Mounting flange** | **C** | **D** | **U** |
|---|---|---|---|
| **Port plate** | 12(62) | 22/32<br>72/82 | 22/32<br>72/82 |
| **Through drive** | K.. | U.. | U.. |

1) 1st pump only with mounting flanges D or U for Uxx through drives (for more information, see also type code on page 3).

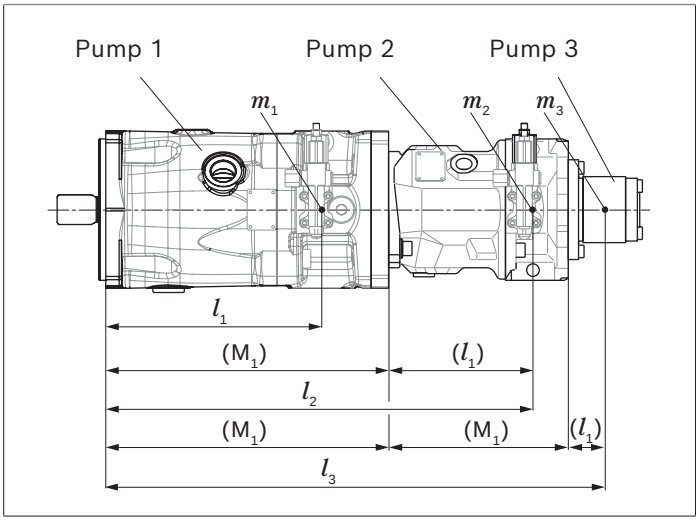
2) Not for main pump NG45 with K/U04

3) Not for main pump NG71 with K/U07

## Combination pumps A10VO + A10VO

By using combination pumps, the user can also have independent circuits without the need for splitter gearboxes.
When ordering combination pumps the type designations for the 1st and the 2nd pump must be joined by a "**+**".
**Order example:**
**A10VO100DR/32R-VSC12K07+**
**A10VO71DR/32R-VSC12N00**
If no further pumps are to be mounted at the factory, the simple type designation is sufficient.
A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic mass acceleration does not exceed maximum 10 $g$ (= 98.1 m/s$^2$).
For combination pumps consisting of more than two pumps, the mounting flange must be calculated for the permissible mass torque.
Through drives are plugged with a **non-pressure-resistant** cover. Therefore, single pumps must be equipped with a pressure-resistant cover before commissioning. Through drives can also be ordered with a pressure-resistant cover, please specify in plain text.
**U00** basic **through drives (without hub and intermediate flange) are supplied with a pressure-resistant** cover. This enables the utilization of various through drive options without mechanical machining of the port plate. Details of the assembled parts can be found in data sheet RE 95581.

Please also pay attention to the installation information on page 76.




| | | |
|---|---|---|
| $m_1, m_2, m_3$ | Weight of pump | [kg (lbs)] |
| $l_1, l_2, l_3$ | Distance from center of gravity | [mm (inch)] |
| $M_m = (m_1 \bullet l_1 + m_2 \bullet l_2 + m_3 \bullet l_3) \bullet \frac{1}{102}$ | | [Nm (lb-ft)] |

| **Calculation for multiple pumps** | | |
|---|---|---|
| $l_1$ | = | Front pump distance from center of gravity (values from "Permissible moments of inertia" table) |
| $l_2$ | = | Dimension "M1" from through drive drawings (from page 60) + $l_1$ of the 2nd pump |
| $l_3$ | = | Dimension "M1" from through drive drawings from page 60) of the 1st pump + "M1" of the 2nd pump + $l_1$ of the 3rd pump |

**Notice**
Through drives with installed hub are supplied with a spacer.
The spacer must be removed before installation of the 2nd pump and before commissioning. For information, please refer to the operating instructions 92714-01-B

