**Rexroth**
**Bosch Group**

# Axial piston variable pump
# A4VG Series 40

## Americas

**RE-A 92004**
Edition: 09.2017
Replaces: 06.2012



▶ High-pressure pump for applications in a closed circuit up to 7250 psi (500 bar)
▶ Size 110 ... 280
▶ Nominal pressure 6500 psi (450 bar)
▶ Maximum pressure 7250 psi (500 bar)
▶ Closed circuit

## Features

▶ High power density owing to a very high pressure level
▶ Integrated auxiliary pump for boost and pilot oil supply
▶ Flow direction changes smoothly when the swashplate is moved through the neutral position
▶ High-pressure relief valves with integrated boost function
▶ With adjustable pressure cut-off as standard
▶ Boost-pressure relief valve
▶ Through drive for mounting of further pumps up to same nominal size
▶ High total efficiency
▶ Large variety of controls
▶ Swashplate design

## Contents

## Type code

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | 23 |
|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|
| A4V | G | | | | | | | | / | 40 | A | | N | | | | | | A | | 0 | | – | |

**Axial piston unit**

| 01 | Swashplate design, variable, nominal pressure 6500 psi (450 bar), maximum pressure 7250 psi (500 bar) | **A4V** |
|----|----|----|

**Operating mode**

| 02 | Pump, closed circuit | **G** |
|----|----|----|

**Size (NG)**

| 03 | Geometric displacement, see "Technical data" on page 9 | $in^3$/rev. | 6.71 | 7.63 | 8.85 | 10.68 | 12.81 | 17.09 |
|----|----|----|----|----|----|----|----|----|
| | | $cm^3$/rev. | 110 | 125 | 145 | 175 | 210 | 280 |

**Control device**

| | | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|----|----|----|----|----|----|----|----|----|----|----|
| 04 | Proportional control, hydraulic | pilot-pressure related $p$ = 87 to 260 psi (6 to 18 bar) | | – | – | ○ | ○ | ○ | ○ | HP1 |
| | | mechanical servo, hexagon shaft with lever | | – | – | ● | ● | ● | ● | HW2 |
| | | | with neutral position switch | ● | ● | ● | ● | ● | ● | HW8 |
| | Hydraulic control, direct operated | | | – | – | ● | ● | ○ | ○ | HT1 |
| | Automatic control, speed related | | $U$ = 12 V | ● | ● | – | – | – | – | DA1 |
| | | | $U$ = 24 V | ● | ● | – | – | – | – | DA2 |
| | Proportional control, electric | | $U$ = 12 V | ● | ● | ● | ● | ● | ● | EP1 |
| | | | $U$ = 24 V | ● | ● | ● | ● | ● | ● | EP2 |
| | | with manual override and spring return | $U$ = 12 V | ● | ● | ● | ● | ● | ● | EP3 |
| | | | $U$ = 24 V | ● | ● | ● | ● | ● | ● | EP4 |
| | Two-point control, electric | | $U$ = 12 V | ● | ● | ● | ● | ● | ● | EZ1 |
| | | | $U$ = 24 V | ● | ● | ● | ● | ● | ● | EZ2 |
| | Electric control, direct operated, two pressure reducing valves (DRE) | | $U$ = 12 V | ● | ● | ● | ● | ○ | ○ | ET5 |
| | | | $U$ = 24 V | ● | ● | ● | ● | ○ | ○ | ET6 |

**Pressure cut-off**

| | | | 110 ... 280 | |
|----|----|----|----|----|
| 05 | Without pressure cut-off | without bypass | ○ | 0 |
| | | with bypass | ○ | C |
| | Pressure cut-off, with bypass (not for HT) | Fixed setting, hydraulic, mechanical | ● | D |

**Connector for solenoids[1]**

| | | 110 ... 280 | |
|----|----|----|----|
| 06 | Without connector (only for purely hydraulic control) | ● | 0 |
| | DEUTSCH molded connector, 2-pin – without suppressor diode | ● | P |

**Swivel angle sensor**

| | | 110 ... 280 | |
|----|----|----|----|
| 07 | Without swivel angle sensor | ● | 0 |
| | Electric swivel angle sensor (DWS20-1, 3-pin)[2] | ○ | R |

● = Available     ○ = On request     – = Not available     ☐ = Preferred program

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1) Connectors for other electric components may deviate.

2) Please contact us if the swivel angle sensor is used for control

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | 23 |
|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|
| A4V | G | | | | | | | | / | 40 | A | | N | | | | | | A | | 0 | | – | |

**Additional function**

| | | | 110 ... 280 | |
|---|---|---|:---:|:---:|
| 08 | Without additional function | | ● | **0** |
| | Mechanical stroke limiter, externally adjustable | | ● | **M** |
| | Stroking chamber pressure port $X_3$, $X_4$ | | ● | **T** |
| | Mechanical stroke limiter and stroking chamber pressure port $X_3$, $X_4$ | | ● | **B** |
| | Neutral valve $U$ = 12 V[3] | | ● | **N** |
| | | and mechanical stroke limiter, externally adjustable | ● | **P** |
| | | and ports $X_3$, $X_4$ for stroking chamber pressure | ● | **R** |
| | | and mechanical stroke limiter and ports $X_3$, $X_4$ | ● | **S** |
| | Neutral valve $U$ = 24 V[3] | | ● | **U** |
| | | and mechanical stroke limiter, externally adjustable | ● | **V** |
| | | and ports $X_3$, $X_4$ for stroking chamber pressure | ● | **W** |
| | | and mechanical stroke limiter and ports $X_3$, $X_4$ | ● | **Y** |

**DA control valve (only for NG110 and 125)**

| | | HP | HW | HT | DA | EP | EZ | ET | |
|---|---|:--:|:--:|:--:|:--:|:--:|:--:|:--:|:--:|
| 09 | Without DA control valve | ● | ● | ● | – | ● | ● | ● | **0** |
| | DA control valve, fixed setting | ● | ● | ● | ● | ● | – | – | **1** |
| | DA control valve, fixed setting and brake inch valve   based on mineral oil mounted, control with brake fluid[4] | – | – | – | ● | – | – | – | **5** |
| | DA control valve, fixed setting, ports for pilot control device | ● | ● | ● | ● | ● | – | – | **6** |

**Series**

| | | 110 ... 280 | |
|---|---|:---:|:---:|
| 10 | Series 4, index 0 | ● | **40** |

**Configuration of port and fastening threads**

| | | 110 ... 280 | |
|---|---|:---:|:---:|
| 11 | ANSI with O-ring sealing according to ISO 11926 | ● | **A** |

**Direction of rotation**

| | | | 110 ... 280 | |
|---|---|---|:---:|:---:|
| 12 | Viewed on drive shaft | clockwise | ● | **R** |
| | | counter-clockwise | ● | **L** |

**Sealing material**

| | | 110 ... 280 | |
|---|---|:---:|:---:|
| 13 | NBR (nitrile rubber), shaft seal in FKM (fluoroelastomer) | ● | **N** |

**Mounting flange**

| | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| 14 | SAE J744 | 127-2/4 | ● | ● | – | – | – | – | **C6** |
| | | 152-2/4 | ● | ● | ● | ● | – | – | **D6** |
| | | 165-4 | – | – | – | ● | ● | ● | **E4** |

**Drive shaft**

| | | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|:---:|:---:|:---:|:---:|:---:|:---:|:---:|
| 15 | Splined shaft ANSI B92.1a–1976 | 1 3/8 in | 21T 16/32DP | ● | – | – | – | – | – | **V8** |
| | | 1 3/4 in | 13T 8/16DP | ● | ● | ● | ● | – | – | **T1** |
| | | 2 in | 15T 8/16DP | ● | ● | ● | – | ● | ● | **T2** |
| | | 2 1/4 in | 17T 8/16DP | – | – | ● | ● | ● | ● | **T3** |

● = Available    ○ = On request    – = Not available    ▨ = Preferred program

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3) Cannot be combined with brake inch valve
4) Cannot bei combined with neutral valve

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| A4V | G | | | | | | | | / | 40 | A | | N | | | | | A | | 0 | | – |

## Working port

| | | 110 ... 280 | |
|---|---|---|---|
| 16 | SAE working port **A** and **B**, on left side (45° left) | ● | 1 |
| | SAE working port **A** and **B**, on right side (45° right)[5] | ● | 2 |

## Boost pump and rotary group configuration

| | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | Standard rotary group | boost pump integrated, standard internal gear pump | ● | ● | ● | ● | ● | ● | F |
| | | boost pump integrated, large internal gear pump | ● | – | ● | ● | ● | – | B |
| | | without boost pump | ● | ● | ● | ● | ● | ● | U |
| | High-speed rotary group | boost pump integrated, standard internal gear pump | ● | – | ● | ● | – | – | V |
| | | without boost pump | ● | – | ● | ● | – | – | W |

## Through drive[6]

| | | | | | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | Without through drive | | | | | | ● | ● | ● | ● | ● | ● | 0000 |
| | Flange SAE J744 | | | Hub for splined shaft[7] | | | | | | | | | |
| | Diameter | Mounting[8] | Code | Diameter | | Code | | | | | | | |
| | 82-2 (A) | ⸙ | A1 | 5/8 in | 9T 16/32DP | S2 | ○ | – | ● | ● | – | – | A1S2 |
| | | ∞ | A2 | 5/8 in | 9T 16/32DP | S2 | ● | ○ | ○ | ○ | ○ | ○ | A2S2 |
| | 101-2 (B) | ⸙ | B1 | 7/8 in | 13T 16/32DP | S4 | ○ | ○ | ● | ● | – | – | B1S4 |
| | | | B1 | 1 in | 15T 16/32DP | S5 | ● | – | ○ | ○ | – | – | B1S5 |
| | | ∞ | B2 | 7/8 in | 13T 16/32DP | S4 | ● | ● | ● | ● | ○ | ● | B2S4 |
| | | | B2 | 1 in | 15T 16/32DP | S5 | ● | ● | ○ | ● | ○ | ○ | B2S5 |
| | | ⸑ | B5 | 7/8 in | 13T 16/32DP | S4 | – | – | ○ | – | – | – | B5S4 |
| | 127-2 (C) | ⸙ | C1 | 1 1/4 in | 14T 12/24DP | S7 | ● | – | ○ | ○ | ○ | ○ | C1S7 |
| | | ∞ | C2 | 1 1/4 in | 14T 12/24DP | S7 | ● | ○ | ● | ● | ● | ○ | C2S7 |
| | | | C2 | 1 3/8 in | 21T 16/32DP | V8 | ● | – | ○ | ○ | – | – | C2V8 |
| | | | C2 | 1 3/4 in | 13T 8/16DP | T1 | – | – | ● | ○ | – | – | C2T1 |
| | 127-4 (C) | ⸽ | C4 | 1 1/4 in | 14T 12/24DP | S7 | ● | – | ○ | ● | – | – | C4S7 |
| | | | C4 | 1 3/8 in | 21T 16/32DP | V8 | ○ | – | – | – | – | – | C4V8 |
| | 152-4 (D) | ⸽ | D4 | 1 3/4 in | 13T 8/16DP | T1 | – | – | ● | ● | ● | ○ | D4T1 |
| | 165-4 (E) | ⸽ | E4 | 1 3/4 in | 13T 8/16DP | T1 | – | – | – | ● | ○ | ○ | E4T1 |
| | | | E4 | 2 in | 15T 8/16DP | T2 | – | – | – | – | ● | ○ | E4T2 |

## High-pressure relief valve

| | | 110 ... 280 | |
|---|---|---|---|
| 19 | High-pressure relief valve, direct operated, fixed setting, with low-pressure relief valve, fixed setting | ● | A |

## Filtration boost circuit/external boost pressure supply

| | | 110 ... 280 | |
|---|---|---|---|
| 20 | Filtration in the boost pump suction line | ● | S |
| | Filtration in the boost pump pressure line | ● | D |
| | Ports for external boost circuit filtration (**F**$_e$ and **F**$_a$) | | |
| | Attachment filter with cold start valve[9] | ● | F |
| | Attachment filter[9] with cold start valve and electric contamination indicator – DEUTSCH connector | ● | B |
| | External boost pressure supply (on version without integrated boost pump) | ● | E |

● = Available   ○ = On request   – = Not available   ▨ = Preferred program

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[5] Only possible without attachment filter.

[6] Specifications for version with integrated standard gear pump, please contact us for version with integrated large gear pump or without boost pump.

[7] Hub for splined shaft according to ANSI B92.1a-1976 (drive shaft allocation according to SAE J744)

[8] Mounting hole pattern viewed on through drive

[9] Only available for working ports located on left

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | 23 |
|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|
| A4V | G | | | | | | | | / | 40 | A | | N | | | | | | A | | 0 | | – | |

**Pressure sensor**

| | | | 110 ... 280 | |
|---|---|---|---|---|
| 21 | Without pressure sensor | | ● | 0 |

**Other sensors**

| | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|
| 22 | Without sensor | ● | ● | ● | ● | ● | ● | 0 |
| | Speed sensor DSM, DSA[10] | ○ | – | ○ | ○ | ○ | ○ | V |

**Standard / special version**

| | | | 110 ... 280 | |
|---|---|---|---|---|
| 23 | Standard version | | ● | 0 |
| | Standard version with installation variants, e.g. **T** ports against standard open or closed | | ● | Y |
| | Special version | | ● | S |

● = Available    ○ = On request    – = Not available    ▢ = Preferred program

**Notice**

▶ Note the project planning notes on page 63!
▶ In addition to the type code, please specify the relevant technical data when placing your order.

[10] Specify type code of sensor acc. to data sheet (DSM - 95132, DSA 95133) separately and observe the requirements on the electronics

## Hydraulic fluid

The axial piston unit is designed for operation with HLP mineral oil according to DIN 51524.

Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

▶ 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
▶ 90221: Environmentally acceptable hydraulic fluids
▶ 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
▶ 90225: Limited technical data for operation with water-free and water-containing fire-resistant hydraulic fluids (HFDR, HFDU, HFAE, HFAS, HFB, HFC)

**Notes on selection of hydraulic fluid**
The hydraulic fluid should be selected 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 [SUS (mm²/s)] | Shaft seal | Temperature[3] | Comment |
|---|---|---|---|---|
| Cold start | $v_{max} \leq 7400$ (1600) | NBR[2] | $\theta_{St} \geq -40$ °F (−40 °C) | $t \leq 3$ min, without load ($p \leq 725$ psi (50 bar), $n \leq 1000$ rpm |
|  |  | FKM | $\theta_{St} \geq -13$ °F (−25 °C) | Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 45 °F (25 K). |
| Warm-up phase | $v = 7400 ... 1850$ (1600 ... 400) |  |  | $t \leq 15$ min, $p \leq 0.7 \times p_{nom}$ and $n \leq 0.5 \times n_{nom}$ |
| Continuous operation | $v = 1850 ... 60$[1] (400 ... 10) | NBR[2] | $\theta \leq +185$ °F (+85 °C) | measured at port **T** |
|  |  | FKM | $\theta \leq +230$ °F (+110 °C) |  |
|  | $v_{opt} = 170 ... 82$ (36 ... 16) |  |  | Range of optimum operating viscosity and efficiency |
| Short-term operation | $v_{min} = 60 ... 49$ (10 ... 7) | NBR[2] | $\theta \leq +185$ °F (+85 °C) | $t \leq 3$ min, $p \leq 0.3 \times p_{nom}$ , measured at port **T** |
|  |  | FKM | $\theta \leq +230$ °F (+110 °C) |  |

▼ **Selection diagram**
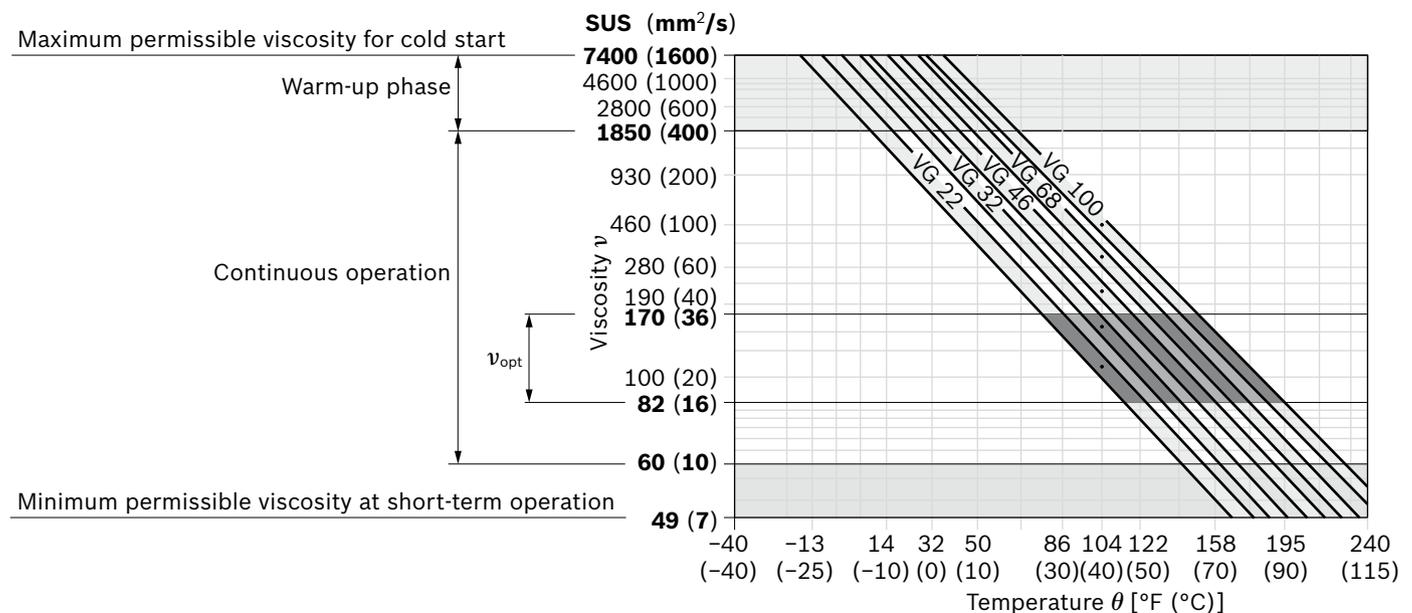


1) Corresponds e.g. for VG 46 to a temperature range of +39 °F (+4 °C) to +185 °F (+85 °C) (see selection diagram)

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

Depending on the system and the application, for the axial piston unit we recommend: Filter elements $\beta_{20} \geq 100$.

At a hydraulic fluid viscosity of less than 60 SUS (10 mm²/s) (e.g. due to high temperatures in short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

For example, the viscosity is 60 SUS (10 mm²/s) at:
▶ HLP 32 a temperature of 163.4 °F (73 °C)
▶ HLP 46 a temperature of 185 °F (85 °C)

## Working pressure range

| Pressure at working port A or B | | Definition |
|---|---|---|
| Nominal pressure $p_{nom}$ | 6500 psi (450 bar) | The nominal pressure corresponds to the maximum design pressure. |
| Maximum pressure $p_{max}$ | 7250 psi (500 bar) | The maximum pressure corresponds to the maximum working pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period. |
| Single operating period | 10 s | |
| Total operating period | 300 h | |
| Minimum pressure (high-pressure side) | 365 psi (25 bar) | Minimum pressure at the high-pressure side (**A** or **B**) which is required to prevent damage to the axial piston unit. |
| Minimum pressure (low-pressure side) | 145 psi (10 bar) above case pressure | Minimum pressure at the low-pressure side (**A** or **B**) which is required to prevent damage to the axial piston unit. Boost pressure setting must be higher depending on system. |
| Rate of pressure change $R_{A\,max}$ | 130000 psi/s (9000 bar/s) | Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range. |
| **Boost pump** | | |
| Nominal pressure $p_{Sp\,nom}$ | 365 psi (25 bar) | |
| Maximum pressure $p_{Sp\,max}$ | 580 psi (40 bar) | |
| Pressure at suction port **S** (inlet) | | |
| Continuous $p_{S\,min}$ | ≥ 12 psi absolute (≥ 0.8 bar absolute) | $\nu \leq 140$ SUS ($\nu \leq 30$ mm²/s) |
| Short-term, at a cold start ($t < 3$ min) | ≥ 7.5 psi (0.5 bar) absolute | |
| Maximum pressure $p_{S\,max}$ | ≤ 75 psi (5 bar) absolute | |
| **Control pressure** | | |
| Required control pressure $p_{St\,min}$ at $n$ = 2000 rpm | | Required control pressure $p_{St}$ to ensure the function of the control. The required control pressure is depending on the rotational speed and working pressure. |
| Controls HP, HW, EP | 290 psi (20 bar) above case pressure | |
| Controls HT, DA, EZ, ET | 365 psi (25 bar) above case pressure | |
| **Case pressure at port T** | | |
| Maximum differential pressure $\Delta p_{T\,max}$ | See the diagram | Permissible differential pressure at the shaft seal (case to ambient pressure) |
| Pressure peak $p_{T\,peak}$ | 145 psi (10 bar) | $t < 0.1$ s, maximum 1000 pressure peaks permissible |

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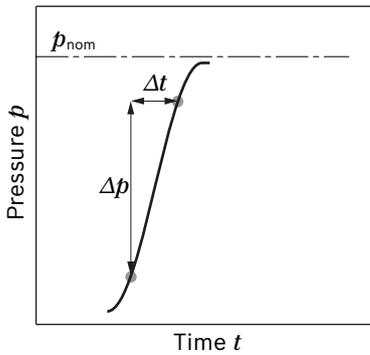


▼ **Pressure definition**
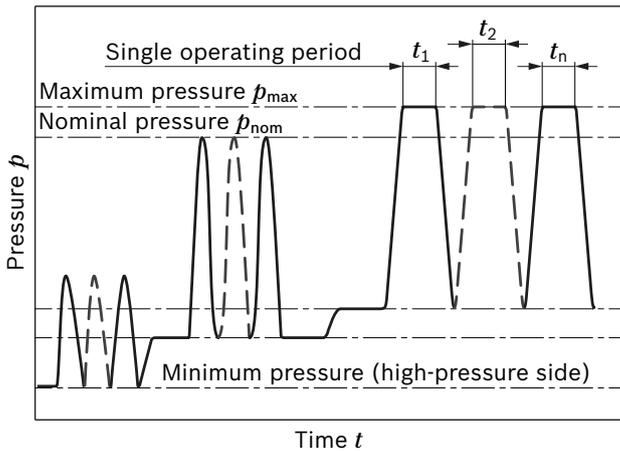


▼ Total operating period = $t_1 + t_2 + ... + t_n$

▼ **Maximum differential pressure at the shaft seal**
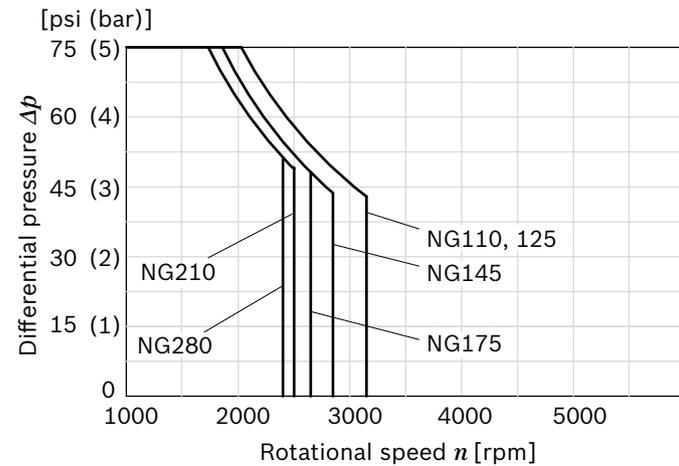


**Notice**

▶ Working pressure range valid 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.