## Permissible moments of inertia

| Size | | | 45 | 71 | 100 | 140 | 180 |
|---|---|---|---|---|---|---|---|
| For **4-hole** flange | | | | | | | |
| static | $M_m$ | Nm | 3000 | 3000 | 7000 | 7000 | 7000 |
| | | lb-ft | 2213 | 2213 | 5163 | 5163 | 5163 |
| Dynamic at 10 $g$ (98.1 m/s$^2$) | $M_m$ | Nm | 300 | 300 | 700 | 700 | 700 |
| | | lb-ft | 221 | 221 | 516 | 516 | 516 |
| For **2-hole** flange | | | | | | | |
| static | $M_m$ | Nm | 1370 | 2160 | 3000 | On request[1)] | – |
| | | lb-ft | 1010 | 1593 | 2213 | | |
| Dynamic at 10 $g$ (98.1 m/s$^2$) | $M_m$ | Nm | 137 | 216 | 300 | | – |
| | | lb-ft | 101 | 159 | 221 | | |
| Weight with port plate 11/12(61/62)N00 and mounting flange C or D | $m$ | kg | 25.8 | 40.4 | 56.4 | 70.5 | 75.2 |
| | | lbs | 57 | 89 | 124 | 155 | 166 |
| Weight with port plate 12(62)K.. and mounting flange C | $m$ | kg | 27.4 | 43.3 | 62.6 | 79.5 | – |
| | | lbs | 60 | 95 | 138 | 175 | |
| Weight with port plate 22/72(32/82)Uxx and mounting flange D or U | $m$ | kg | 32.6 | 51.8 | 76 | 90.2 | 89.4 |
| | | lbs | 72 | 144 | 168 | 199 | 197 |
| Distance from center of gravity with 11/12(61/62)N00 | $l_1$ | mm | 108 | 120 | 138 | 158 | 159 |
| | | inch | 4.25 | 4.72 | 5.43 | 6.22 | 6.26 |
| Distance from center of gravity with 12(62)Kxx | $l_1$ | mm | 115 | 129 | 153 | 177 | – |
| | | inch | 4.53 | 5.08 | 6.02 | 6.97 | |
| Distance from center of gravity at 22/72Uxx; 32/82Uxx | $l_1$ | mm | 135 | 153 | 184 | 196 | 190 |
| | | inch | 5.31 | 6.02 | 7.24 | 7.72 | 7.48 |

1) Pump combinations permissible only max. as double pump up to the same size.

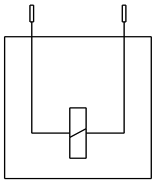
## Connector for solenoids

**DEUTSCH DT04-2P**

Molded, 2-pin, without bidirectional suppressor diode.
The following type of protection ensues with the installed mating connector:

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

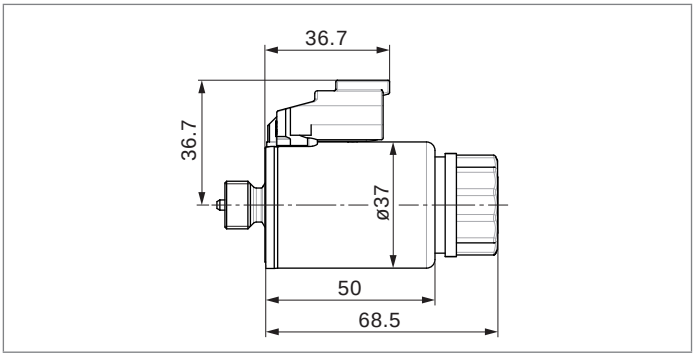
▼ **Switching symbol**



▼ **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).




**Notice**

- If necessary, you can change the position of the connector by turning the solenoid body.
- This procedure is defined in operating instructions 92714-01-B.
- Only the dead weight (<1 N (0.22 lbf)) of the connection cable with a length of 150 mm (5.91 inch) may act on the plug-in connection and the solenoid coil with coil nut.
  Other forces and vibrations are not permissible.
  This can be realized e.g. by fixing the cable to the same vibration system.

## Swivel angle sensor

### Description

The swivel angle sensor PAL is used for contactless detection of the swivel angle of axial piston units using a Hall effect-based sensor IC. The measured position is converted into electric signals by the redundant swivel angle sensor.

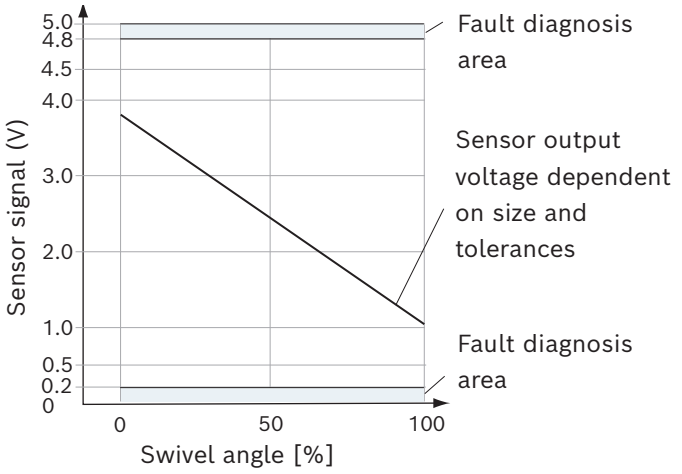
Technical data and safety instructions for the sensor are provided in the relevant data sheet 95161.