▶ The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.

▶ The case pressure must be greater than the ambient pressure.

# Technical data

| Size | | NG | | 110 | 125 | 145 | 175 | 210 | 280 |
|---|---|---|---|---|---|---|---|---|---|
| Displacement, geometric, per revolution variable pump | | $V_{g\,max}$ | in³ | 6.74 | 7.63 | 8.87 | 10.7 | 2.85 | 17.1 |
| | | | cm³ | 110.4 | 125 | 145.3 | 175.4 | 210.6 | 280.3 |
| | boost pump (at $p$ = 290 psi (20 bar)) | $V_{g\,Sp}$ | in³ | 1.5 | 1.89 | 1.95 | 2.38 | 2.81 | 3.66 |
| | | | cm³ | 24.5 | 31 | 32 | 39 | 46 | 60 |
| | boost pump large (at $p$ = 290 psi (20 bar))[1] | $V_{g\,Sp}$ | in³ | 1.89 | – | 2.38 | 2.87 | 3.66 | – |
| | | | cm³ | 31 | – | 39 | 47 | 60 | – |
| Torque[2] | at $V_{g\,max}$ and | $\Delta p$ = 6250 psi | $T$ | lb-ft | 558 | 631 | 631 | 885 | 1063 | 1415 |
| | | $\Delta p$ = 430 bar | $T$ | Nm | 756 | 856 | 994 | 1200 | 1441 | 1918 |
| | | $\Delta p$ = 1450 psi | $T$ | lb-ft | 130 | 148 | 170 | 206 | 247 | 329 |
| | | $\Delta p$ = 100 bar | $T$ | Nm | 176 | 200 | 231 | 279 | 335 | 446 |
| Rotary stiffness of drive shaft | V8 | $c$ | lb-ft/rad | 127598 | – | – | – | – | – |
| | | | kNm/rad | 173 | – | – | – | – | – |
| | T1 | $c$ | lb-ft/rad | 157838 | 142349 | 182315 | 196192 | – | – |
| | | | kNm/rad | 214 | 193 | 248 | 266 | – | – |
| | T2 | $c$ | lb-ft/rad | 181440 | 161526 | 216106 | **–** | 290599 | 303138 |
| | | | kNm/rad | 246 | 219 | 293 | **–** | 394 | 411 |
| | T3 | $c$ | lb-ft/rad | – | – | 250771 | 275848 | 356243 | 376157 |
| | | | kNm/rad | – | – | 340 | 374 | 483 | 510 |
| Moment of inertia for rotary group | | $J_{TW}$ | lbs-ft² | 0.517 | 0.551 | 0.783 | 1.353 | 1.5 | 2.314 |
| | | | kgm² | 0.0218 | 0.0232 | 0.0330 | 0.0570 | 0.0632 | 0.0975 |
| Maximum angular acceleration[3] | | $\alpha$ | rad/s² | 14500 | 13000 | 12000 | 10000 | 8000 | 5000 |
| Case volume | | $V$ | gal | 0.66 | 0.61 | 0.87 | 0.82 | 1.29 | 1.43 |
| | | | l | 2.5 | 2.3 | 3.3 | 3.1 | 4.9 | 5.4 |
| Weight (without through drive) approx. | | $m$ | lbs-ft² | 194 | 185 | 234 | 254 | 335 | 353 |
| | | | kg | 88 | 84 | 106 | 115 | 152 | 160 |

| **Standard rotary group** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rotational speed[4] | maximum at $V_{g\,max}$ | $n_{nom\,S}$ | rpm | 3150 | 3000 | 2850 | 2650 | 2500 | 2400 |
| | at $\Delta p \geq$ 580 psi (40 bar) ($t$ < 15 s) | $n_{max\,40}$ | rpm | 3350 | 3150 | 3000 | 2800 | 2650 | 2550 |
| | minimum | $n_{min}$ | rpm | 500 | 500 | 500 | 500 | 500 | 500 |
| Flow | at $n_{nom}$ and $V_{g\,max}$ | $q_v$ | gpm | 91.9 | 99.1 | 109.4 | 122.8 | 139 | 178 |
| | | | l/min | 348 | 375 | 414 | 465 | 527 | 673 |
| Power[2] | at $n_{nom}$, $V_{g\,max}$ and | $\Delta p$ = 6250 psi | $P$ | hp | 334 | 361 | 398 | 447 | 506 | 646 |
| | | $\Delta p$ = 430 bar | $P$ | kW | 249 | 269 | 297 | 333 | 377 | 482 |

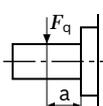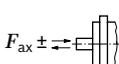| **High-speed rotary group** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rotational speed[4] | maximum at $V_{g\,max}$ | $n_{nom\,H}$ | rpm | 3400 | – | 3050 | 3000 | – | – |
| | at $\Delta p \geq$ 580 psi (40 bar) ($t$ < 15 s) | $n_{max\,40}$ | rpm | 3600 | – | 3200 | 3100 | – | – |
| | minimum | $n_{min}$ | rpm | 500 | – | 500 | 500 | – | – |
| Flow | at $n_{nom}$ and $V_{g\,max}$ | $q_v$ | gpm | 99.1 | – | 117 | 139 | – | – |
| | | | l/min | 375 | – | 443 | 526 | – | – |
| Power[2] | at $n_{nom}$, $V_{g\,max}$ and | $\Delta p$ = 6250 psi | $P$ | hp | 361 | – | 426 | 506 | – | – |
| | | $\Delta p$ = 430 bar | $P$ | kW | 269 | – | 318 | 377 | – | – |

## 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 recommend testing the loads by means of experiment or calculation/simulation and comparison with the permissible values.

[1] The version with a large internal gear pump can result in maximum rotational speed limitations. Please contact us.

[2] Without boost pump

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

[4] The values are applicable:
– for the optimum viscosity range from $n_{opt}$ = 170 to 82 SUS (36 to 16 mm²/s)
– for hydraulic fluid based on mineral oils (for HF hydraulic fluids, observe the technical data in 90225)

## Permissible radial and axial forces of the drive shafts

▼ **Splined shaft ANSI B92.1a**

| Size | | NG | 110 | 110 | 110 | 125 | 125 | 145 | 145 |
|---|---|---|---|---|---|---|---|---|---|
| Drive shaft | | in | 1 3/8 | 1 3/4 | 2 | 1 3/4 | 2 | 1 3/4 | 2 |
| Maximum radial force at distance a (from shaft collar) | $F_{q\,max}$ | lbf | 2141 | 1682 | 1472 | 1461 | 1304 | 2077 | 1818 |
| | | N | 9524 | 7483 | 6548 | 6500 | 5800 | 9241 | 8086 |
| | a | in | 0.94 | 1.32 | 1.57 | 1.32 | 1.57 | 1.32 | 1.57 |
| | | mm | 24 | 33.5 | 40 | 33.5 | 40 | 33.5 | 40 |
| Maximum axial force | $+ F_{ax\,max}$ | lbf | 1417 | 1417 | 1417 | 1441 | 1441 | 1520 | 1520 |
| | | N | 6305 | 6305 | 6305 | 6411 | 6411 | 6763 | 6763 |
| | $- F_{ax\,max}$ | lbf | 921 | 921 | 921 | 897 | 897 | 997 | 997 |
| | | N | 4095 | 4095 | 4095 | 3989 | 3989 | 4437 | 4437 |

| Size | | NG | 145 | 175 | 175 | 210 | 210 | 280 | 280 |
|---|---|---|---|---|---|---|---|---|---|
| Drive shaft | | in | 2 1/4 | 1 3/4 | 2 1/4 | 2 | 2 1/4 | 2 | 2 1/4 |
| Maximum radial force at distance a (from shaft collar) | $F_{q\,max}$ | lbf | 1818 | 1079 | 989 | 2514 | 2261 | 3274 | 2980 |
| | | N | 8086 | 4800 | 4400 | 11185 | 10059 | 14562 | 13256 |
| | a | in | 1.57 | 1.32 | 1.57 | 1.57 | 1.57 | 1.57 | 1.57 |
| | | mm | 40 | 33.5 | 40 | 40 | 40 | 40 | 40 |
| Maximum axial force | $+ F_{ax\,max}$ | lbf | 1520 | 1630 | 1630 | 1745 | 1745 | 1900 | 1900 |
| | | N | 6763 | 7252 | 7252 | 7760 | 7760 | 8450 | 8450 |
| | $- F_{ax\,max}$ | lbf | 997 | 1067 | 1067 | 1133 | 1133 | 1158 | 1158 |
| | | N | 4437 | 4748 | 4748 | 5040 | 5040 | 5150 | 5150 |
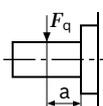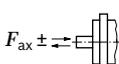
### Determining the operating characteristics

Flow $\quad q_v = \dfrac{V_g \times n \times \eta_v}{231}$ [gpm] $\qquad \left(\dfrac{V_g \times n \times \eta_v}{1000}\right)$ [l/min]

Torque $T = \dfrac{V_g \times \Delta p}{24 \times \pi \times \eta_{hm}}$ [lb-ft] $\qquad \left(\dfrac{V_g \times \Delta p}{24 \times \pi \times \eta_{hm}}\right)$ [Nm]

Power $P = \dfrac{2\pi \times T \times n}{33000} = \dfrac{q_v \times \Delta p}{1714 \times \eta_t}$ [HP] $\left(\dfrac{2\pi \times T \times n}{60000} = \dfrac{q_v \times \Delta p \times \eta_t}{600}\right)$ [kW]

**Key**

$V_g$    Displacement per revolution [in³ (cm³)]

$\Delta p$    Differential pressure [psi (bar)]

$n$    Rotational speed [rpm]

$\eta_v$    Volumetric efficiency

$\eta_{mh}$    Hydraulic-mechanical efficiency

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

### Notice

▶ The axial and radial forces generally influence the service life of the bearings.

▶ Special requirements apply in the case of belt drive and cardan shaft. Please contact us.

## Permissible input and through-drive torques

| Size | | NG | | | 110 | 125 | 145 | 175 | 210 | 280 |
|---|---|---|---|---|---|---|---|---|---|---|
| Torque at $V_{g\,max}$ and | | $\Delta p$ = 6250 psi[1] | $T$ | lb-ft | 558 | 631 | 733 | 885 | 1063 | 1415 |
| | | $\Delta p$ = 430 bar[1] | $T$ | Nm | 756 | 856 | 994 | 1200 | 1441 | 1918 |
| Maximum input torque at drive shaft[2] | **V8** | 1 3/8 in | $T_{E\,max}$ | lb-ft | 715 | – | – | – | – | – |
| ANSI B92.1a–1976 | | | | Nm | 970 | – | – | – | – | – |
| | **T1** | 1 3/4 in | $T_{E\,max}$ | lb-ft | 1210 | 1210 | 1210 | 1210 | – | – |
| | | | | Nm | 1640 | 1640 | 1640 | 1640 | – | – |
| | **T2** | 2 in | $T_{E\,max}$ | lb-ft | 1969 | 1969 | 1969 | – | 1969 | 1969 |
| | | | | Nm | 2670 | 2670 | 2670 | – | 2670 | 2670 |
| | **T3** | 2 1/4 in | $T_{E\,max}$ | lb-ft | – | – | 3002 | 3002 | 3002 | 3002 |
| | | | | Nm | – | – | 4070 | 4070 | 4070 | 4070 |
| Maximum through-drive torque | | | $T_{D\,max}$ | lb-ft | 689 | 819 | 1298 | 1298 | 1948 | 1948 |
| | | | | Nm | 934 | 1110 | 1760 | 1760 | 2641 | 2641 |

## ▼ Distribution of torques
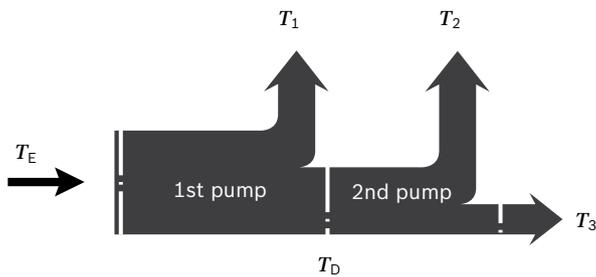


| Torque at 1st pump | $T_1$ | |
|---|---|---|
| Torque at 2nd pump | $T_2$ | |
| Torque at 3rd pump | $T_3$ | |
| Input torque | $T_E$ = | $T_1 + T_2 + T_3$ |
| | $T_E$ < | $T_{E\,max}$ |
| Through-drive torque | $T_D$ = | $T_2 + T_3$ |
| | $T_D$ < | $T_{D\,max}$ |

---

1) Efficiency not considered

2) For drive shafts free of radial force

## HP – Proportional control, hydraulic, pilot-pressure related

The output flow of the pump is infinitely variable between 0 and 100%, proportional to the difference in pilot pressure applied to the two pilot pressure ports ($Y_1$ and $Y_2$).
The pilot signal, coming from an external source, is a pressure signal. Flow is negligible, as the pilot signal acts only on the control spool of the control valve.
This control spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required.
A feedback lever connected to the stroking piston maintains the pump flow for any given pilot signal within the control range.

If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.

▼ **Circuit diagram, standard version**
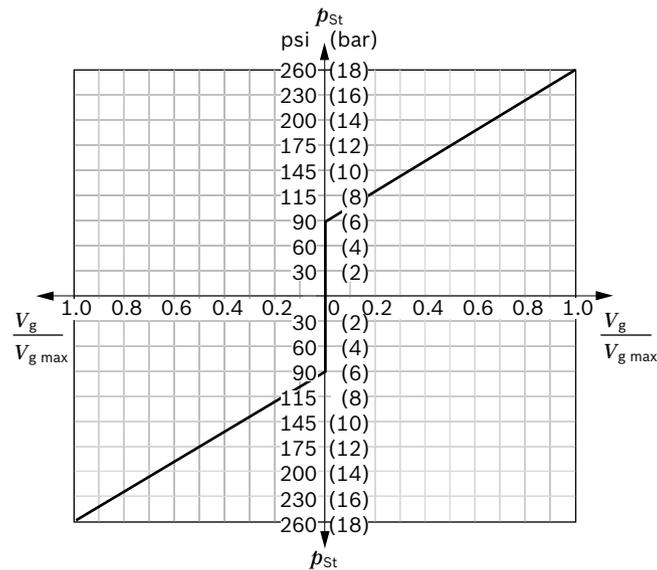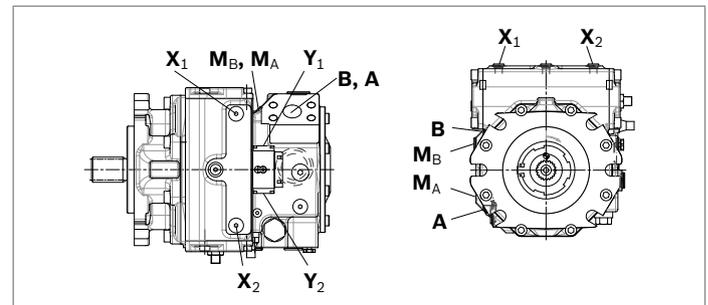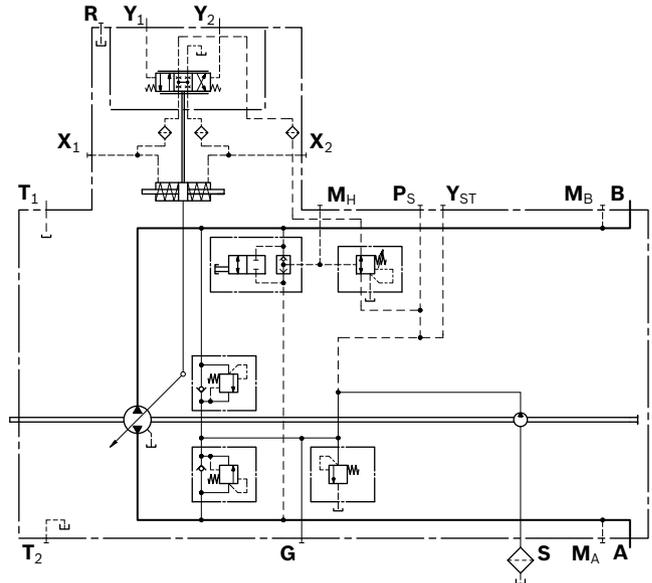






▶ $V_g$ = Displacement at $p_{St}$
   $V_{g\,max}$ = Displacement at $p_{St}$ = 260 psi (18 bar)
▶ Pilot signal $p_{St}$ = 87 to 260 psi (6 to 18 bar)
   (at port $Y_1$, $Y_2$)
▶ Start of control at 87 psi (6 bar)
▶ End of control at 260 psi (18 bar)
   (maximum displacement $V_{g\,max}$)

| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Pilot signal | $Y_1$ | $Y_2$ | $Y_1$ | $Y_2$ |
| Control pressure | $X_1$ | $X_2$ | $X_1$ | $X_2$ |
| Flow direction | **B** to **A** | **A** to **B** | **A** to **B** | **B** to **A** |
| Working pressure | $M_A$ | $M_B$ | $M_B$ | $M_A$ |

**Notice**

In the neutral position, the HP control module must be vented to reservoir via the external pilot control device.

# HW – Proportional control, hydraulic, mechanical servo

The output flow of the pump is infinitely variable between 0 and 100%, proportional to the swivel angle of the control lever.

A feedback lever connected to the stroking piston maintains the pump flow for any given position of the control lever.

If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.
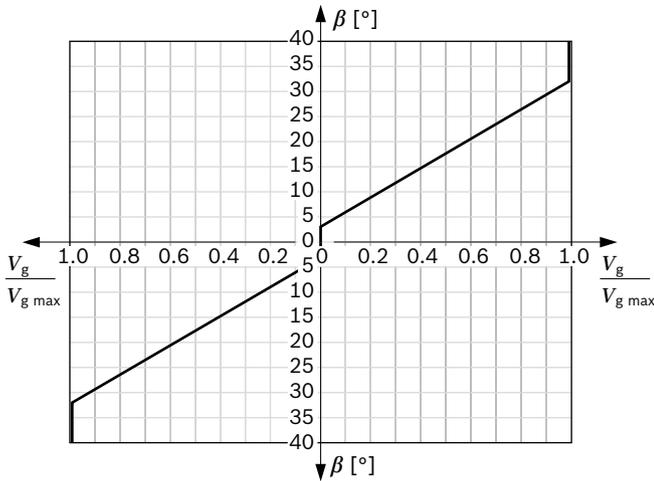
Swivel angle $\beta$ at the control lever for pump displacement change:

▶ Start of control at $\beta = \pm3°$

▶ End of control at $\beta$ (maximum displacement $V_{g\,max}$) at $\pm32°$

▶ Rotational limit $\beta$ of the control lever (internal) $\pm38°$

The maximum required torque at the lever is 15 lb-in (170 Ncm). To prevent damage to the HW control module, a positive mechanical stop of 36.5°±1 must be provided for the HW control lever on the customer side.

**Notice**

▶ Spring centering enables the pump, depending on pressure and speed, to move automatically to the neutral position ($V_g = 0$) as soon as there is no longer any torque on the control lever of the HW control module.

▶ As standard delivery, the control lever is oriented toward the thru drive (see dimensions).
If necessary, the position of the control lever can be changed. The procedure is defined in the instruction manual.

▶ The position of the control lever can deviate from the installation drawing.

**Option: Neutral position switch**

The switch contact in the neutral position switch is closed when the control lever on the HW control module is in its neutral position. The switch opens when the control lever is moved out of the central position in either direction.

Thus, the neutral position switch provides a monitoring function for drive units that require the pump to be in the neutral position during certain operating conditions (e.g. starting diesel engines).

| Technical data | |
|---|---|
| Load capacity | 20 A (continuous), without switching operations |
| Switching capacity | 15 A / 32 V (resistive load) |
| | 4 A / 32 V (inductive load) |
| Connector version | DEUTSCH DT04-2P-EP04 (mating connector, see page 57) |

▼ **Circuit diagram, standard version**
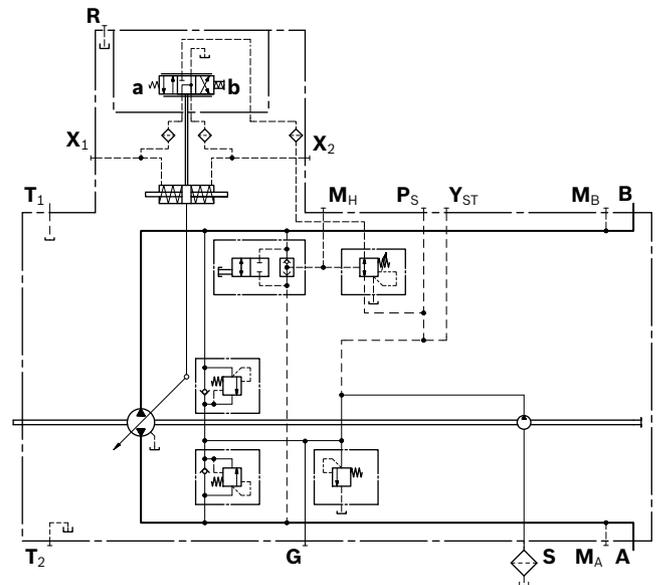
▼ **Circuit diagram, version with neutral position switch**
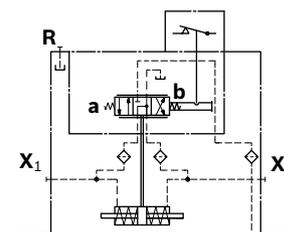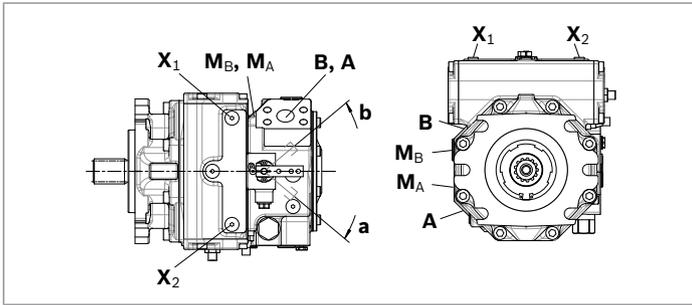
| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Lever direction | **a** | **b** | **a** | **b** |
| Control pressure | $X_1$ | $X_2$ | $X_1$ | $X_2$ |
| Flow direction | **B** to **A** | **A** to **B** | **A** to **B** | **B** to **A** |
| Working pressure | $M_A$ | $M_B$ | $M_B$ | $M_A$ |

# HT – Hydraulic control, direct operated

With the direct operated hydraulic control, the output flow of the pump is controlled by a hydraulic control pressure, applied directly to the stroking piston through either port $X_1$ or $X_2$.

Flow direction is determined by which control pressure port is pressurized (refer to table below).

Pump displacement is infinitely variable and proportional to the applied control pressure, but is also influenced by system pressure and pump drive speed.

In order to use the optional built-in pressure cut-off, port $Y_{HT}$ must be used as the control pressure source for the selected control module. See page 48 for a functional description of the pressure cut-off.

Maximum permissible control pressure: 580 psi (40 bar)

Use of the HT control requires a review of the engine and vehicle parameters to ensure that the pump is set up correctly. We recommend that all HT applications be reviewed by a Bosch Rexroth application engineer.