### Features

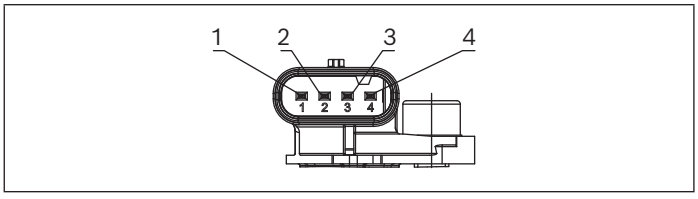
- High temperature stability of the output signal
- Shock and vibration resistance
- Integrated electronic fault detection
- CE conformity

▼ **Output characteristic at pin 4, code H**

Swivel angle sensor installation left with view of the shaft; control valve top




### Pin assignment




▼ **Pin assignment analog ratiometric/PWM** (order code H)
**PAL 2 313A357 CM/10F**
(for further information, see data sheet 95161)

| Pin | Connection | |
|---|---|---|
| **1** | Sensor signal 2 | PWM (active-high; 5 ... 95% on time) |
| **2** | Supply voltage | $U_{supply}$ |
| **3** | Weight | GND |
| **4** | Sensor signal 1 | analog ratiometric (10 ... 90% $U_{supply}$) |

▼ **Permissible PAL variants**

| Output signal | Type | Code |
|---|---|---|
| Analog ratiometric/PWM | PAL 2 313A357 CM/10F | H |
| SENT/SENT | PAL 2 313A357 SM/10F | P |

| Characteristic | |
|---|---|
| Supply voltage $U_{supply}$ | 5 VDC |
| Maximum supply voltage range $U_{supply}$ | 4.5 ... 5.5 VDC |
| Overvoltage range for 48 h | 28 VDC |
| Overvoltage range for 60 sec ($\tau_{amb}$ < 35 °C (95 °F)) | 37 VDC |
| Current consumption ($I_{DD}$) | 20 to 27 mA |
| Load resistance | see data sheet 95161 |
| Reverse polarity protection (48h/60sec) | -14 VDC/-18 VDC |
| Operating temperature | -40 °C (–40 °F) to +125 °C (257 °F) |
| Type of protection ISO 20653 (with plugged mating connector and cable) | IPx9k, IP6kx, IPX6, and IPX7 |

**Notice**

- Information on environmental and EMC conditions on request.
- Painting with electrostatic charging of the sensor is not permitted (danger: ESD damage)

▼ **Pin assignment SENT/SENT** (order code P)
**PAL 2 313A357 SM/10F**
(for further information, see data sheet 95161)

| Pin | Connection | |
|---|---|---|
| **1** | Sensor signal 2 | SENT format H.1 (two 12-bit fast channels) |
| **2** | Supply voltage | $U_{supply}$ |
| **3** | Weight | GND |
| **4** | Sensor signal 1 | SENT format H.4 (12 bit fast channel and single secure) |

### Mating connector

The mating connector is not included in the scope of delivery and can be ordered on request from Bosch Rexroth with the material number R917012863. For additional mating connector variants (for other cable diameters, among others), see data sheet 95161.

## 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. Filling and air bleeding must be carried out completely, particularly in the installation position "drive shaft upwards," as there is e.g. a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest available drain port (**L**, **$L_1$**). For combination pumps, the leakage must be drained off at each single pump.
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To avoid the transmission of structure-borne noise, decouple all connecting lines from all vibrating components (e.g. tank, frame parts) using elastic elements.
Under all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height $h_S$ results from the total pressure loss. However, it must not be higher than $h_{S\ max}$ = 800 mm (31.5 inch). The minimum suction pressure at port **S** (see the technical data on page 8) must not be fallen short of during operation and at cold starting either. When designing the reservoir, ensure that there is adequate distance between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

### Installation position

See the following examples **1** to **9**.
Further installation positions are available upon request.
Recommended installation position: **1** and **3**

| Key | |
|---|---|
| **L, $L_1$** (**F**) | Filling / Air bleeding |
| **S** | Suction port |
| **L, $L_1$** | Drain port |
| SB | Baffle (baffle plate) |
| $h_{t\ min}$ | Minimum required immersion depth (200 mm (7.87 inch)) |
| $h_{min}$ | Minimum required distance to reservoir bottom (100 mm (3.94 inch)) |
| $h_{ES\ min}$ | Minimum height required to prevent axial piston unit from draining (25 mm (0.98 inch)) |
| $h_{S\ max}$ | Maximum permissible suction height (800 mm (31.5 inch)) |

**Notice**

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

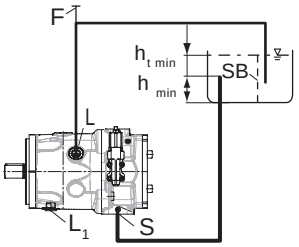
1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

### Below-reservoir installation (standard)

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

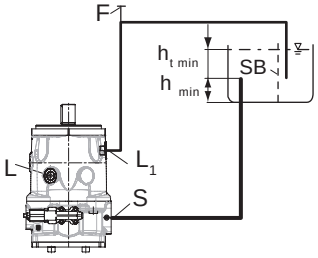
▼ **Installation position 1**

| Air bleed | Filling |
|---|---|
| F | L (F) |



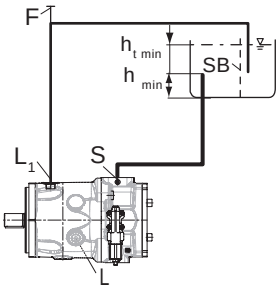

▼ **Installation position 2[1])**

| Air bleed | Filling |
|---|---|
| F | $L_1$ (F) |




▼ **Installation position 3**

| Air bleeding | Filling |
|---|---|
| F | $L_1$ (F) |




For key, see page 73

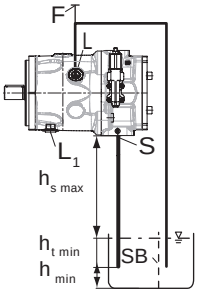
1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

### Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm (0.98 inch) is required in position 6. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm (31.5 inch).
A check valve in the drain line is only permissible in individual cases. Consult us for approval.

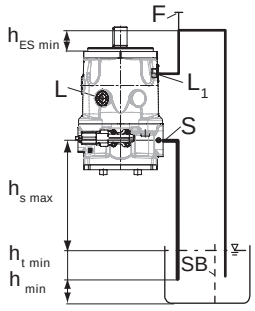
▼ **Installation position 4**

| Air bleeding | Filling |
|---|---|
| F | L (F) |



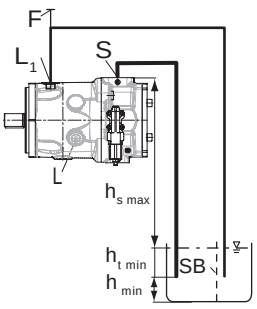

▼ **Installation position 5[1])**

| Air bleeding | Filling |
|---|---|
| F | $L_1$ (F) |




▼ **Installation position 6**

| Air bleeding | Filling |
|---|---|
| F | $L_1$ (F) |



### Inside-reservoir installation

Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid. If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

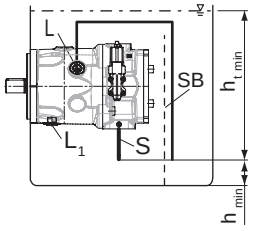
Axial piston units with electrical components (e.g. electric control, sensors) must not be installed in a reservoir below the fluid level.

**Notice**

- Our advice is to fit a suction pipe to the suction port **S** and to fit a pipe to case drain port **L** or **$L_1$**. In this case, the other drain port must be plugged. The housing of the axial piston unit is to be filled via **L** or **$L_1$** (see installation position 7 to 9) before the pipework is fitted and the reservoir is filled with hydraulic fluid.

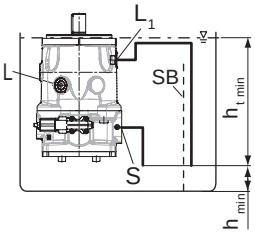
▼ **Installation position 7**

| Air bleeding | Filling |
|---|---|
| L (F) | L (F) |




▼ **Installation position 8[1)]**

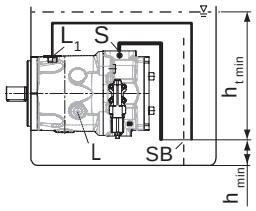
| Air bleeding | Filling |
|---|---|
| $L_1$ (F) | $L_1$ (F) |




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.

▼ **Installation position 9**

| Air bleeding | Filling |
|---|---|
| $L_1$ (F) | $L_1$ (F) |



## Project planning notes

- The A10VO axial piston variable pump is intended to be used in an open circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding operating instructions completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- The characteristic curve may also shift due to the dither frequency or control electronics.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the operating instructions.
- Not all configuration variants of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact at Bosch Rexroth if you require reliability parameters (e.g., $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct current signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct current signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. A pressure relief valve should therefore be provided in the hydraulic system. In this connection, observe the technical limits of the pressure relief valve.
- For drives that are operated for a long period of time with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency x 9). This can be prevented with suitably designed hydraulic lines.
- Please note the information regarding the tightening torques of port threads and other screw connections in the operating instructions.
- The ports and fastening threads are designed for the permissible pressures $p_{max}$ of the respective ports, see the connection tables. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service ports and function ports are only intended to accommodate hydraulic lines.

**Assembly information**

Due to the compact design of the housing, 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.

## Safety instructions

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