If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.
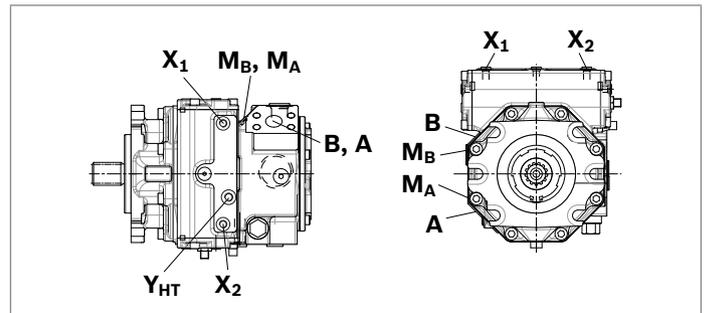


| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Control pressure | $X_1$ | $X_2$ | $X_1$ | $X_2$ |
| Flow direction | **B** to **A** | **A** to **B** | **A** to **B** | **B** to **A** |
| Working pressure | $M_A$ | $M_B$ | $M_B$ | $M_A$ |

▼ **Circuit diagram**
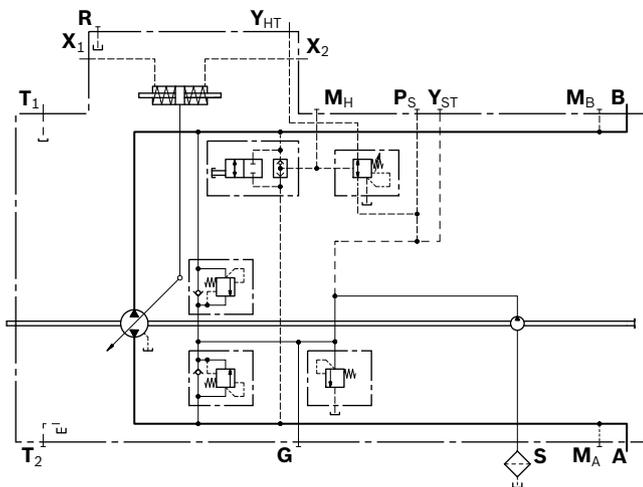
# DA – Automatic control, speed related

The DA closed loop control is an engine speed-dependent system for travel drives. The built-in DA control valve generates a pilot pressure that is proportional to pump (engine) drive speed. This pilot pressure is directed to the stroking cylinder of the pump by an electromagnetically actuated 4/3-way directional valve. The pump displacement is infinitely variable in each flow direction and is influenced by both pump drive speed and system pressure. The flow direction (e.g. machine moving forward or backward) is determined by either solenoid **a** or **b** being activated. Increasing the pump drive speed generates a higher pilot pressure from the DA control valve, with a subsequent increase in pump flow.

Depending on the selected pump operating characteristics, increasing system pressure (e.g. machine load) causes the pump to swivel back towards a smaller displacement. An overload protection for the engine (against stalling) is achieved by combining this pressure-dependent reduction in pump stroke with a reduction in pilot pressure as the engine speed drops.

Any additional power requirement, e.g. for hydraulic functions from attachments, could cause the engine speed to drop further. This will cause a further reduction in pilot pressure and thus of the pump displacement. Automatic power distribution and full exploitation of the available power are achieved in this way, both for the travel drive and for the implement hydraulics, with priority given to the implement hydraulics.

Various override options are available for DA control function to allow controlled operation of the implement hydraulics with high rpm at reduced travel speed.

The DA control valve can also be used in pumps with HP, HW, HT, DA and EP control modules to protect the combustion engine against overload.

**Notice**
▶ Our Sales department will provide you detailed information. Use our computer program to work out the input design that meets your needs. All DA applications must be approved by a Bosch Rexroth application engineer.
▶ DA closed loop control is only suitable for certain types of travel drive systems and requires review of the engine and vehicle parameters to ensure that the pump is used correctly and that machine operation is safe and efficient. We recommend that all DA applications be reviewed by a Bosch Rexroth application engineer.

| Technical data, solenoid | DA1 | DA2 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Neutral position $V_g = 0$ | de-energized | de-energized |
| Position $V_{g\ max}$ | Current switched on | Current switched on |
| Nominal resistance (at 68 °F (20 °C)) | 5.5 Ω | 21.7 Ω |
| Nominal power | 26.2 W | 26.5 W |
| Minimum active current required | 1.32 A | 0.67 A |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 57 | | |



| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Actuation of solenoid | **a** | **b** | **a** | **b** |
| Control pressure | $X_2$ | $X_1$ | $X_2$ | $X_1$ |
| Flow direction | **A** to **B** | **B** to **A** | **B** to **A** | **A** to **B** |
| Working pressure | $M_B$ | $M_A$ | $M_A$ | $M_B$ |

### DA..1 – DA control valve, fixed setting

Pilot pressure is generated in relation to drive speed.

▼ **Circuit diagram**
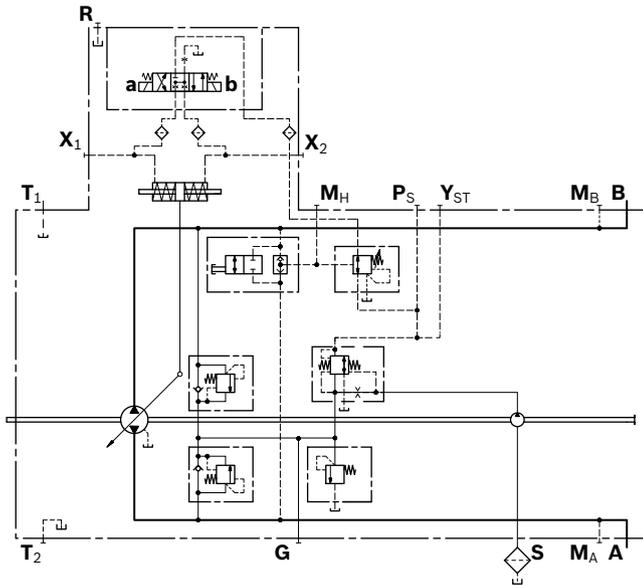


### DA..5 – DA control valve, fixed setting and brake inch valve mounted
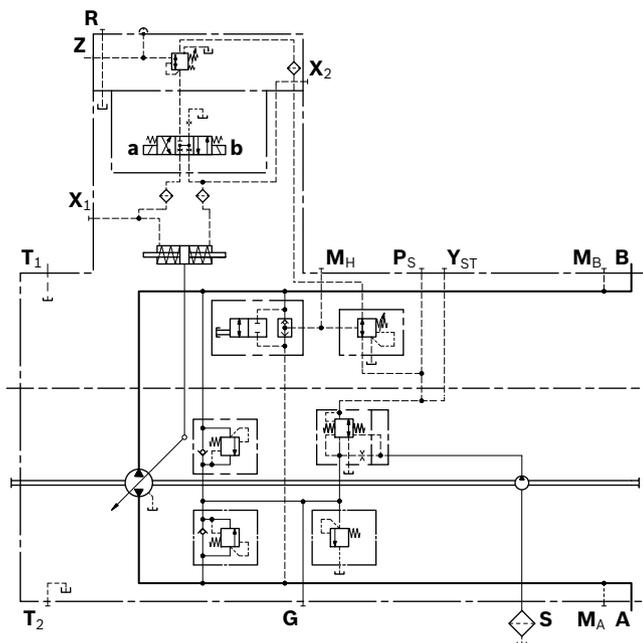
Only for pumps with DA control module.

Version with pressure reducing valve.

Permits reduction of the pilot pressure, independently of the drive speed via hydraulic control (port **Z**).

Control at port **Z** by means of brake fluid based on mineral oil.

Maximum permissible pilot pressure at port **Z**: 1150 psi (80 bar)

▼ **Circuit diagram**



### DA..6 – DA control valve, fixed setting, ports for pilot control device as inch valve

Any reduction of the pilot pressure possible, independent of the drive speed is achieved by the mechanical actuation of the pilot control device.

The pilot control device is installed separately from the pump (for example in the driver's cabin) and connected to the pump by two hydraulic control lines via ports $P_S$ and $Y_{ST}$. A suitable pilot control device must be ordered separately and is not included in the scope of delivery.

▼ **Circuit diagram**
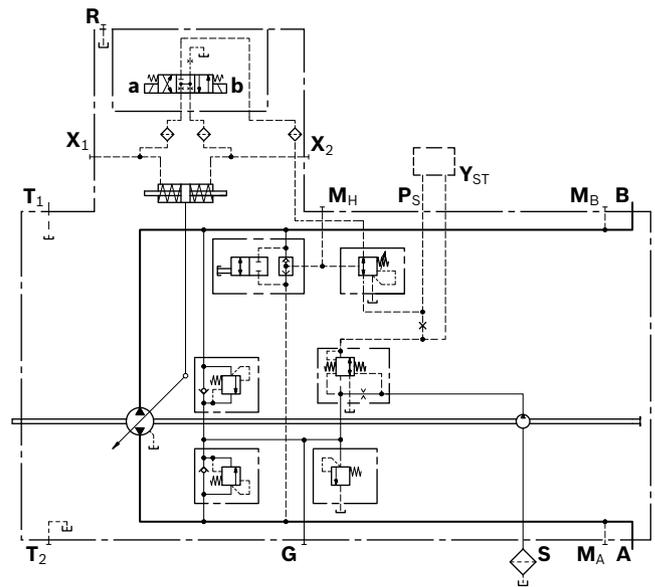
## EP – Proportional control, electric

The output flow of the pump is infinitely variable between 0 and 100%, proportional to the electrical current supplied to solenoid **a** or **b**.

The electrical energy is converted into a force acting on the control spool.

This control spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required.

A feedback lever connected to the stroking piston maintains the pump flow for any given current within the control range.

If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.

Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics

▼ **Circuit diagram**
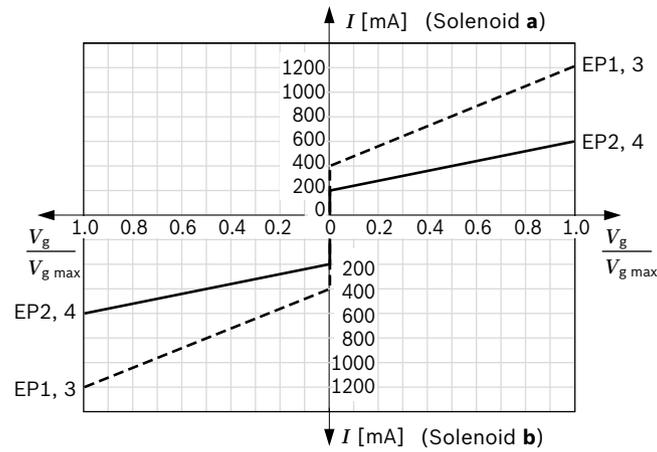






### Notice

The proportional solenoids in version EP1/EP2 do not have manual override. Proportional solenoids with manual override and spring return are available on request (version EP3/EP4).

| Technical data, solenoid | EP1, 3 | EP2, 4 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Control current | | |
|     Start of control at $V_g = 0$ | 400 mA | 200 mA |
|     End of control at $V_{g\,max}$ | 1200 mA | 600 mA |
| Current limit | 1.54 A | 0.77 A |
| Nominal resistance (at 68 °F (20 °C)) | 5.5 Ω | 22.7 Ω |
| Dither | | |
|     Frequency | 100 Hz | 100 Hz |
|     minimum oscillation range[1] | 240 mA | 120 mA |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 57 | | |

| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Actuation of solenoid | **a** | **b** | **a** | **b** |
| Control pressure | $X_1$ | $X_2$ | $X_1$ | $X_2$ |
| Flow direction | **B** to **A** | **A** to **B** | **A** to **B** | **B** to **A** |
| Working pressure | $M_A$ | $M_B$ | $M_B$ | $M_A$ |

[1] Minimum required oscillation range of the control current $\Delta I_{p\text{-}p}$ (peak to peak) within the respective control range (start of control to end of control)

# EZ – Two-point control, electric

By actuating either switching solenoid **a** or **b**, internal control pressure is applied directly to the stroking piston and the pump swivels to maximum displacement. The EZ control enables pump flow to be switched between $V_g = 0$ and $V_{g\,max}$.

Flow direction is determined by which solenoid is energized.

| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Actuation of solenoid | **a** | **b** | **a** | **b** |
| Control pressure | $X_2$ | $X_1$ | $X_2$ | $X_1$ |
| Flow direction | **A** to **B** | **B** to **A** | **B** to **A** | **A** to **B** |
| Working pressure | $M_B$ | $M_A$ | $M_A$ | $M_B$ |

| Technical data, solenoid | EZ1 | EZ2 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Neutral position $V_g = 0$ | de-energized | de-energized |
| Position $V_{g\,max}$ | Current switched on | Current switched on |
| Nominal resistance (at 68 °F (20 °C)) | 5.5 Ω | 21.7 Ω |
| Nominal power | 26.2 W | 26.5 W |
| Minimum active current required | 1.32 A | 0.67 A |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 57 | | |



▼ **Circuit diagram**

## ET – Electric control, direct operated

The output flow of the pump is infinitely variable between 0 and 100%. Depending on the preselected current $I$ at solenoids **a** and **b** of the pressure reducing valves, the stroking cylinder of the pump is proportionally supplied with control pressure. The pump displacement that arises at a certain control current is dependent on the speed and working pressure of the pump. A different flow direction is associated with each pressure reducing valve. Maximum permissible control pressure: 580 psi (40 bar).

| Correlation of direction of rotation, control and flow direction | | | | |
|---|---|---|---|---|
| Direction of rotation | clockwise | | counter-clockwise | |
| Actuation of solenoid | **a** | **b** | **a** | **b** |
| Control pressure (in $X_3$, $X_4$ optional) | $X_1$ | $X_2$ | $X_1$ | $X_2$ |
| | $X_3$ | $X_4$ | $X_3$ | $X_4$ |
| Flow direction | **B** to **A** | **A** to **B** | **A** to **B** | **B** to **A** |
| Working pressure | $M_A$ | $M_B$ | $M_B$ | $M_A$ |

| Technical data, solenoid | ET5 | ET6 |
|---|---|---|
| Voltage | 12 V (±20%) | 24 V (±20%) |
| Current limit | 1.54 A | 0.77 A |
| Nominal resistance (at 68 °F (20 °C)) | 5.5 Ω | 22.7 Ω |
| Dither | | |
|     Frequency | 100 Hz | 100 Hz |
|     minimum oscillation range[1] | 240 mA | 120 mA |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 57 | | |
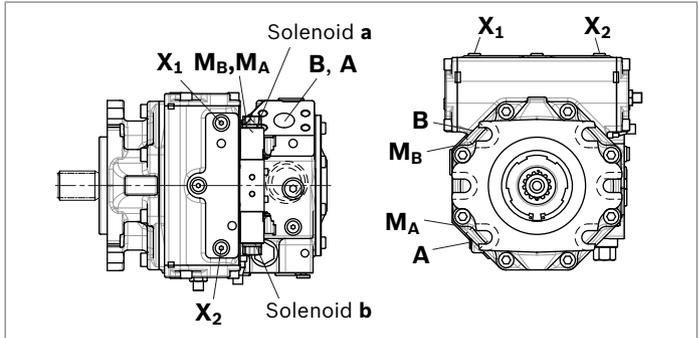


▼ **Circuit diagram**
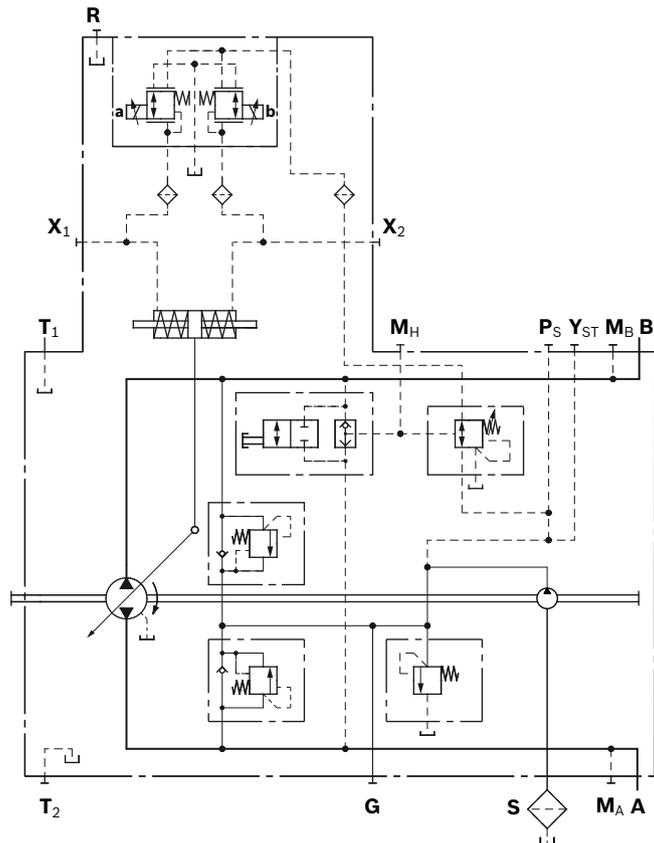


[1] Minimum required oscillation range of the control current $\Delta I_{p\text{-}p}$ (peak to peak) within the respective control range (start of control to end of control)

## Dimensions, size 110

**EP – Proportional control, electric**

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]



Detail view of mounting flange C6 (optional)

Flange C6
SAE J744

Detail **X**
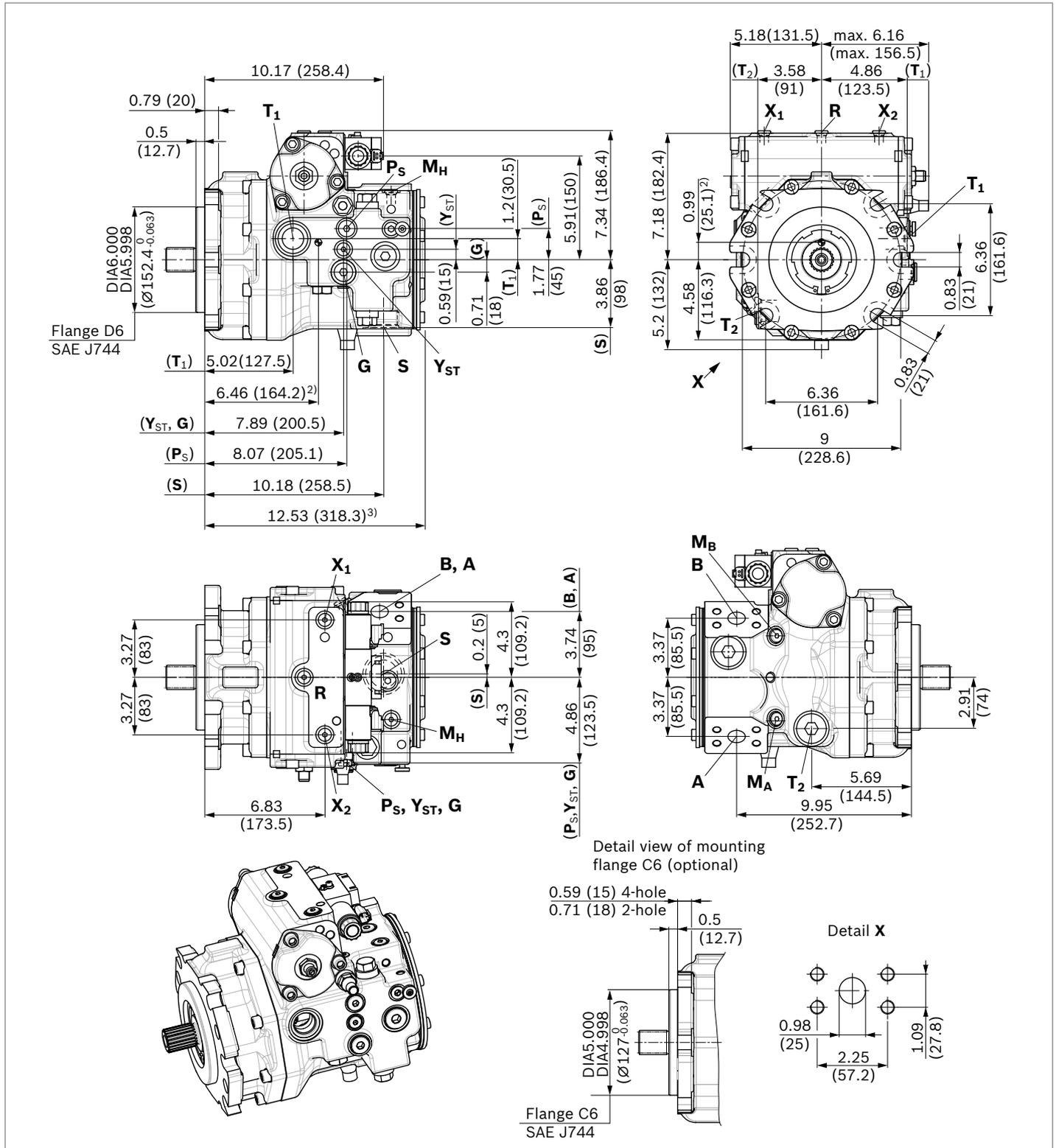
[1] For SAE working ports **A** and **B**, 45° right (viewed on drive shaft), the complete case and thus the dimensions are mirrored.

[2] Center of gravity

[3] Valid for version with standard internal gear pump, overall length without boost pump and with large internal gear pump, see through drive, page 41

▼ **Splined shaft ANSI B92.1a–1976**

**V8 – 1 3/8 in 21T 16/32DP**[1]
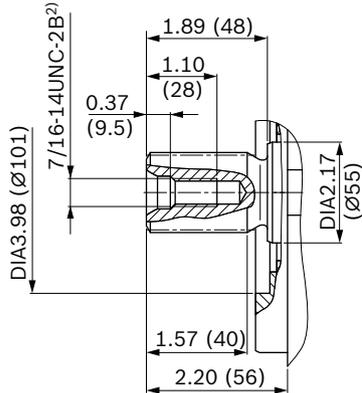


▼ **Splined shaft ANSI B92.1a**

**T1 – 1 3/4 in 13T 8/16DP**[1]
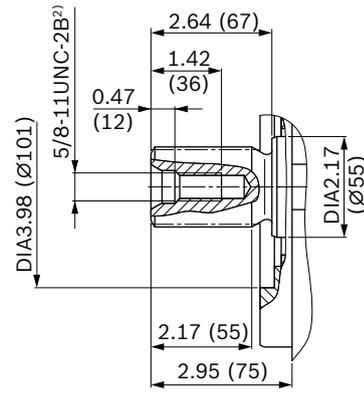


▼ **Splined shaft ANSI B92.1a**

**T2 – 2 in 15T 8/16DP**[1]



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[1] Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

[2] Thread according to ASME B1.1

| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3] | State[10] |
|---|---|---|---|---|---|
| **A, B**[9] | Working port<br>Fastening thread,<br>screw grade 8 with hardened washer | SAEJ518[4]<br>ASME B1.1 | 1 in<br>7/16-14UNC; 0.87 (22) deep | 7250 (500) | O |
| **S** | Suction port | ISO 11926[7] | 1 5/8-12UN-2B; 0.79 (20) deep | 75 (5) | O[5] |
| **T₁** | Drain port | ISO 11926[7] | 1 5/16-12UN-2B; 0.79 (20) deep | 45 (3) | O[6] |
| **T₂** | Drain port | ISO 11926[7] | 1 5/16-12UN-2B; 0.79 (20) deep | 45 (3) | X[6] |
| **R** | Air bleed port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X₁, X₂** | Control pressure port (upstream of orifice) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X₃, X₄**[8] | Stroking chamber pressure port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **Pₛ** | Pilot pressure port inlet | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **Pₛ** | Pilot pressure port inlet (DA..6 only) | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y_ST** | Pilot pressure port outlet | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y_ST** | Pilot pressure port outlet (DA..6 only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M_A, M_B** | Measuring port pressure A, B | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M_H** | Measuring port, high pressure | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

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[3] Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

[4] Only dimensions according to SAE J518.

[5] Plugged for external boost pressure supply.

[6] Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 60).

[7] The countersink can be deeper than as specified in the standard.

[8] Optional, see page 51

[9] For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
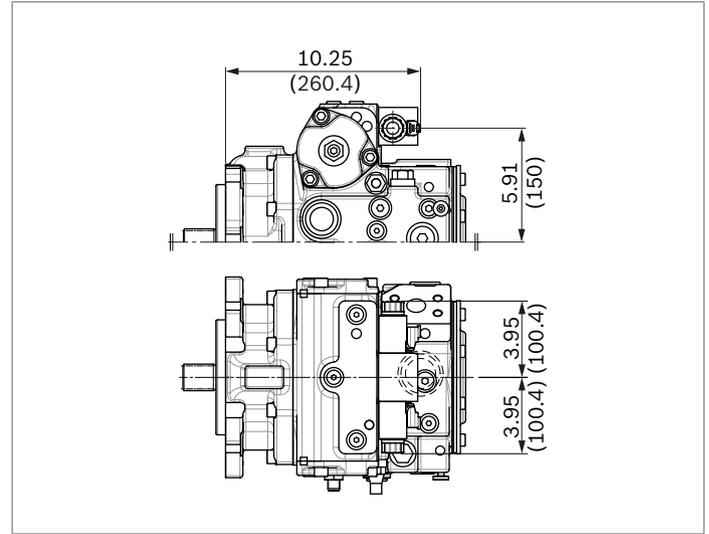
[10] O = Must be connected (plugged when delivered)
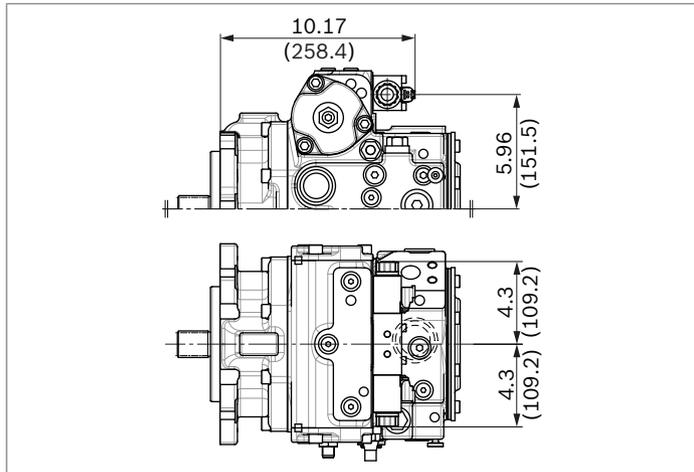X = Plugged (in normal operation)

▼ **HW** – Proportional control, hydraulic, mechanical servo



Version with neutral position switch, HW8

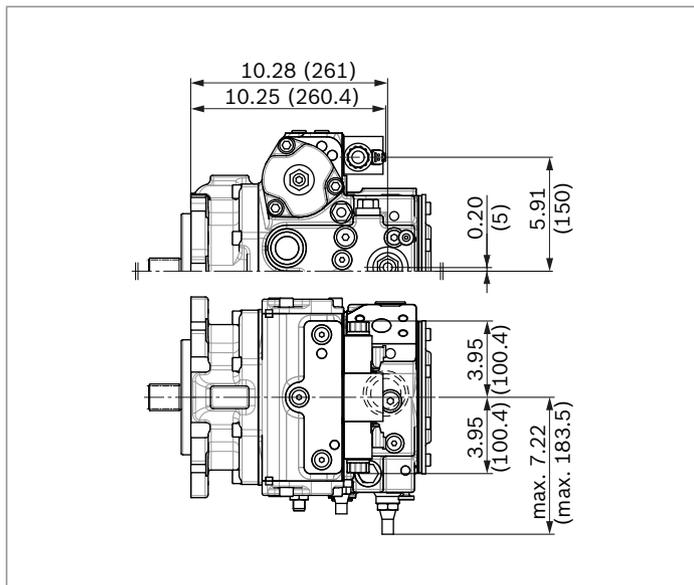▼ **EZ** – Two-point control, electric



▼ **ET** – Electric control, direct operated, two DRE
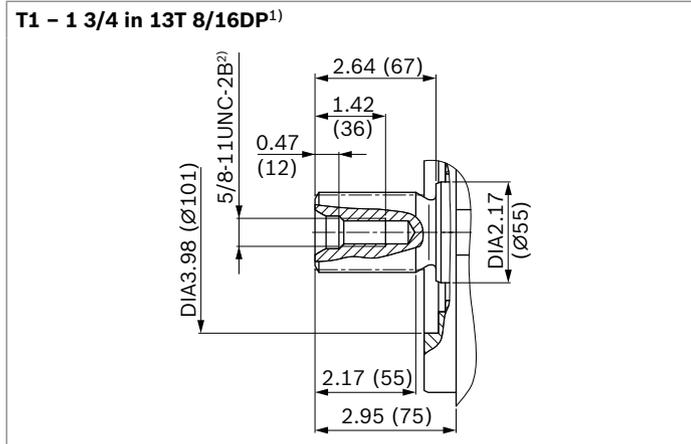


**DA control valve**

▼ **DA..1** – fixed setting

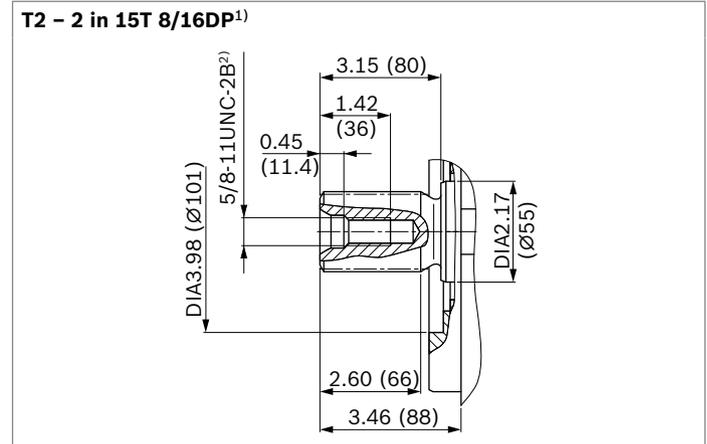

▼ **DA..5** – fixed setting and inch valve mounted

## Dimensions, size 125

### EP – Proportional control, electric

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]



Detail view of mounting flange C6 (optional)

0.59 (15) 4-hole
0.71 (18) 2-hole

Flange C6
SAE J744

Detail **X**

[1] For SAE working ports **A** and **B**, 45° right (viewed on drive shaft),
   the complete case and thus the dimensions are mirrored.

[2] Center of gravity

[3] Valid for version with standard internal gear pump,
   overall length without boost pump see through drive, page 41.

▼ **Splined shaft ANSI B92.1a**

**T1 – 1 3/4 in 13T 8/16DP**[1]



▼ **Splined shaft ANSI B92.1a**

**T2 – 2 in 15T 8/16DP**[1]



| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3] | State[10] |
|---|---|---|---|---|---|
| **A, B**[9] | Working port Fastening thread, screw grade 8 with hardened washer | SAEJ518[4] ASME B1.1 | 1 in 7/16-14UNC; 0.87 (22) deep | 7250 (500) | O |
| **S** | Suction port | ISO 11926[7] | 1 5/8-12UN-2B; 0.79 (20) deep | 75 (5) | O[5] |
| **T₁** | Drain port | ISO 11926[7] | 1 5/16-12UN-2B; 0.79 (20) deep | 45 (3) | O[6] |
| **T₂** | Drain port | ISO 11926[7] | 1 5/16-12UN-2B; 0.79 (20) deep | 45 (3) | X[6] |
| **R** | Air bleed port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X₁, X₂** | Control pressure port (upstream of orifice) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X₃, X₄**[8] | Stroking chamber pressure port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet (DA..6 only) | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y_ST** | Pilot pressure port outlet | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y_ST** | Pilot pressure port outlet (DA..6 only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M_A, M_B** | Measuring port pressure A, B | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M_H** | Measuring port, high pressure | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

[1] Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ASME B1.1
[3] Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
[4] Only dimensions according to SAE J518.
[5] Plugged for external boost pressure supply.

[6] Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 60).
[7] The countersink can be deeper than as specified in the standard.
[8] Optional, see page 51
[9] For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
[10] O = Must be connected (plugged when delivered)
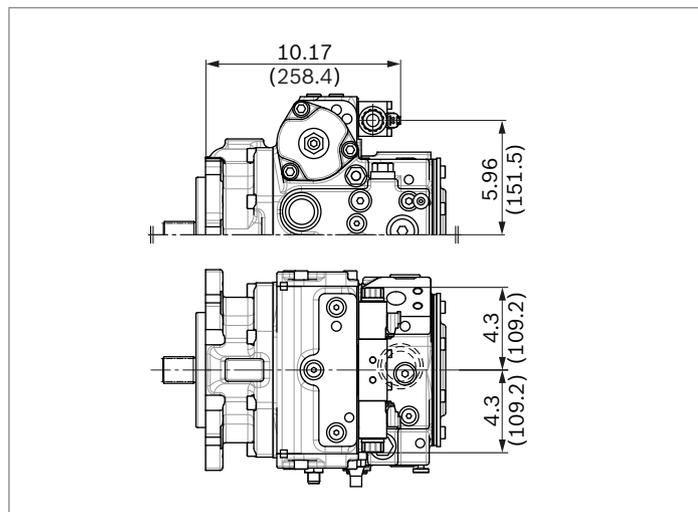X = Plugged (in normal operation)

▼ **HW** – Proportional control, hydraulic, mechanical servo



Version with
neutral position
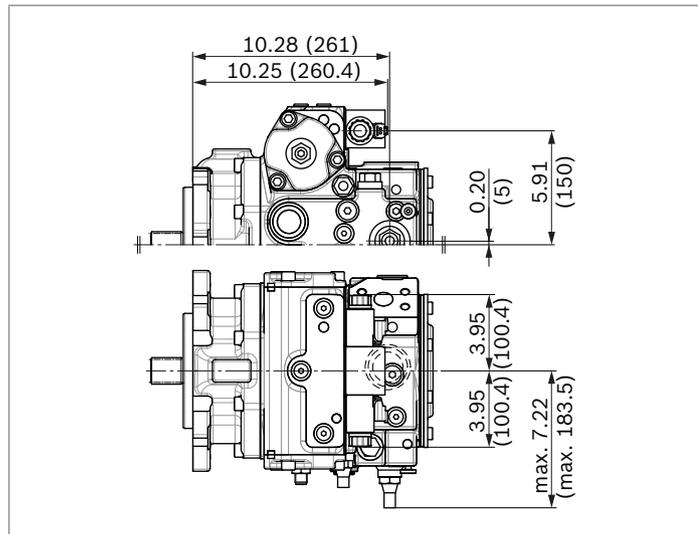switch, HW8

▼ **EZ** – Two-point control, electric



▼ **ET** – Electric control, direct operated, two DRE
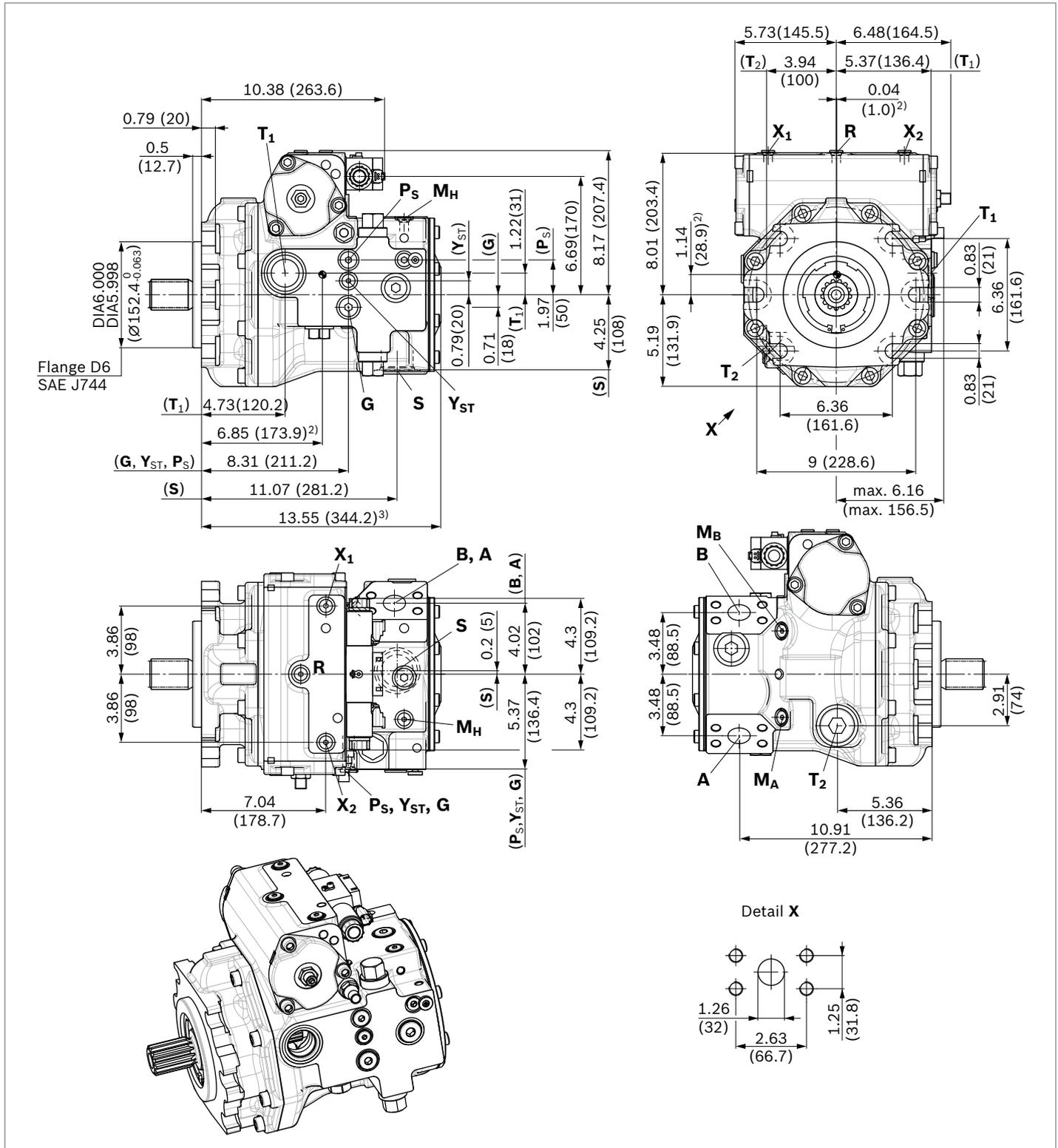


## DA control valve

▼ **DA..1** – fixed setting

## Dimensions, size 145

### EP – Proportional control, electric

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]
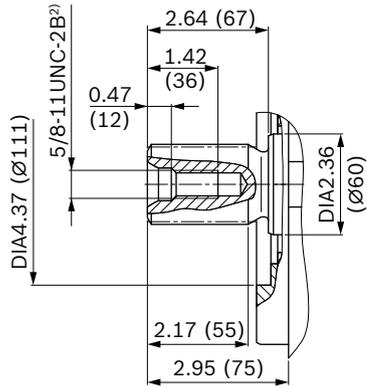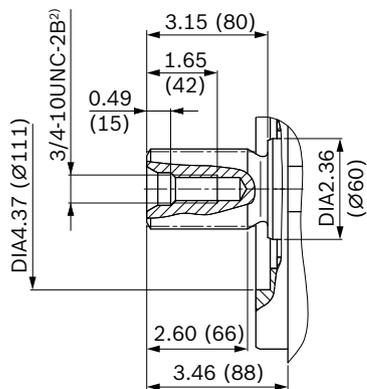


Detail **X**



[1] For SAE working ports **A** and **B**, 45° right (viewed on drive shaft), the complete case and thus the dimensions are mirrored.

[2] Center of gravity

[3] Valid for version without boost pump and for standard internal gear pump, overall length with large internal gear pump, see through drive, page 41.

▼ **Splined shaft ANSI B92.1a**

**T1 – 1 3/4 in 13T 8/16DP**[1]



▼ **Splined shaft ANSI B92.1a**

**T2 – 2 in 15T 8/16DP**[1]
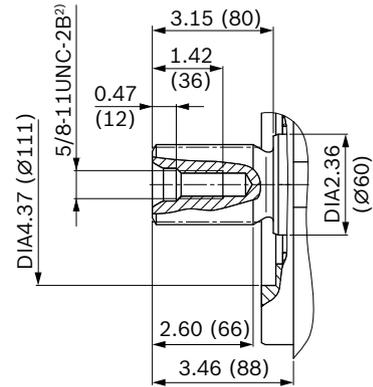


▼ **Splined shaft ANSI B92.1a**

**T3 – 2 1/4 in 17T 8/16DP**[1]



---

[1] Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

[2] Thread according to ASME B1.1

| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3] | State[10] |
|---|---|---|---|---|---|
| **A, B**[9] | Working port<br>Fastening thread,<br>screw grade 8 with hardened washer | SAEJ518[4]<br>ASME B1.1 | 1 1/4 in<br>1/2-13UNC; 0.75 (19) deep | 7250 (500) | O |
| **S** | Suction port | ISO 11926[7] | 1 7/8-12UN-2B; 0.79 (20) deep | 75 (5) | O[5] |
| **T**$_1$ | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | O[6] |
| **T**$_2$ | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | X[6] |
| **R** | Air bleed port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X**$_1$, **X**$_2$ | Control pressure port (upstream of orifice) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X**$_1$, **X**$_2$ | Control pressure port (upstream of orifice, HT only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **X**$_3$, **X**$_4$[8] | Stroking chamber pressure port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **P**$_S$ | Pilot pressure port inlet | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **P**$_S$ | Pilot pressure port inlet (DA..6 only) | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y**$_{ST}$ | Pilot pressure port outlet | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y**$_{ST}$ | Pilot pressure port outlet (DA..6 only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Y**$_{HT}$ | Pilot pressure port outlet (HT only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M**$_A$, **M**$_B$ | Measuring port pressure A, B | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M**$_H$ | Measuring port, high pressure | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Y**$_1$, **Y**$_2$ | Pilot pressure port (pilot signal HP only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

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3)  Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4)  Only dimensions according to SAE J518.
5)  Plugged for external boost pressure supply.
6)  Depending on installation position, **T**$_1$ or **T**$_2$ must be connected (see also installation instructions on page 60).

7)  The countersink can be deeper than as specified in the standard.
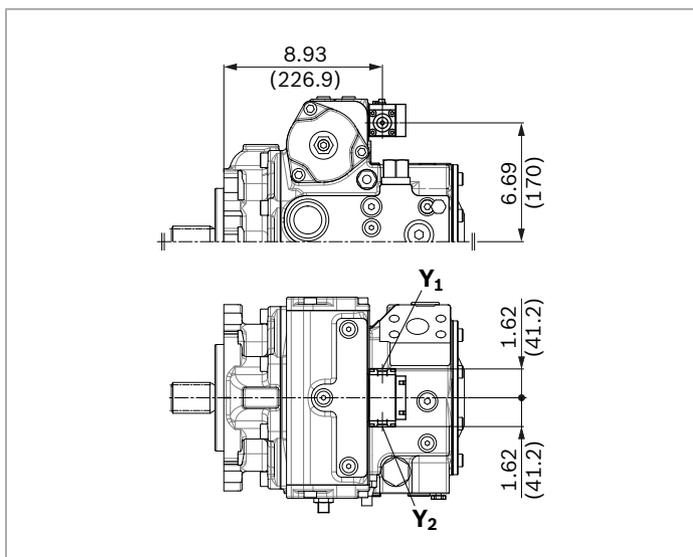8)  Optional, see page 51
9)  For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
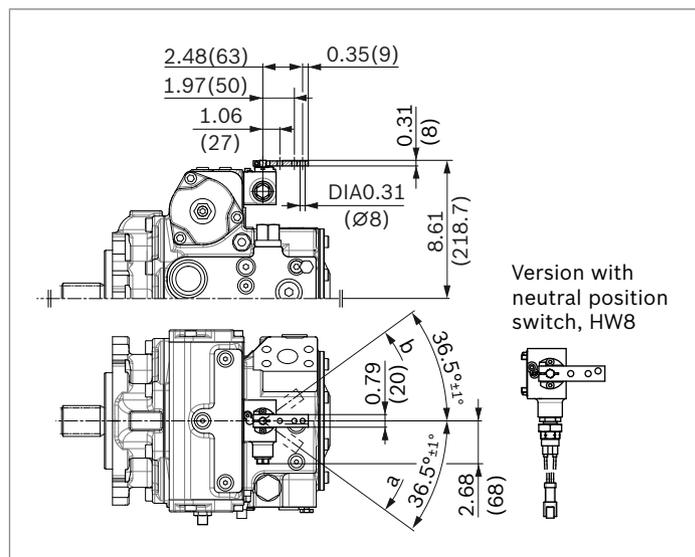10)  O = Must be connected (plugged when delivered)
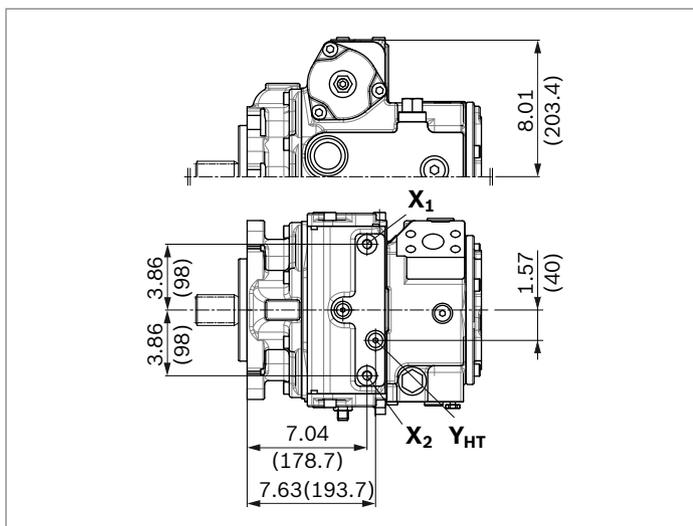    X = Plugged (in normal operation)

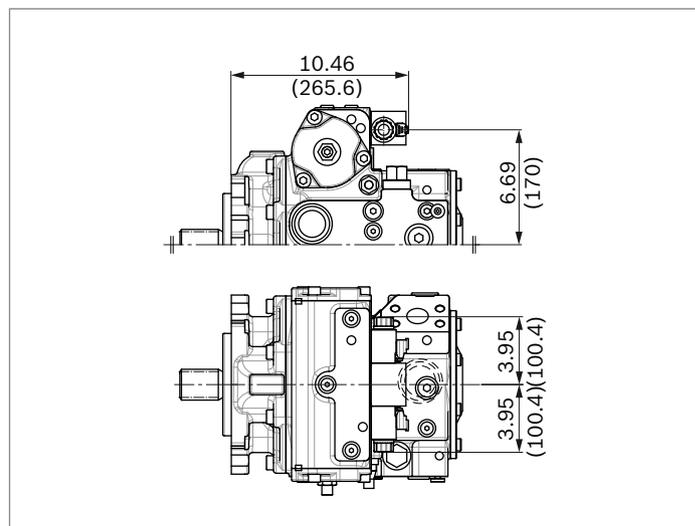▼ **HP** – Proportional control, hydraulic, pilot-pressure related



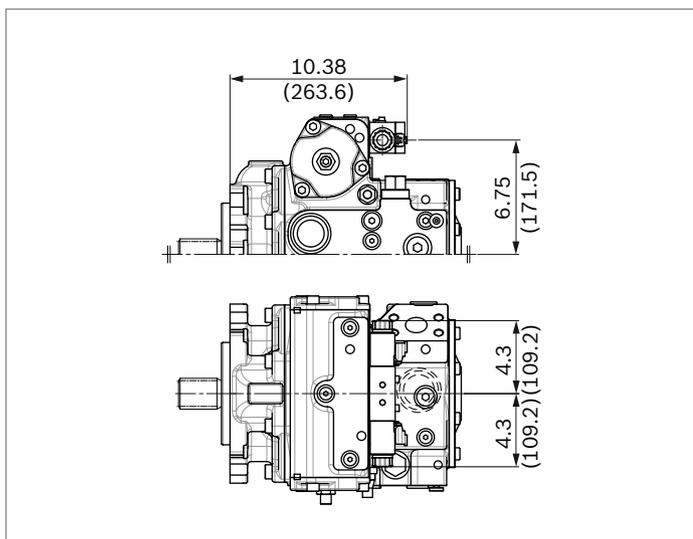▼ **HW** – Proportional control, hydraulic, mechanical servo



Version with neutral position switch, HW8

▼ **HT** – Hydraulic control, direct operated
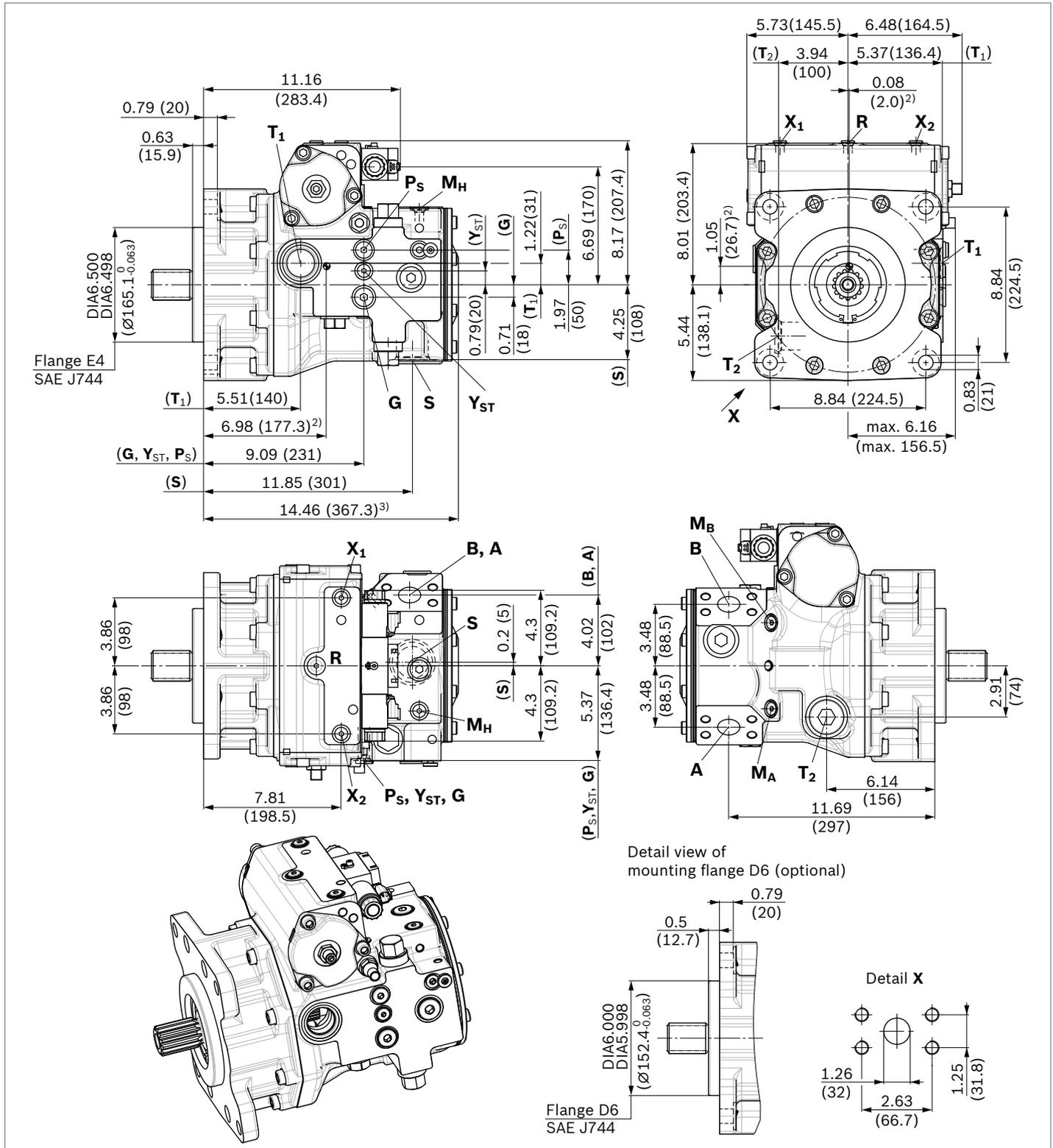


▼ **EZ** – Two-point control, electric



▼ **ET** – Electric control, direct operated, two DRE

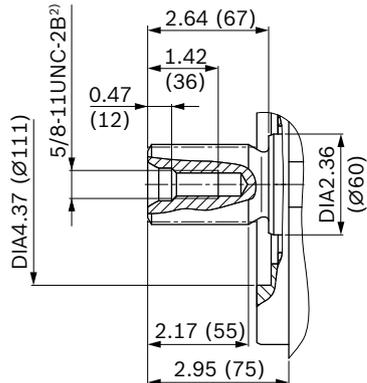## Dimensions, size 175

### EP – Proportional control, electric

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]



Detail view of
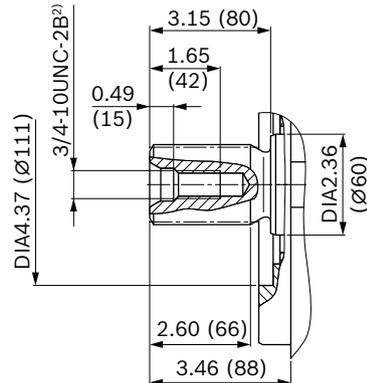mounting flange D6 (optional)

Flange D6
SAE J744

Detail **X**

[1]  For SAE working ports **A** and **B**, 45° right (viewed on drive shaft),
    the complete case and thus the dimensions are mirrored.
[2]  Center of gravity

[3]  Valid for version with standard internal gear pump,
    overall length without boost pump and with large internal gear
    pump, see through drive, page 41.

▼ **Splined shaft ANSI B92.1a**

**T1 – 1 3/4 in 13T 8/16DP[1)]**



▼ **Splined shaft ANSI B92.1a**

**T3 – 2 1/4 in 17T 8/16DP[1)]**



| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3)] | State[10)] |
|---|---|---|---|---|---|
| **A, B**[9)] | Working port Fastening thread, screw grade 8 with hardened washer | SAEJ518[4)] ASME B1.1 | 1 1/4 in 1/2-13UNC; 0.75 (19) deep | 7250 (500) | O |
| **S** | Suction port | ISO 11926[7)] | 1 7/8-12UN-2B; 0.79 (20) deep | 75 (5) | O[5)] |
| **T$_1$** | Drain port | ISO 11926[7)] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | O[6)] |
| **T$_2$** | Drain port | ISO 11926[7)] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | X[6)] |
| **R** | Air bleed port | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X$_1$, X$_2$** | Control pressure port (upstream of orifice) | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X$_1$, X$_2$** | Control pressure port (upstream of orifice, HT only) | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **X$_3$, X$_4$**[8)] | Stroking chamber pressure port | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7)] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **P$_S$** | Pilot pressure port inlet | ISO 11926[7)] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **P$_S$** | Pilot pressure port inlet (DA..6 only) | ISO 11926[7)] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y$_{ST}$** | Pilot pressure port outlet | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y$_{ST}$** | Pilot pressure port outlet (DA..6 only) | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Y$_{HT}$** | Pilot pressure port outlet (HT only) | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M$_A$, M$_B$** | Measuring port pressure A, B | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M$_H$** | Measuring port, high pressure | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Y$_1$, Y$_2$** | Pilot pressure port (pilot signal HP only) | ISO 11926[7)] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7)] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518.
5) Plugged for external boost pressure supply.

6) Depending on installation position, **T$_1$** or **T$_2$** must be connected (see also installation instructions on page 60).
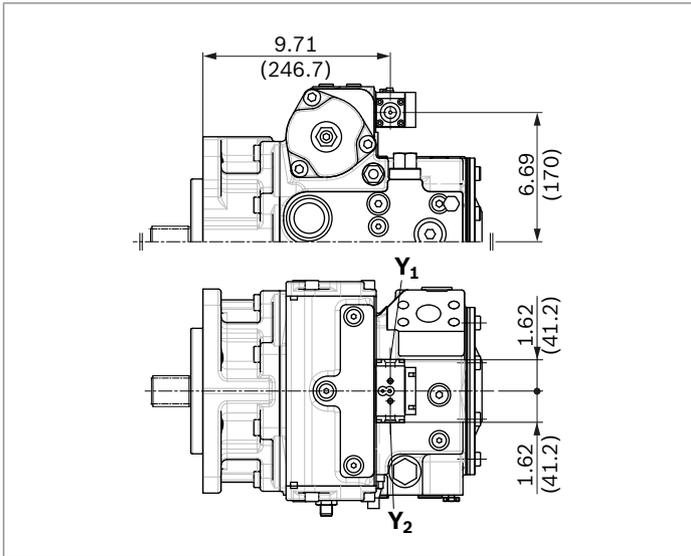7) The countersink can be deeper than as specified in the standard.
8) Optional, see page 51
9) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
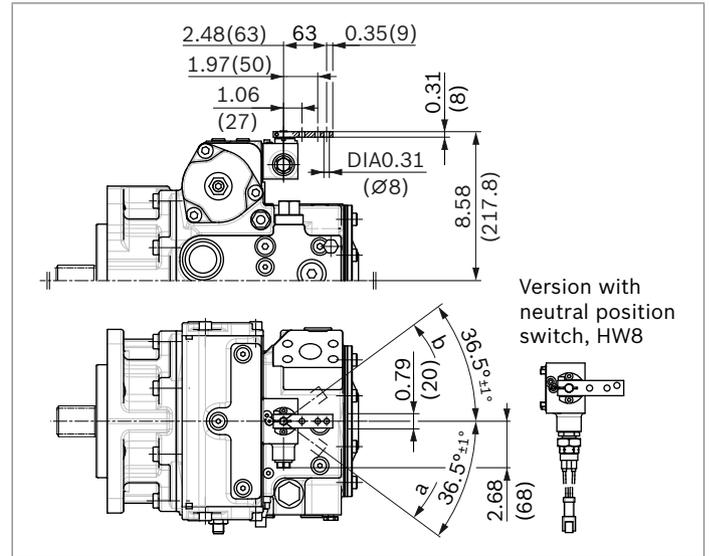10) O = Must be connected (plugged when delivered)
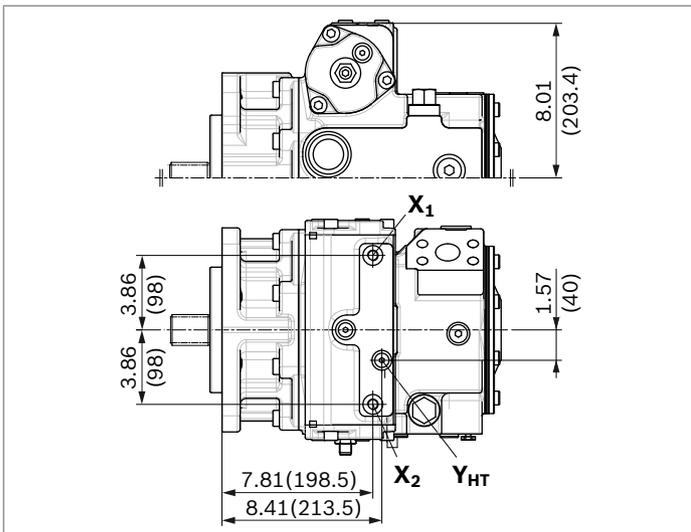    X = Plugged (in normal operation)

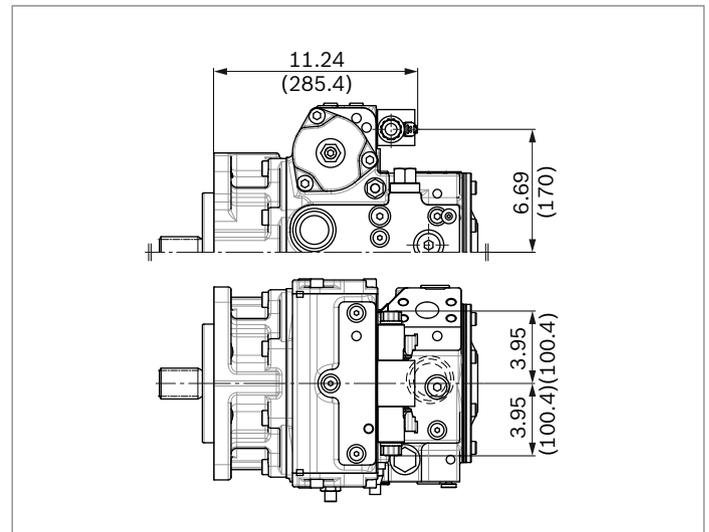▼ **HP** – Proportional control, hydraulic, pilot-pressure
related

9.71
(246.7)

6.69
(170)

**Y₁**

1.62
(41.2)

1.62
(41.2)

**Y₂**

▼ **HW** – Proportional control, hydraulic, mechanical servo

2.48(63)   63   0.35(9)
1.97(50)
1.06
(27)

0.31
(8)

DIA0.31
(Ø8)

8.58
(217.8)

Version with
neutral position
switch, HW8

36.5°±1°

b
0.79
(20)

a   36.5°±1°

2.68
(68)

▼ **HT** – Hydraulic control, direct operated

8.01
(203.4)

**X₁**

3.86
(98)

3.86
(98)

1.57
(40)

7.81(198.5)
8.41(213.5)

**X₂**   **Y_HT**

▼ **EZ** – Two-point control, electric

11.24
(285.4)

6.69
(170)

3.95
(100.4)

3.95
(100.4)

▼ **ET** – Electric control, direct operated, two DRE

11.16
(283.4)

6.75
(171.5)

4.3
(109.2)

4.3
(109.2)

## Dimensions, size 210

### EP – Proportional control, electric

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]



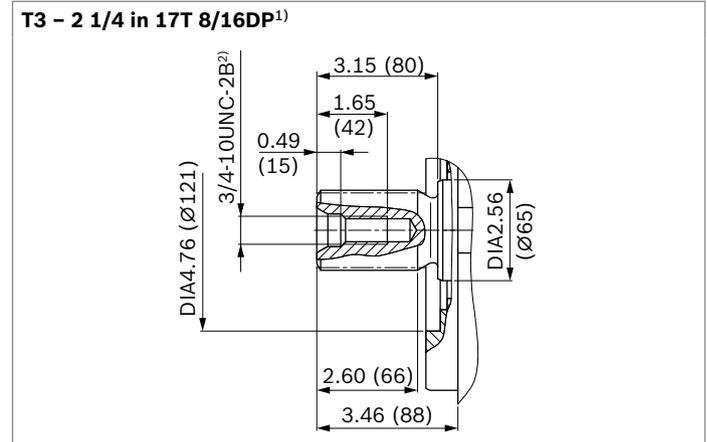Detail **X**
Port **A**, **B**

Detail **Y**
Port **S**

[1] For SAE working ports **A** and **B**, 45° right (viewed on drive shaft),
the complete case and thus the dimensions are mirrored.

[2] Center of gravity

[3] Valid for version without boost pump and for standard internal
gear pump, overall length with large internal gear pump, see
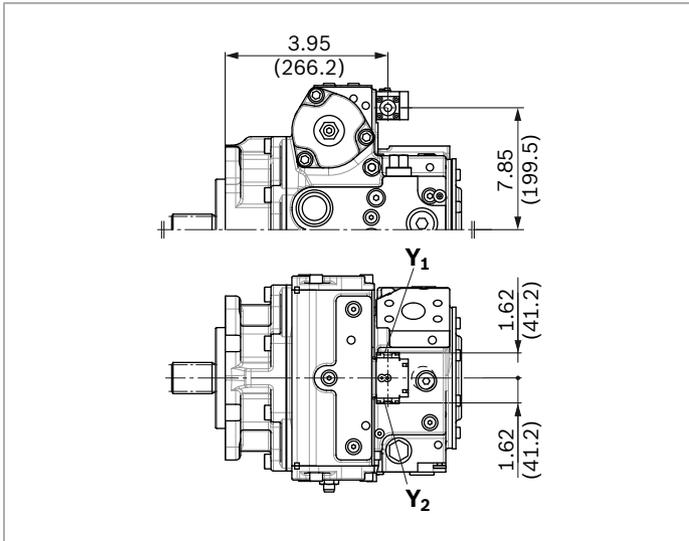through drive, page 41.

▼ **Splined shaft ANSI B92.1a**

**T2 – 2 in 15T 8/16DP[1]**



▼ **Splined shaft ANSI B92.1a**

**T3 – 2 1/4 in 17T 8/16DP[1]**



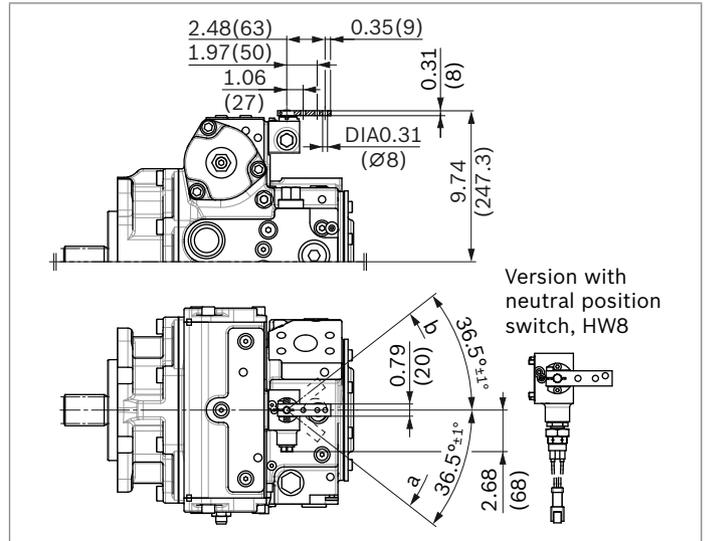| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3] | State[10] |
|---|---|---|---|---|---|
| **A, B**[9] | Working port Fastening thread, screw grade 8 with hardened washer | SAEJ518[4] ASME B1.1 | 1 1/2 in 5/8-11UNC; 1.14 (29) deep | 7250 (500) | O |
| **S** | Suction port Fastening thread | SAEJ518[4] ASME B1.1 | 1 1/4 in 1/2-13UNC; 0.94 (24) deep | 75 (5) | O[5] |
| **T₁** | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | O[6] |
| **T₂** | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | X[6] |
| **R** | Air bleed port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X₁, X₂** | Control pressure port (upstream of orifice) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X₃, X₄**[8] | Stroking chamber pressure port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet (DA..6 only) | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y_ST** | Pilot pressure port outlet | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y_ST** | Pilot pressure port outlet (DA..6 only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M_A, M_B** | Measuring port pressure A, B | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M_H** | Measuring port, high pressure | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Y₁, Y₂** | Pilot pressure port (pilot signal HP only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518.
5) Plugged for external boost pressure supply.

6) Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 60).
7) The countersink can be deeper than as specified in the standard.
8) Optional, see page 51
9) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
10) O = Must be connected (plugged when delivered)
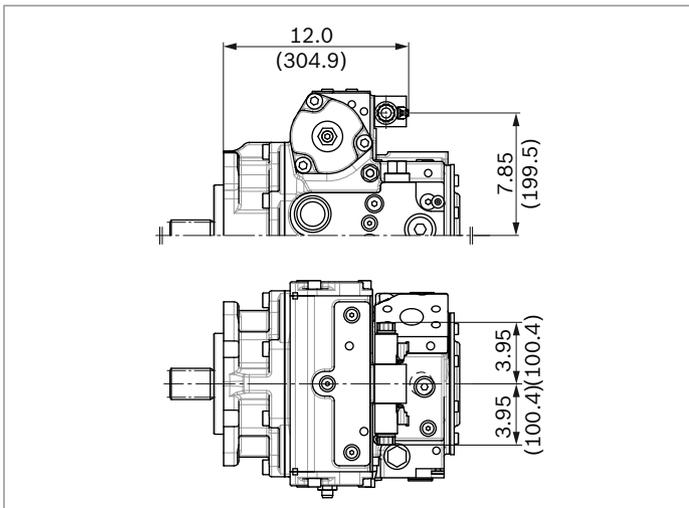    X = Plugged (in normal operation)

▼ **HP** – Proportional control, hydraulic, pilot-pressure
    related

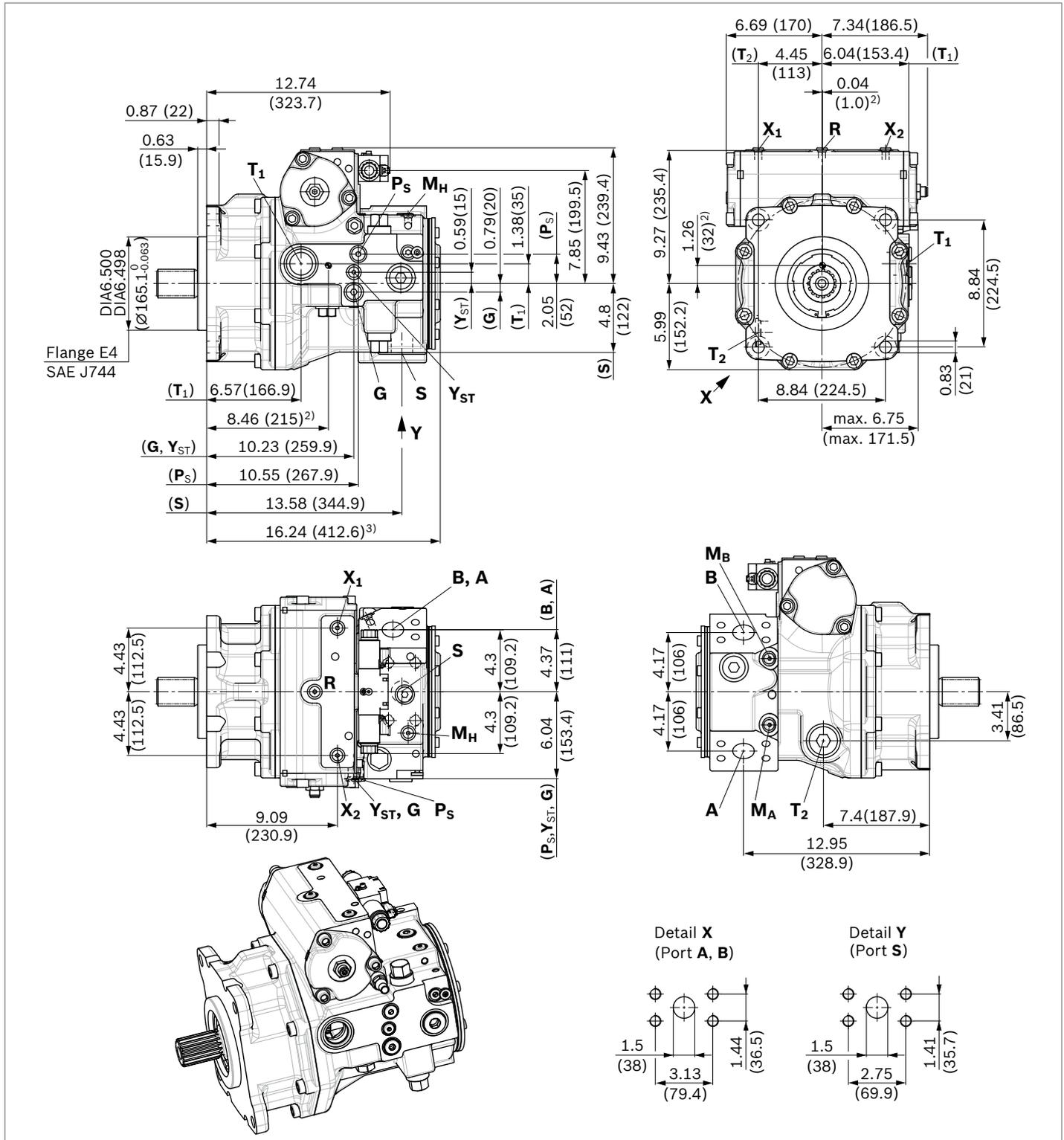▼ **HW** – Proportional control, hydraulic, mechanical servo



▼ **EZ** – Two-point control, electric

## Dimensions, size 280

### EP – Proportional control, electric

SAE working ports **A** and **B**, on left side 45° (viewed on drive shaft)[1]



Detail **X**
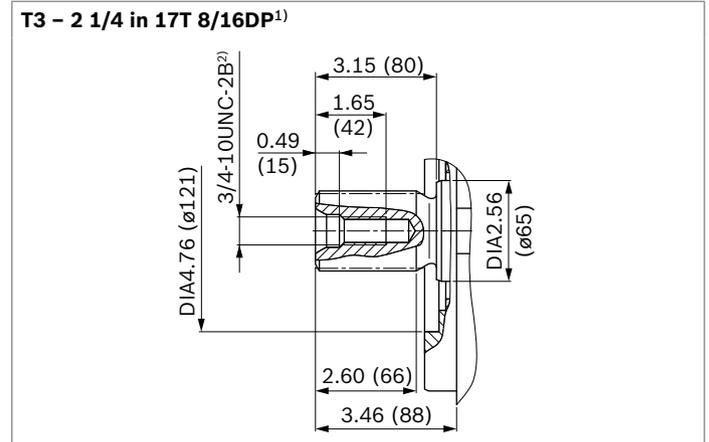(Port **A**, **B**)

Detail **Y**
(Port **S**)

[1] For SAE working ports **A** and **B**, 45° right (viewed on drive shaft),
the complete case and thus the dimensions are mirrored.

[2] Center of gravity

[3] Valid for version with standard internal gear pump,
overall length without boost pump see through drive, page 41.

▼ **Splined shaft ANSI B92.1a**

**T2 – 2 in 15T 8/16DP**[1]
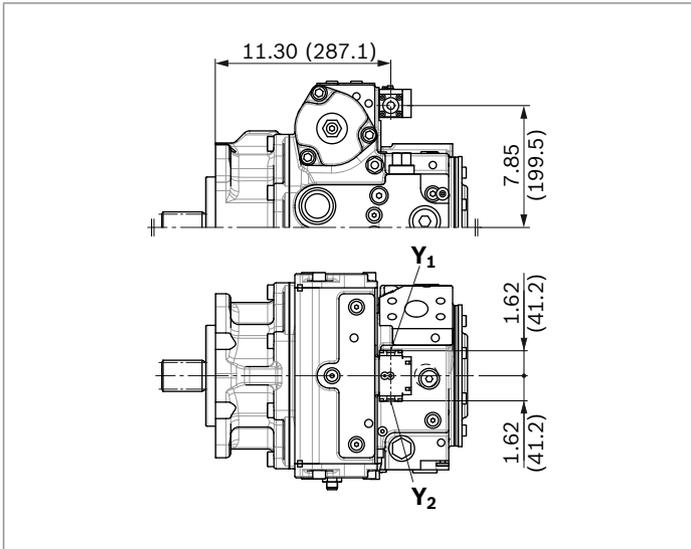


▼ **Splined shaft ANSI B92.1a**

**T3 – 2 1/4 in 17T 8/16DP**[1]



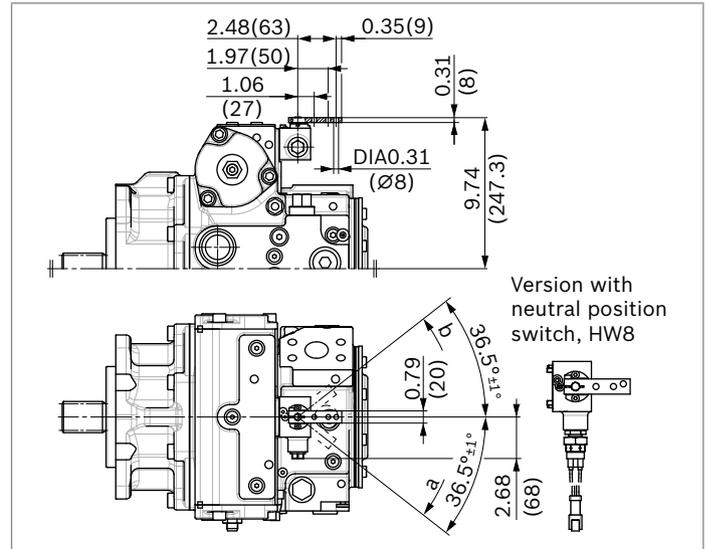| Ports | | Standard | Size | $p_{max}$ [psi (bar)][3] | State[10] |
|---|---|---|---|---|---|
| **A, B**[9] | Working port Fastening thread, screw grade 8 with hardened washer | SAEJ518[4] ASME B1.1 | 1 1/2 in 5/8-11UNC; 1.14 (29) deep | 7250 (500) | O |
| **S** | Suction port fastening thread | SAEJ518[4] ASME B1.1 | 1 1/2 in 1/2-13UNC; 0.94 (24) deep | 75 (5) | O[5] |
| **T₁** | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | O[6] |
| **T₂** | Drain port | ISO 11926[7] | 1 5/8-12UN-2B; 0.77 (19.5) deep | 45 (3) | X[6] |
| **R** | Air bleed port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 45 (3) | X |
| **X₁, X₂** | Control pressure port (upstream of orifice) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **X₃, X₄**[8] | Stroking chamber pressure port | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **G** | Boost pressure port inlet | ISO 11926[7] | 7/8-14UNF-2B; 0.67 (17) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | X |
| **P_S** | Pilot pressure port inlet (DA..6 only) | ISO 11926[7] | 3/4-16UNF-2B; 0.59 (15) deep | 580 (40) | O |
| **Y_ST** | Pilot pressure port outlet | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | X |
| **Y_ST** | Pilot pressure port outlet (DA..6 only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **M_A, M_B** | Measuring port pressure A, B | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **M_H** | Measuring port, high pressure | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 7250 (500) | X |
| **Y₁, Y₂** | Pilot pressure port (pilot signal HP only) | ISO 11926[7] | 9/16-18UNF-2B; 0.51 (13) deep | 580 (40) | O |
| **Z** | Pilot pressure port (inch signal DA..5 only) | ISO 11926[7] | 3/8-24UNF-2B; 0.39 (10) deep | 1150 (80) | O |

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518.
5) Plugged for external boost pressure supply.

6) Depending on installation position, $T_1$ or $T_2$ must be connected (see also installation instructions on page 60).
7) The countersink can be deeper than as specified in the standard.
8) Optional, see page 51
9) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.
10) O = Must be connected (plugged when delivered)
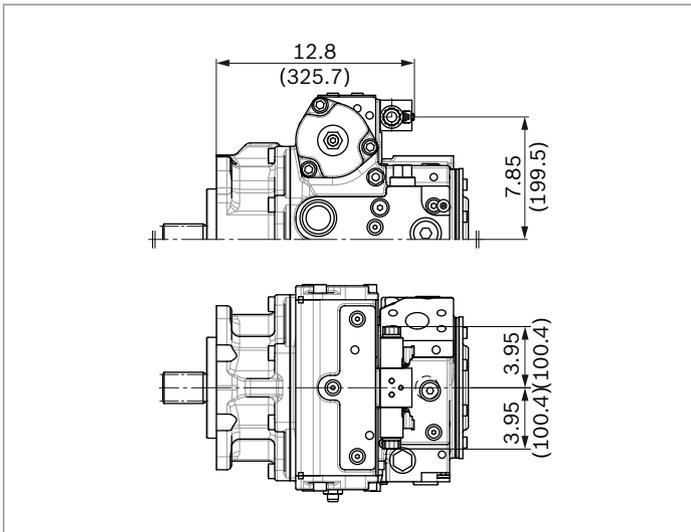    X = Plugged (in normal operation)

▼ **HP** – Proportional control, hydraulic, pilot-pressure related

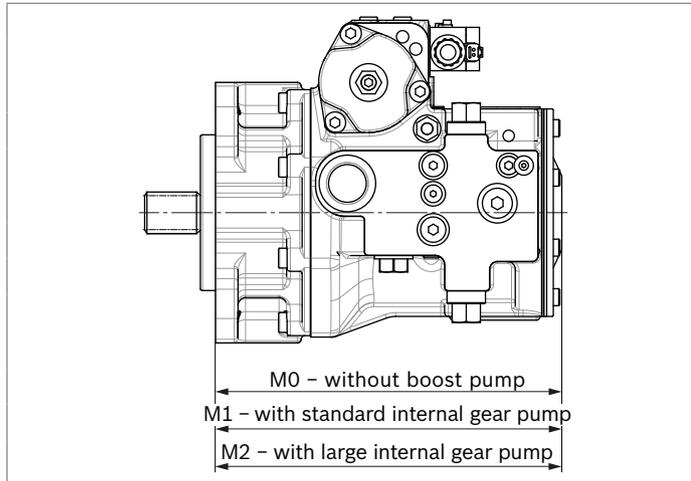▼ **HW** – Proportional control, hydraulic, mechanical servo

Version with neutral position switch, HW8

▼ **EZ** – Two-point control, electric

## Dimensions, through drive

| Flange SAE J744[1] | | | Hub for splined shaft[2] | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[3] | Code | Diameter | Code | 110 | 125 | 145 | 175 | 210 | 280 | |
| Without through drive | | | | | ● | ● | ● | ● | ● | ● | **0000** |
| 82-2 (A) | ᵒ̤ | A1 | 5/8 in  9T 16/32DP | S2 | ○ | – | ● | ○ | – | – | **A1S2** |
| | ∞ | A2 | 5/8 in  9T 16/32DP | S2 | ● | ○ | ○ | ○ | ○ | ○ | **A2S2** |

▼ **Without through drive, without boost pump, with standard internal gear pump or with large internal gear pump**



M0 – without boost pump
M1 – with standard internal gear pump
M2 – with large internal gear pump

| NG | M0 | M1 | M2 |
|---|---|---|---|
| **110** | 12.37 | 12.53 | 12.70 |
| | (314.3) | (318.3) | (322.7) |
| **125** | 12.37 | 12.70 | – |
| | (314.3) | (322.7) | – |
| **145** | 13.55 | 13.55 | 13.68 |
| | (344.2) | (344.2) | (347.5) |
| **175** | 14.32 | 14.46 | 14.s57 |
| | (363.8) | (367.3) | (370.1) |
| **210** | 15.26 | 15.26 | 15.46 |
| | (387.6) | (387.6) | (392.7) |
| **280** | 16.04 | 16.24 | – |
| | (407.3) | (412.6) | – |

▼ **82-2**



A1 ᵒ̤
A2 ∞    4.19
       (106.4)

M1 – with standard internal gear pump
M2 – with large internal gear pump
   (to mounting flange)

M6
O-ring[4]
M3
M4
M5
(DIA3.25 +0.0014/+0.0004)
(Ø82.55 +0.035/+0.010)

| NG | M1 | M2 | M3 | M4 | M5 | M6[5] |
|---|---|---|---|---|---|---|
| **110** | 12.77 | 12.93 | 0.35 | 0.37 | 1.36 | 3/8-16UNC-2B; |
| | (324.3) | (328.3) | (9) | (9.4) | (34.6) | 0.51 (13) deep |
| **125** | 12.93 | – | 0.35 | 0.39 | 1.38 | |
| | (328.3) | – | (9) | (10) | (35) | |
| **145** | 13.63 | 13.76 | 0.35 | 0.37 | 1.37 | 3/8-16UNC-2B; |
| | (346.2) | (349.5) | (9) | (9.3) | (34.7) | 0.51 (13) deep |
| **175** | 14.54 | 14.65 | 0.35 | 0.36 | 1.31 | |
| | (369.3) | (372.1) | (9) | (9.1) | (33.4) | |
| **210** | 15.34 | 15.54 | 0.35 | 0.29 | 1.30 | On request |
| | (389.6) | (394.7) | (9) | (7.3) | (33) | |
| **280** | 16.36 | – | 0.38 | 0.37 | 1.34 | |
| | (415.6) | – | (9.7) | (9.4) | (34.1) | |

---

1) The through-drive shaft is only supplied with the fastening thread
   corresponding to the ordering code designation.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat
   root, side fit, tolerance class 5
3) Mounting hole pattern viewed on through drive with control at top
4) O-ring included in the scope of delivery
5) Thread according to ASME B1.1

| Flange SAE J744[1] | | | Hub for splined shaft[2] | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Diameter** | **Mounting**[3] | **Code** | **Diameter** | | **Code** | | | | | | | |
| 101-2 (B) | ⚇ | B1 | 7/8 in | 13T 16/32DP | S4 | ○ | – | ● | ○ | – | – | **B1S4** |
| | | B1 | 1 in | 15T 16/32DP | S5 | ○ | – | ○ | ○ | – | – | **B1S5** |
| | ○–○ | B2 | 7/8 in | 13T 16/32DP | S4 | ● | ● | ● | ○ | ○ | ○ | **B2S4** |
| | | B2 | 1 in | 15T 16/32DP | S5 | ● | ● | ○ | ○ | ○ | ○ | **B2S5** |
| | ⚇° | B5 | 7/8 in | 13T 16/32DP | S4 | – | – | ○ | – | – | – | **B5S4** |

▼ **101-2**



| NG | M1 | M2 | M3 | M4 | M5 | M6[5] |
|---|---|---|---|---|---|---|
| **110** | 12.89 | 13.04 | 0.39 | 0.43 | 1.93 | 1/2-13UNC-2B; 0.63 (16) deep |
| | (327.3) | (331.2) | (10) | (10.9) | (48.9) | |
| **125** | 13.04 | – | 0.39 | 0.43 | 1.89 | |
| | (331.2) | – | (10) | (11) | (48) | |
| **145** | 13.75 | 13.88 | 0.39 | 0.41 | 1.59 | |
| | (349.2) | (352.5) | (10) | (10.3) | (40.3) | |
| **175** | 14.66 | 14.77 | 0.39 | 0.41 | 1.59 | |
| | (372.3) | (375.1) | (10) | (10.3) | (40.3) | |
| **210** | 15.46 | 15.66 | 0.39 | 0.39 | 1.80 | 1/2-13UNC-2B; 0.63 (16) deep |
| | (392.6) | (397.7) | (10) | (9.8) | (45.8) | |
| **280** | 16.48 | – | 0.39 | 0.41 | 1.91 | |
| | (418.6) | – | (10) | (10.5) | (48.5) | |

1) The through-drive shaft is only supplied with the fastening thread
   corresponding to the ordering code designation.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat
   root, side fit, tolerance class 5
3) Mounting hole pattern viewed on through drive with control at top
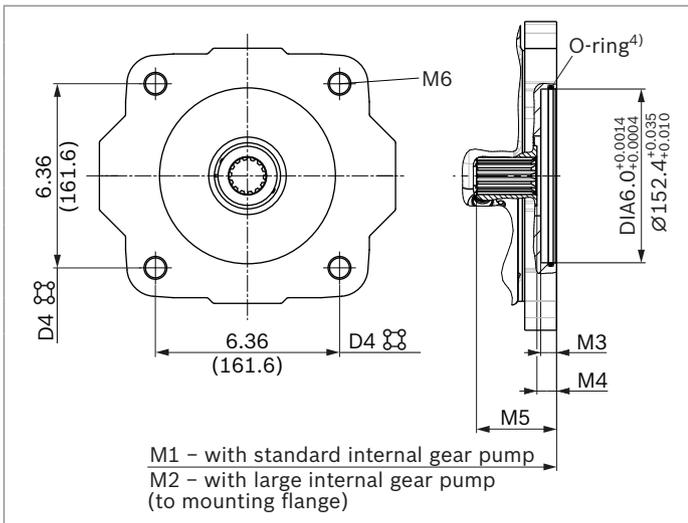4) O-ring included in the scope of delivery
5) Thread according to ASME B1.1

| Flange SAE J744[1] | | | Hub for splined shaft[2] | | | 110 | 125 | 145 | 175 | 210 | 280 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[3] | Code | Diameter | | Code | 110 | 125 | 145 | 175 | 210 | 280 | |
| 127-2 (C) | ⃝ | C1 | 1 1/4 in | 14T 12/24DP | S7 | ● | – | ○ | ○ | ○ | ○ | **C1S7** |
| | ∞ | C2 | 1 1/4 in | 14T 12/24DP | S7 | ● | ○ | ● | ● | ● | ○ | **C2S7** |
| | | C2 | 1 3/8 in | 21T 16/32DP | V8 | ● | – | ○ | ○ | – | – | **C2V8** |
| | | C2 | 1 3/4 in | 13T 8/16DP | T1 | – | – | ● | ○ | – | – | **C2T1** |
| 127-4 (C) | ⃝⃝ | C4 | 1 1/4 in | 14T 12/24DP | S7 | ○ | – | ○ | ● | – | – | **C4S7** |
| | | C4 | 1 3/8 in | 21T 16/32DP | V8 | ○ | – | – | – | – | – | **C4V8** |
| 152-4 (D) | ⃝⃝ | D4 | 1 3/4 in | 13T 8/16DP | T1 | – | – | ● | ● | ● | ○ | **D4T1** |

#### ▼ 127-2, 127-2/4



C4 ⃝⃝   4.51 (114.5)   M7
M6
O-ring[4]
4.51 (114.5)
DIA5.00 +0.0014/+0.0004
Ø127 +0.035/+0.010
C4 ⃝⃝
M3
M4
C1 ⃝
C2 ∞
7.13(181)
M5
M1 – with standard internal gear pump
M2 – with large internal gear pump
(to mounting flange)
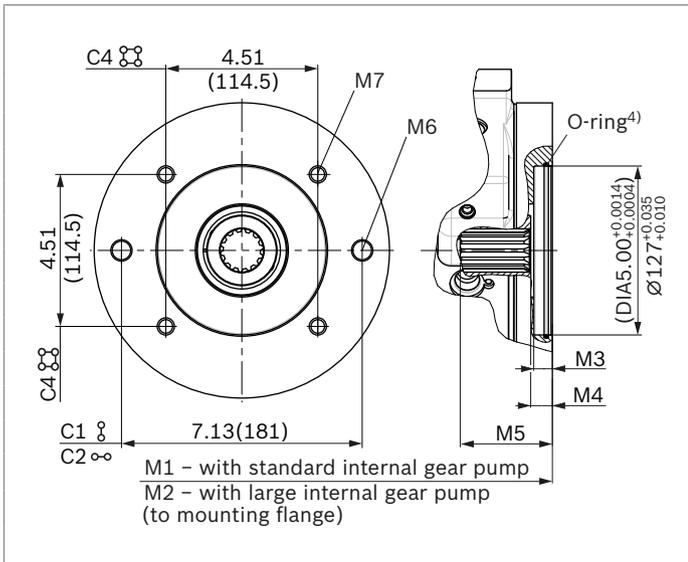
| NG | M1 | M2 | M3 | M4 | M5 | M6[5] 2-hole |
|---|---|---|---|---|---|---|
| **110** | 13.12 | 13.28 | 0.55 | 0.67 | 2.29 | 5/8-11UNC-2B; |
| | (333.3) | (337.3) | (14) | (16.9) | (54.9) | 0.83(21) deep |
| **125** | On request | | 0.55 | 0.43 | 2.36 | On request |
| | | | (14) | (10.9) | (59.9) | |
| **145** | 13.98 | 14.11 | 0.55 | 0.64 | 2.49 | 5/8-11UNC-2B; |
| | (355.2) | (358.5) | (14) | (16.3) | (63.3) | 0.83(21) deep |
| **175** | 14.89 | 15.0 | 0.55 | 0.64 | 2.41 | |
| | (378.3) | (381.1) | (14) | (16.3) | (61.3) | |
| **210** | 15.89 | 16.09 | 1.06 | 0.56 | 2.22 | |
| | (403.7) | (408.8) | (27) | (14.2) | (56.4) | |
| **280** | 16.72 | – | 1.06 | 0.57 | 2.31 | |
| | (424.6) | – | (27) | (14.4) | (58.6) | |
| **NG** | **M7[5] 4-hole** | | | | | |
| **110** | On request | | | | | |
| **145, 175** | 1/2-13UNC-2B; 0.83(21) deep | | | | | |

#### ▼ 152-4



O-ring[4]
M6
6.36 (161.6)
DIA6.0 +0.0014/+0.0004
Ø152.4 +0.035/+0.010
D4 ⃝⃝
6.36 (161.6)
D4 ⃝⃝
M3
M4
M5
M1 – with standard internal gear pump
M2 – with large internal gear pump
(to mounting flange)

| NG | M1 | M2 | M3 | M4 | M5 | M6[5] |
|---|---|---|---|---|---|---|
| **145** | 14.02 | 14.15 | 0.55 | 0.39 | 2.93 | 3/4-10UNC-2B; |
| | (356.2) | (359.5) | (14) | (10) | (74.4) | 0.87 (22) deep |
| **175** | 14.93 | 15.04 | 0.55 | 0.70 | 3.00 | |
| | (379.3) | (382.1) | (14) | (17.8) | (76.3) | |
| **210** | 16.20 | 16.41 | 1.02 | 0.56 | 3.10 | |
| | (411.6) | (416.7) | (26) | (14.3) | (78.8) | |
| **280** | 17.03 | – | 1.02 | 0.57 | 3.31 | |
| | (432.5) | – | (26) | (14.5) | (84) | |

1) The through-drive shaft is only supplied with the fastening thread corresponding to the ordering code designation.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Mounting hole pattern viewed on through drive with control at top
4) O-ring included in the scope of delivery
5) Thread according to ASME B1.1

| Flange SAE J744[1] | | | Hub for splined shaft[2] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter | Mounting[3] | Code | Diameter | | Code | 110 | 125 | 145 | 175 | 210 | 280 | |
| 165-4 (E) | ⬚ | E4 | 1 3/4 in | 13T 8/16DP | T1 | – | – | – | o | o | o | **E4T1** |
| | | | 2 in | 15T 8/16DP | T2 | – | – | – | – | o | o | **E4T2** |

▼ **165-4**



M1 – with standard internal gear pump
M2 – with large internal gear pump
(to mounting flange)
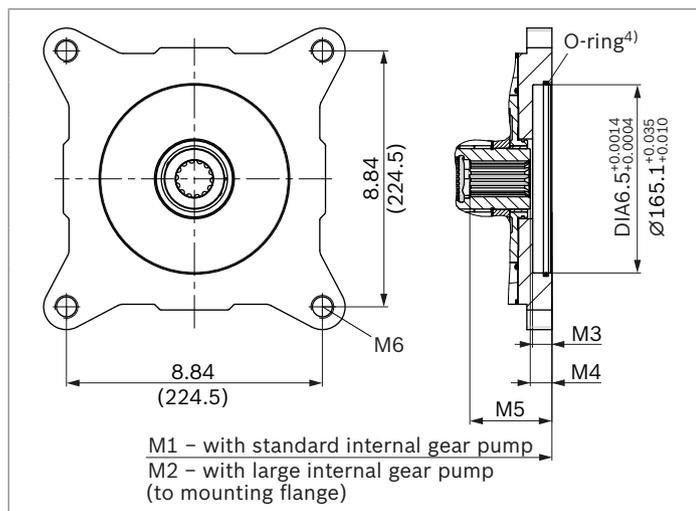
| NG | M1 | M2 | M3 | M4 | M5 | M6[5] |
|---|---|---|---|---|---|---|
| **175** | 15.00 | 15.11 | 0.67 | 0.76 | 3.07 | 3/4-10UNC-2B; |
| | (381) | (383.8) | (17) | (19.4) | (77.9) | 0.87 (22) deep |
| **210** | 16.04 | 16.24 | On request | | | |
| | (407.3) | (412.4) | | | | |
| **280** | 17.61 | – | On request | | | |
| | (447.3) | – | | | | |

1) The through-drive shaft is only supplied with the fastening thread
   corresponding to the ordering code designation.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat
   root, side fit, tolerance class 5
3) Mounting hole pattern viewed on through drive with control at top
4) O-ring included in the scope of delivery
5) Thread according to ASME B1.1

## Overview of mounting options

| Through drive[1] | | | Mounting option – 2nd pump | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Flange | Hub for splined shaft | Code | A4VG/40 NG (shaft) | A4VG/32 NG (shaft) | A10VG NG (shaft) | A10VO/3x NG (shaft) | A10V(S)O/5x NG (shaft) | A11VO/1 NG (shaft) | External gear pump[2] |
| 82-2 (A) | 5/8 in | **A_S2** | – | – | – | 18 (U) | 10, 18 (U) | – | AZPF, AZPS NG4 … 28 AZPW NG5 … 22 |
| 101-2 (B) | 7/8 in | **B_S4** | – | – | 18 (S) | 28 (S) 45 (U) | 28 (S) 45 (U) | – | AZPN-11 NG20 … 25 AZPG-22 NG28 … 100 |
| | 1 in | **B_S5** | – | 28 (S) | 28, 45 (S) | 45 (S) | 45 (S) 60, 63, 72 (U) | 40 (S) | – |
| 127-2 (C) | 1 1/4 in | **C_S7** | – | 40, 56, 71 (S) | 63 (S) | 71 (S) 100 (U) | 85, 100 (U) | 60 (S) | – |
| | 1 3/8 in | **C2V8** | 110 (V8) | 56, 71 (T) | 63 (T) | – | – | 60 (T) | |
| | 1 3/4 in | **C2T1** | 110, 125 (T1) | – | – | – | – | – | |
| 127-4 (C) | 1 1/4 in | **C4S7** | – | – | – | – | 60, 63, 72 (S) 85, 100 (U) | – | |
| | 1 3/8 in | **C4V8** | 110 (V8) | – | – | – | – | – | |
| 152-4 (D) | 1 3/4 in | **D4T1** | 110, 125, 145, 175 (T1) | 90, 125 (S) | – | 140, 180 (S) | – | 95, 130, 145 (S) | – |
| 165-4 (E) | 1 3/4 in | **E4T1** | 175 (T1) | 180 (S) | – | – | – | 190, 260 (S) | – |
| | 2 in | **E4T2** | 210, 280 (T2) | – | – | – | – | 190 (T) | |

**Notice**

The mounting options listed only apply for drive shaft versions with undercut. Please contact us for drive shafts without undercut.

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1) Availability of the individual sizes, see type code on page 4.
2) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.

## Combination pumps A4VG + A4VG

### Total length A[1] with standard mounting flange

| A4VG | | A4VG 2nd pump[2] | | | | | |
|------|-----|--------|--------|--------|--------|--------|--------|
| 1st pump | | NG110 | NG125 | NG145 | NG175 | NG210 | NG280 |
| NG110 | in | 25.7 | – | – | – | – | – |
|  | mm | 652.6 | – | – | – | – | – |
| NG125 | in | On request | On request | – | – | – | – |
|  | mm | | | – | – | – | – |
| NG145 | in | 26.6 | On request | 27.6 | – | – | – |
|  | mm | 674.5 | | 700.4 | – | – | – |
| NG175 | in | 27.5 | On request | 28.5 | 29.5 | – | – |
|  | mm | 697.6 | | 723.5 | 748.3 | – | – |
| NG210 | in | 28.7 | On request | 29.8 | On request | 31.8 | – |
|  | mm | 729.9 | | 755.8 | | 807.9 | – |
| NG280 | in | 29.8 | On request | 30.8 | On request | On request | On request |
|  | mm | 755.9 | | 781.8 | | | |

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

**A4VG145EP1DP000/40MRNC6S71FC2S7AS00-0 + A4VG110EP1DP000/40MRNC2S71F0000AS00-0**

A tandem pump, with two pumps of equal size, is permissible without additional supports, assuming that the dynamic acceleration does not exceed maximum
10 $g$ = 322 ft/s² (= 98.1 m/s²).
We recommend using the 4-hole mounting flanges.
For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible moment of inertia, please contact us.

**Notice**
The combination pump type code is shown in shortened form in the order confirmation.
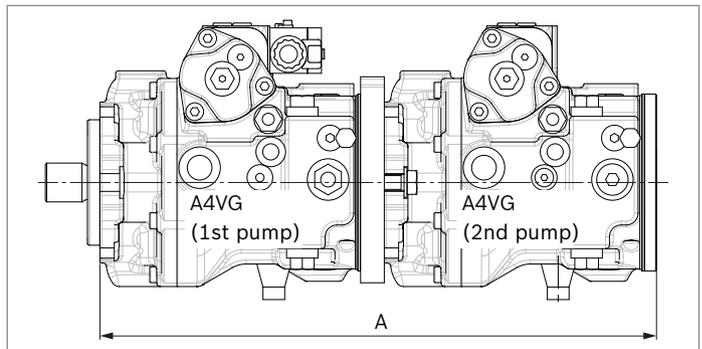


[1] Overall length is valid for standard mounting flange and integrated boost pump.
[2] 2nd pump without through drive and with boost pump, F0000/V0000

## High-pressure relief valves

The two high-pressure relief valves protect the hydrostatic transmission (pump and motor) from overloading. They limit the maximum pressure in the respective high-pressure line and serve simultaneously as boost valves.
High-pressure relief valves are not working valves and are only suitable for pressure peaks or high rates of pressure change.

### Setting ranges

| High-pressure relief valve A and B | Differential pressure setting $\Delta p_{HD}$ |
|---|---|
| Preferred values | 5800 psi (400 bar) |
| | 5950 psi (410 bar) |
| | 6100 psi (420 bar) |
| | 6250 psi (430 bar) |
| | 6400 psi (440 bar) |
| | 6500 psi (450 bar) |
| | 6650 psi (460 bar) |
| | 6800 psi (470 bar) |
| Optional values | 4350 psi (300 bar) |
| | 4650 psi (320 bar) |
| | 4950 psi (340 bar) |
| | 5200 psi (360 bar) |
| | 5500 psi (380 bar) |

| Settings on high-pressure relief valve A and B | |
|---|---|
| Differential pressure setting | $\Delta p_{HD}$ = ... psi |
| Cracking pressure of the HD valve (at $q_{V1}$) ($p_{max} = \Delta p_{HD} + p_{Sp}$) | $p_{max}$ = ... psi |

▶ The valve settings are made at $n$ = 1000 rpm and at $V_{g\ max}$ ($q_{V1}$). There may be deviations in the cracking pressures with other operating parameters.

▶ When ordering, state differential pressure setting in plain text.

### ▼ Circuit diagram
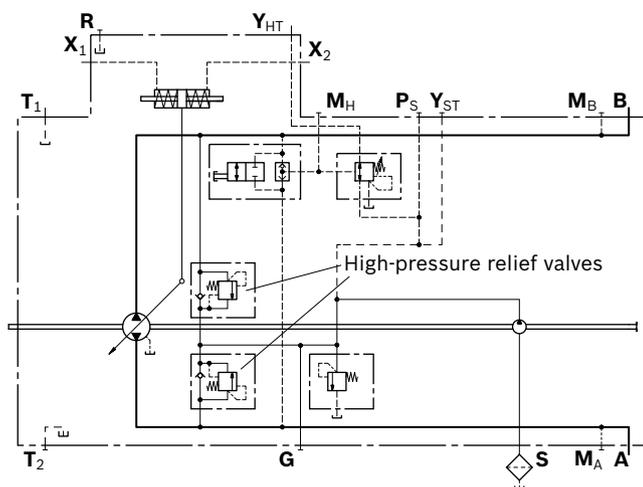


### High-pressure relief valve without pressure cut-off

#### ▼ Example

| Working pressure | Boost pressure | Differential pressure |
|---|---|---|
| $p_{A,B}$ | $p_{Sp}$ | $\Delta p_{HD}$ |
| 6500 psi (450 bar) | – 290 psi (20 bar) | = **6250 psi (430 bar)** |

#### ▼ Setting diagram
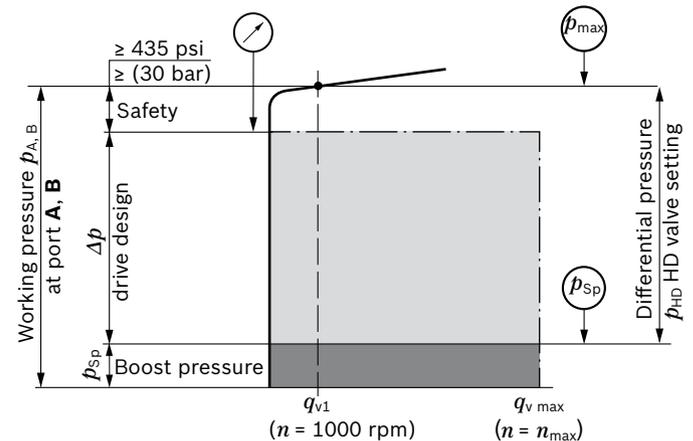


### High-pressure relief valve with pressure cut-off

#### ▼ Example

| Working pressure | Boost pressure | Safety | Differential pressure |
|---|---|---|---|
| $p_{A,B}$ | $p_{Sp}$ | | $\Delta p_{HD}$ |
| 6500 psi (450 bar) | – 290 psi (20 bar) | + 435 psi (30 bar) | = **6645 psi (460 bar)** |

#### ▼ Setting diagram
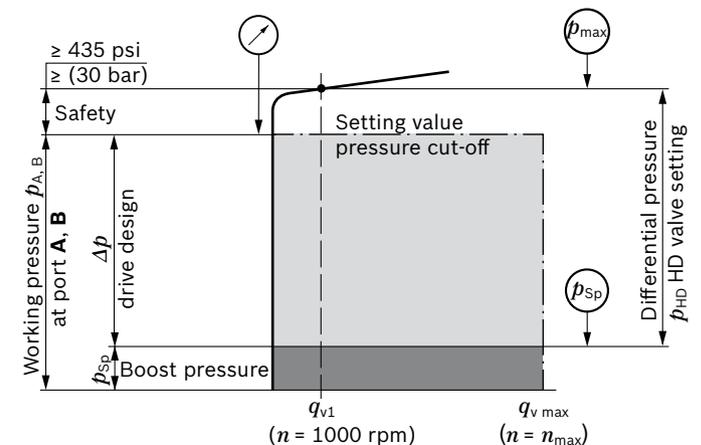
## Pressure cut-off

The pressure cut-off is a pressure control which, after reaching the set pressure, adjusts the displacement of the pump back to $V_{g\,min}$.

This valve prevents the operation of the high-pressure relief valves when accelerating or decelerating.

The high-pressure relief valves protect against the pressure peaks which occur during fast swiveling of the swashplate and limit the maximum pressure in the system.

The setting range of the pressure cut-off may be anywhere within the entire working pressure range. However, it must be set 435 psi (30 bar) lower than the setting value of the high-pressure relief valves (see setting diagram, page 47).

Please state the setting value of the pressure cut-off in plain text when ordering.

▼ **Circuit diagram with pressure cut-off**
  **Example: electric control, EP_D**
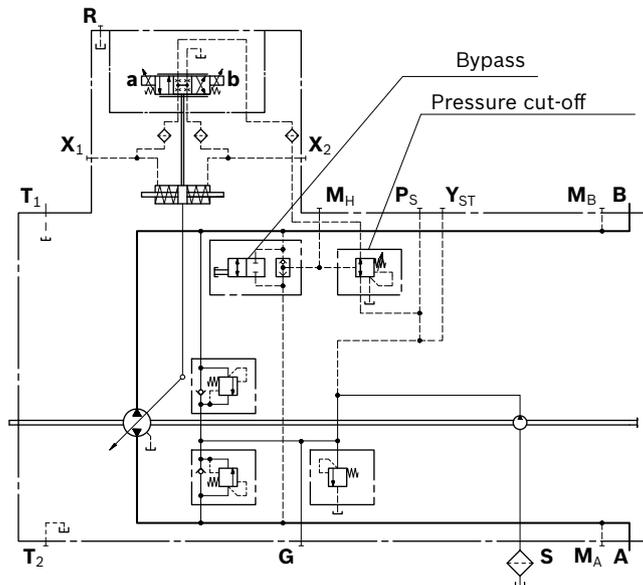


## Bypass function

A connection between the two high-pressure channels **A** and **B** can be established using the bypass valve (e.g. for machine towing).

### Towing speed

The maximum towing speed is dependent on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer.

The corresponding flow of $q_V$ = 7.9 gpm (= 30 l/min) may not be exceeded.

### Towing distance

The vehicle may only be towed out of the immediate danger zone.

## Neutral valve

Actuation of the switching solenoid enables pilot pressure through-flow into the control device of the pump. The pump can be swiveled out. When the solenoid is de-energized, this connection is interrupted and simultaneously the two stroking chambers are connected to each other and relieved to the pump housing. This ensures the pump is torque-free.

The return swivel times can be specifically and precisely adapted to the respective customer application. A second capability for deactivation and therefore making the pump torque-free is therefore realized when the neutral valve is used in safety-critical applications.

**Technical data**

| | 12 V (±20%) | 24 V (±20%) |
|---|---|---|
| Voltage | | |
| Neutral position $V_g = 0$ | de-energized | de-energized |
| Position $V_{g\ max}$ | Current switched on | Current switched on |
| Nominal resistance (at 68 °F (20 °C)) | 5.5 Ω | 21.7 Ω |
| Nominal power | 26.2 W | 26.5 W |
| Minimum active current required | 1.2 A | 0.6 A |
| Duty cycle | 100% | 100% |
| Type of protection: see connector version page 57 | | |

▼ **Circuit diagram**



**Dimensions**



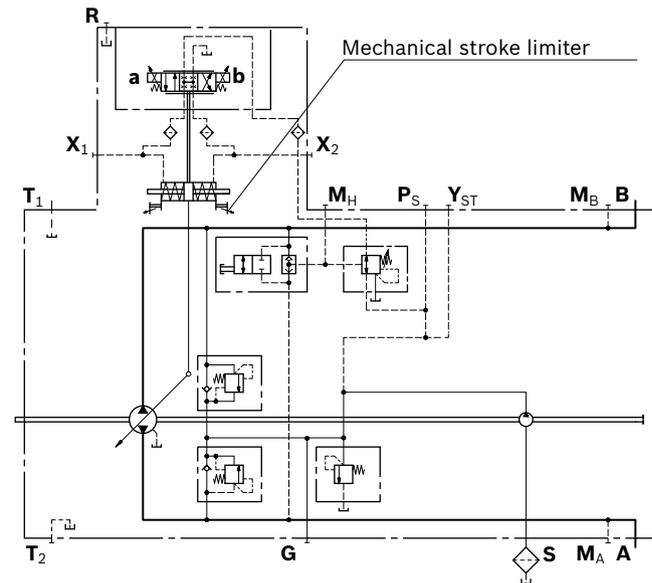| NG | 110 | 125 | 145 | 175 | 210 | 280 |
|---|---|---|---|---|---|---|
| N1 | 7.81 | 7.81 | 8.02 | 8.80 | 9.37 | 10.19 |
| | (198.4) | (198.4) | (203.6) | (223.4) | (237.9) | (258.8) |
| N2 | 3.96 | 3.96 | 4.17 | 4.95 | 5.52 | 6.34 |
| | (100.7) | (100.7) | (105.9) | (125.7) | (140.2) | (161.1) |
| N3 | 9.05 | 9.05 | 9.86 | 9.86 | 11.14 | 11.14 |
| | (229.8) | (229.8) | (250.5) | (250.5) | (283) | (283) |
| N4 | 6.83 | 6.83 | 7.04 | 7.81 | 8.27 | 9.09 |
| | (173.5) | (173.5) | (178.7) | (198.5) | (210) | (230.9) |
| N5 | 4.04 | 4.04 | 4.04 | 4.04 | 4.04 | 4.04 |
| | (102.5) | (102.5) | (102.5) | (102.5) | (102.5) | (102.5) |
| N6 | 3.27 | 3.27 | 3.86 | 3.86 | 4.43 | 4.43 |
| | (83) | (83) | (98) | (98) | (112.5) | (112.5) |
| N7 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| | (96.5) | (96.5) | (96.5) | (96.5) | (96.5) | (96.5) |
| N8 | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 |
| | (79) | (79) | (79) | (79) | (79) | (79) |
| N9 | 6.79 | 6.79 | 7.0 | 7.78 | 8.35 | 9.17 |
| | (172.5) | (172.5) | (177.7) | (197.5) | (212) | (232.9) |

# Mechanical stroke limiter

The mechanical stroke limiter is an auxiliary function allowing the maximum displacement of the pump to be steplessly reduced, regardless of the control module used.
By means of two threaded pins, the stroke of the stroking piston and thus the maximum swivel angle of the pump can be limited.
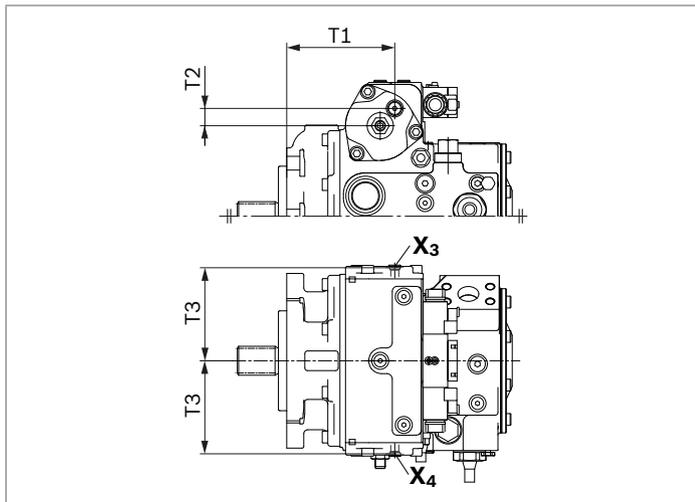
## Dimensions
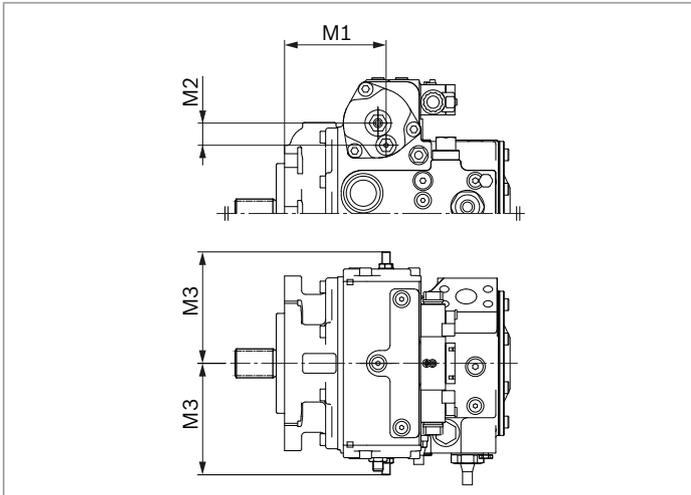


▼ **Circuit diagram**



| NG | M1 | M2 | M3 |
|---|---|---|---|
| **110** | 6.05 | 1.09 | 6.19 |
| | (153.6) | (27.7) | (157.3) |
| **125** | 6.05 | 1.09 | 6.19 |
| | (153.6) | (27.7) | (157.3) |
| **145** | 6.10 | 1.33 | 6.70 |
| | (155) | (33.8) | (170.1) |
| **175** | 6.88 | 1.33 | 6.70 |
| | (174.8) | (33.8) | (170.1) |
| **210** | 7.24 | 1.50 | 7.86 |
| | (183.9) | (38.1) | (199.6) |
| **280** | 8.06 | 1.50 | 7.86 |
| | (204.7) | (38.1) | (199.6) |

## Stroking chamber pressure port $X_3$ and $X_4$

**Dimensions**



▼ **Circuit diagram**



| NG | T1 | T2 | T3 |
|-----|---------|---------|--------|
| **110** | 6.37 | 0.86 | 5.04 |
| | (161.8) | (21.8) | (128) |
| **125** | 6.37 | 0.86 | 5.04 |
| | (161.8) | (21.8) | (128) |
| **145** | 6.49 | 1.04 | 5.59 |
| | (164.9) | (26.4) | (142) |
| **175** | 7.27 | 1.04 | 5.59 |
| | (184.7) | (26.4) | (142) |
| **210** | 7.70 | 1.20 | 6.54 |
| | (195.7) | (30.6) | (166) |
| **280** | 8.53 | 1.20 | 6.54 |
| | (216.6) | (30.6) | (166) |

| Ports | | Standard[1] | Size | $p_{max}$ [bar][2] | State[3] |
|-------|---|----------|------|-------------|--------|
| $X_3$, $X_4$ | Stroking chamber pressure port | ISO 11926 | 9/16-18UNF-2B; 0.51 (13) deep | 40 | X |
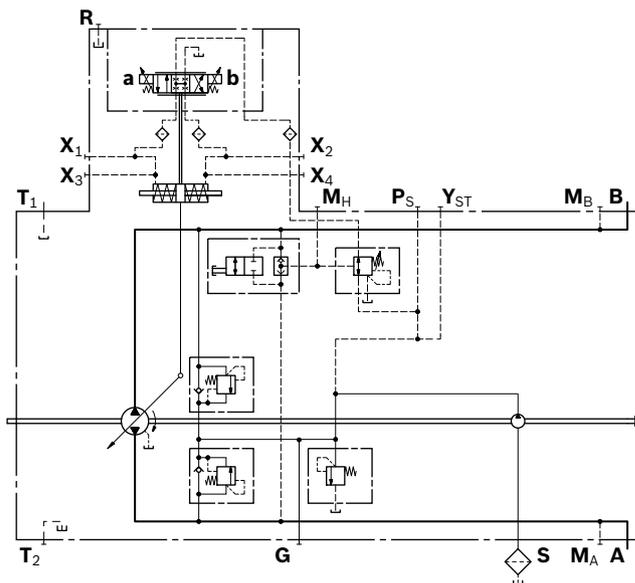
[1] The countersink can be deeper than as specified in the standard.

[2] Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

[3] X = Plugged (in normal operation)

## Filtration in the boost pump suction line

### Version S

| Filter version | Suction filter |
|---|---|
| Recommendation | With contamination indicator, with cold start valve |
| **Recommended flow resistance at filter element** | |
| At $v$ = 140 SUS, $n = n_{max}$ (30 mm²/s, $n = n_{max}$) | $\Delta p \leq 1.5$ psi ($\leq 0.1$ bar) |
| At $v$ = 4600 SUS, $n = n_{max}$ (1000 mm²/s, $n = n_{max}$) | $\Delta p \leq 4.5$ psi ($\leq 0.3$ bar) |
| **Pressure at suction port S** | |
| Continuous $p_{S\ min}$ ($v \leq 140$ SUS) ($v \leq 30$ mm²/s) | $\geq 12$ psi absolute ($\geq 0.8$ bar absolute) |
| Short-term, at a cold start ($t < 3$ min) | $\geq 7.5$ psi absolute ($\geq 0.5$ bar absolute) |
| Maximum pressure $p_{S\ max}$ | $\leq 75$ psi absolute ($\leq 5$ bar absolute) |

Use of version S is preferred.
The suction filter is not included in the scope of delivery.

▼ **Circuit diagram**



## Filtration in the boost pump pressure line

### Version D
### Ports for external boost circuit filtration

| Ports | |
|---|---|
| Boost pressure inlet | Port $F_a$ |
| Boost pressure outlet | Port $F_e$ |
| **Filter version** | **Boost pressure filter** |
| Recommendation | With contamination indicator, with cold start valve |
| Filter arrangement | Separate in the pressure line (inline filter) |
| **Permissible flow resistance at filter element[1]** | |
| At $v$ = 140 SUS (30 mm²/s) | $\Delta p \leq 15$ psi ($\leq 1$ bar) |
| For cold start | $\Delta p \leq 45$ psi ($\leq 3$ bar) |

**Notice**

▶ Filters with a bypass **not recommended**. Please contact us for applications with a bypass.

▶ On versions with HT control (with pilot pressure not from a boost circuit) a filter must be used that fulfills the requirement with regard to filtration of the hydraulic fluid (see page 7).

The boost pressure filter is not included in the scope of delivery.

▼ **Circuit diagram**
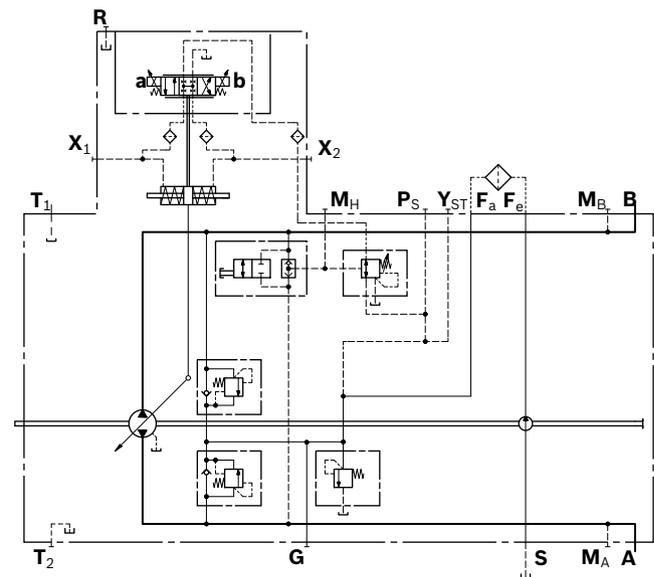


**Notice**

Bosch Rexroth has a comprehensive filter range. An inline filter such as the 110 LEN (see data sheet 51448) is suitable for charge pressure filtration. Further informations can also be found at www.boschrexroth.com/filter.

---

1) Valid for entire speed range $n_{min} - n_{max}$

## Version F[1)]
## Attachment filter with cold start valve

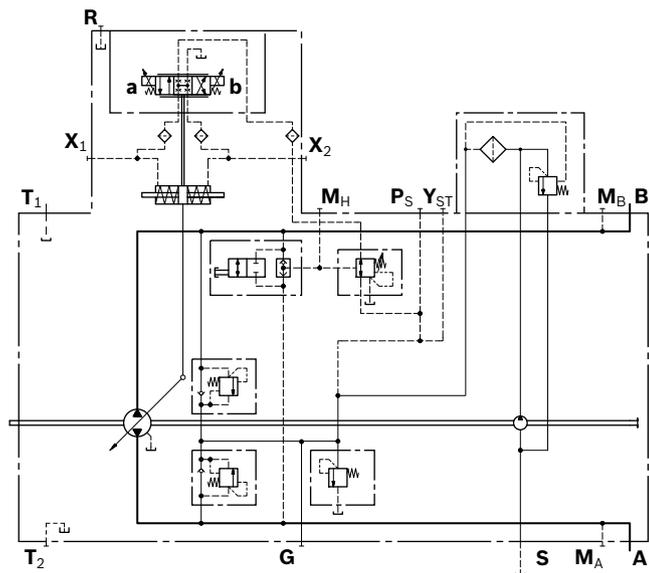| Filter version | Attachment filter without bypass |
|---|---|
| Recommendation | Version with contamination indicator, see B (differential pressure $\Delta p$ = 75 psi (5 bar) |
| Filter grade (absolute) | 20 microns |
| Filter material | Glass fiber |
| Pressure rating | 1450 psi (100 bar) |
| Filter arrangement | Mounted on pump |

The attachment filter is equipped with a cold start valve and thereby protects the pump from damage. The valve opens at flow resistance of $\Delta p \geq 87$ psi (6 bar).

▼ **Filter characteristics**

Differential pressure/flow characteristics to ISO 3968 (valid for clean filter element).
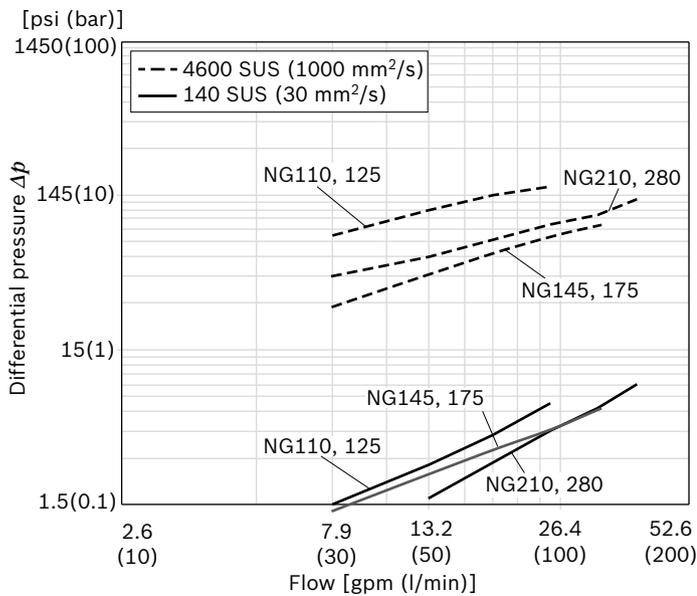


▼ **Circuit diagram**



## Version B[1)]
## Attachment filter with cold start valve and electric contamination indicator

Filtration similar to version F, however with additional electric contamination indicator.

| Technical data | | |
|---|---|---|
| Display type | electrical | |
| Connector version (mating connector, see page 57) | DEUTSCH DT04-2P-EP04 | |
| Differential pressure (switching pressure) | $\Delta p$ = 75 psi (5 bar) | |
| Maximum switching capacity | 12 V DC | 24 W |
| | 24 V DC | 48 W |
| Type of protection IP67 | DIN EN 60529 | |

▼ **Circuit diagram**
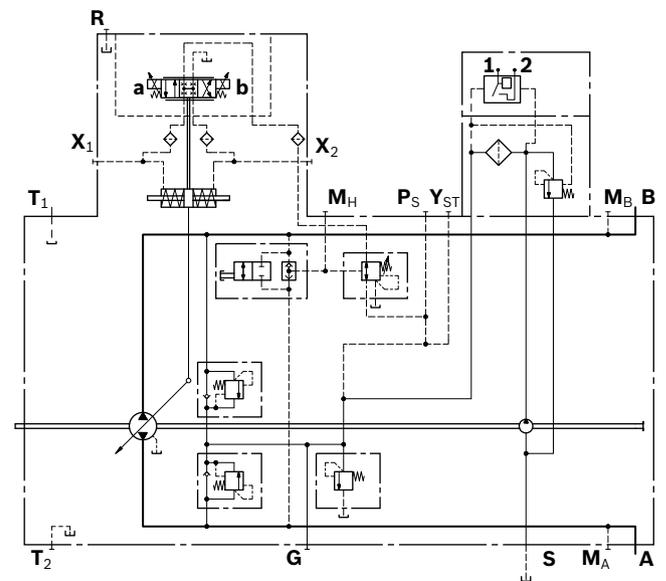


[1)] If using the filter versions F and B, make sure that a hydraulic fluid with a minimum electrical conductance of 300 pS/m is used. Please contact us if this value cannot be observed.

## External boost pressure supply

### Version E

This variant should be used in versions without integrated boost pump (**U**).
Port **S** is plugged.
The boost pressure supply comes from port **G**.
The filter should be installed separately on port **G** before the boost pressure supply.
To ensure the functional reliability, maintain the required cleanliness level for the boost fluid fed in at port **G** (see page 7).
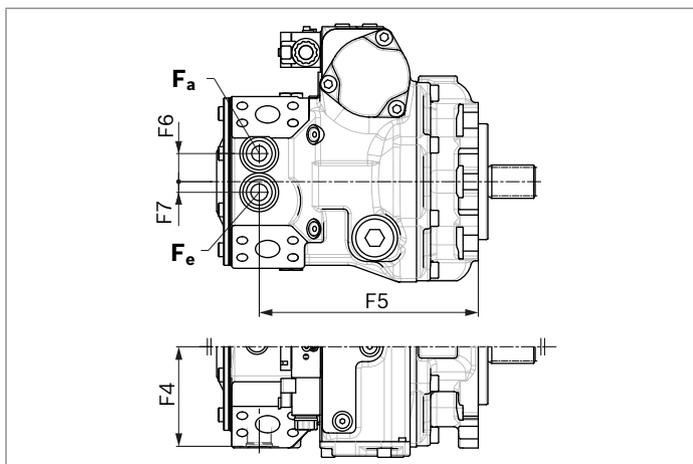
▼ **Circuit diagram**
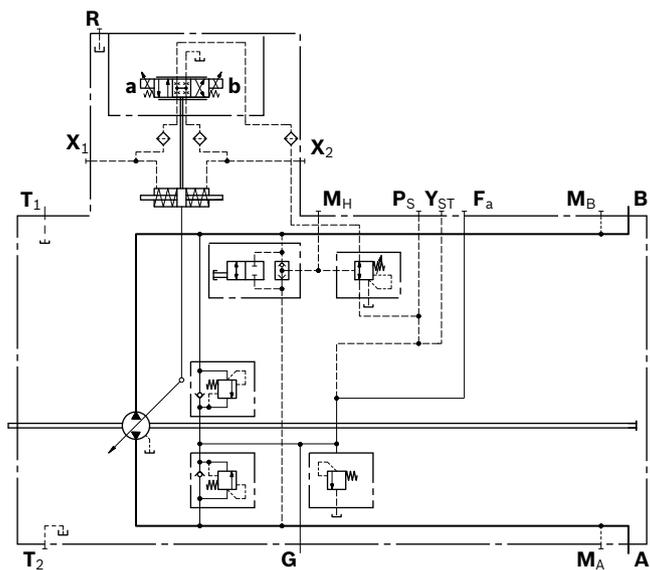
## Dimensions with mounted filter

▼ **Version D**
  Ports for external boost circuit filtration



| NG | F1 | F2 | F3 | F4 | F5 | F6 | F7 |
|---|---|---|---|---|---|---|---|
| **110** | 3.01 | 9.04 | 0.87 | 4.76 | 10.41 | 1.46 | 0.55 |
| | (76.5) | (229.5) | (22) | (121) | (264.5) | (37) | (14) |
| **125** | 3.01 | 9.04 | 0.87 | 4.76 | 10.41 | 1.46 | 0.55 |
| | (76.5) | (229.5) | (22) | (121) | (264.5) | (37) | (14) |
| **145** | 1.46 | 9.43 | 0.87 | 5.16 | 11.35 | 1.46 | 0.55 |
| | (37.2) | (239.5) | (22) | (131) | (288.2) | (37) | (14) |
| **175** | 2.24 | 9.43 | 0.87 | 5.16 | 12.13 | 1.46 | 0.55 |
| | (57) | (239.5) | (22) | (131) | (308) | (37) | (14) |
| **210** | 2.72 | 10.49 | 0.87 | 5.76 | 12.80 | 1.69 | 0.39 |
| | (69) | (266.5) | (22) | (146.3) | (325) | (43) | (10) |
| **280** | 3.54 | 10.49 | 0.87 | 5.76 | 13.62 | 1.69 | 0.39 |
| | (89.9) | (266.5) | (22) | (146.3) | (345.9) | (43) | (10) |
| $F_a$, $F_e$[1] | 1 5/16-12UN-2B; 0.79 (20) deep | | | | | | |

▼ **Version F**
  Attachment filter without contamination indicator



Detail **A**
rotated through 90°
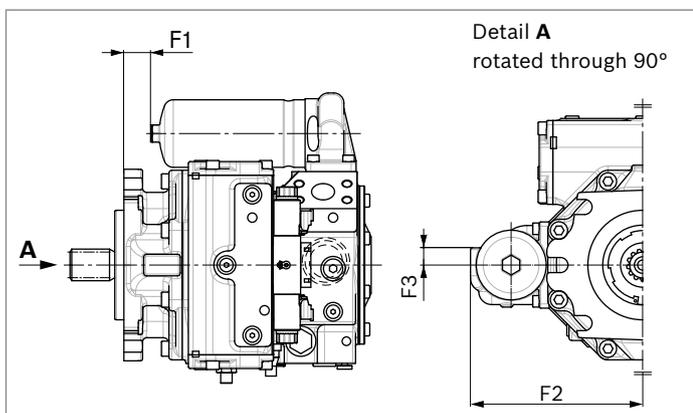
▼ **Version B**
  Attachment filter with cold start valve and electric contamination indicator



Detail **A** rotated through 90°

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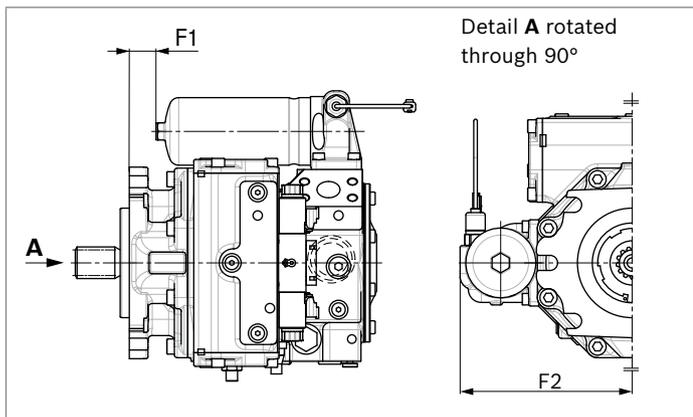
[1] The countersink can be deeper than as specified in the standard.

## Swivel angle sensor

The swivel angle sensor is used to detect the swivel angle of axial piston units and thus the displacement using a Hall-effect based sensor IC. The determined measurement value is converted into an analog signal.

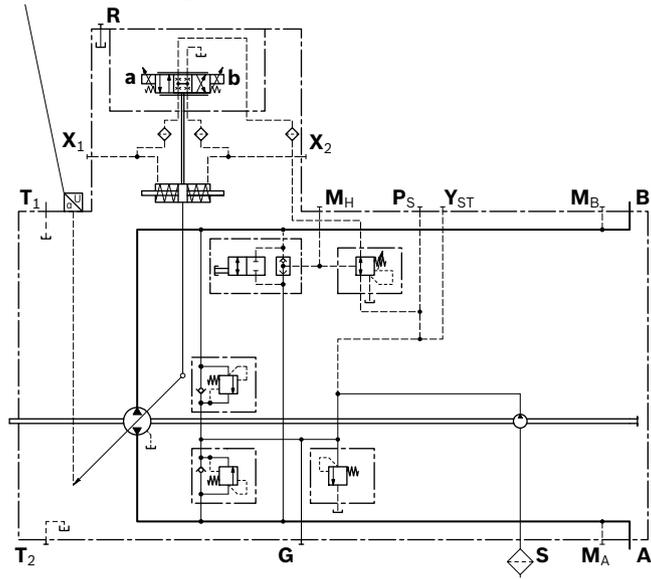Please contact us if the swivel angle sensor is used for control.

| Characteristics | |
|---|---|
| Supply voltage $U_b$ | 10 to 30 V DC |
| Output voltage $U_a$ | 1 V ($V_{g\,max}$)  2.5 V ($V_{g\,0}$)  4 V ($V_{g\,max}$) |
| Reverse polarity protection | Short-circuit resistant |
| EMC resistance | Details on request |
| Operating temperature range | -40 °F to +240 °F (-40 °C to +115 °C) |
| Vibration resistance sinusoidal vibration EN 60068-2-6 | 322 ft/s² (10 $g$) / 5 to 2000 Hz |
| Shock resistance: continuous shock IEC 68-2-29 | 805 ft/s² (25 $g$) |
| Salt spray resistance (DIN 50 021-SS) | 96 h |
| Type of protection with installed mating connector | IP67 – DIN EN 60529 IP69K – DIN 40050-9 |
| Housing material | Plastic |

### Output voltage

| Direction of rotation[1] | Flow direction | Working pressure | Output voltage at $V_{g\,0}$ |
|---|---|---|---|
| Clockwise | **B** to **A** | $M_A$ | >2.5 V |
| | **A** to **B** | $M_B$ | <2.5 V |
| Counter-clockwise | **A** to **B** | $M_B$ | >2.5 V |
| | **B** to **A** | $M_A$ | <2.5 V |

### ▼ Circuit diagram

Electric swivel angle sensor



### Dimensions



Detail **Y**
Connector DT04-3P-EP04

Supply voltage $U_b$   Ground
Output voltage $U_a$
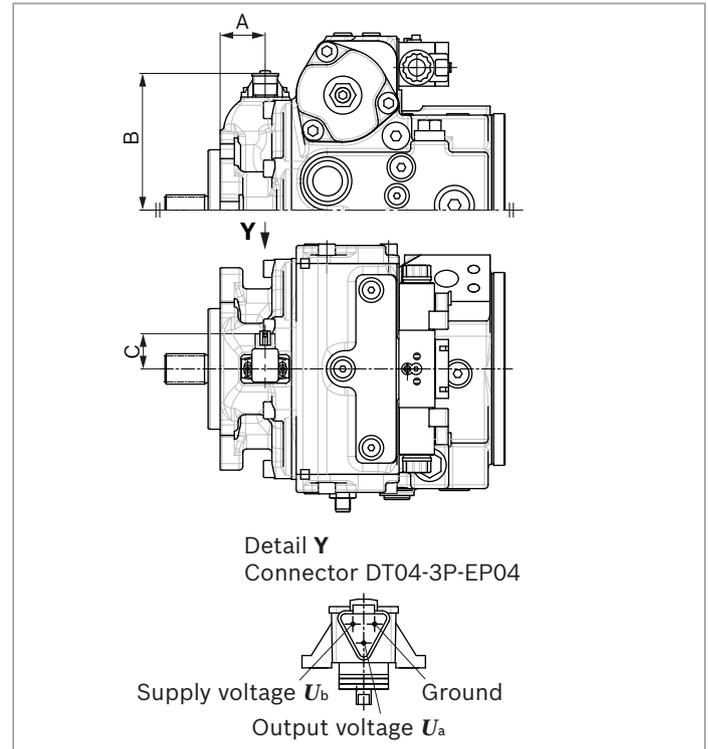
| NG | A | | B | | C | |
|---|---|---|---|---|---|---|
| **110** | 2.03 | (51.5) | 5.86 | (148.8) | 1.46 | (37) |
| **125** | 2.03 | (51.5) | 5.86 | (148.8) | 1.46 | (37) |
| **145** | 2.09 | (53.1) | 6.33 | (160.8) | 1.46 | (37) |
| **175** | 2.54 | (64.4) | 6.33 | (160.8) | 1.46 | (37) |
| **210** | 2.72 | (69) | 6.84 | (173.8) | 1.46 | (37) |
| **280** | 2.96 | (75.1) | 6.84 | (173.8) | 1.46 | (37) |

### Mating connector DEUTSCH DT06-3S-EP04

| Consisting of | DT designation |
|---|---|
| 1 housing | DT06-3S-EP04 |
| 1 wedge | W3S |
| 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 R902603524).

> **Notice**
>
> It is not possible to retrofit existing units with a swivel angle sensor.

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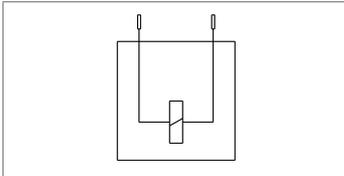1) For flow direction, see controls

## Connector for solenoids

**DEUTSCH DT04-2P-EP04**

Molded, 2-pin, without bidirectional suppressor diode (standard).

The following type of protection ensues with an 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.

▶ The procedure is defined in the instruction manual.

## Speed sensor

With the speed sensor DSA/DSM mounted, a signal proportional to pump speed can be generated. The DSA/DSM sensor measures the speed and direction of rotation. Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95133 – DSA or 95132 – DSM. The sensor is mounted on the port provided for this purpose with a mounting bolt.

### Dimensions
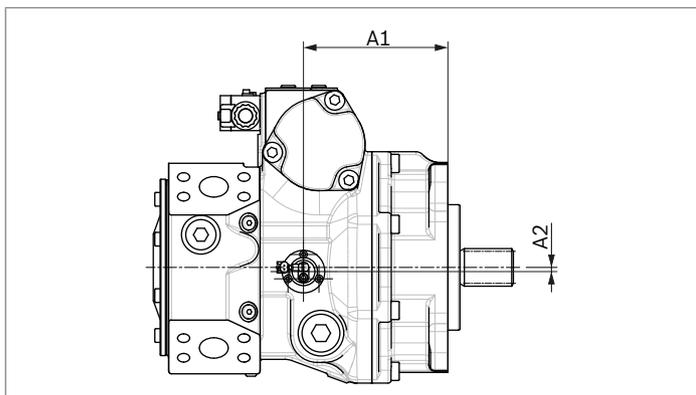


| NG | 110 | 125 | 145 | 175 | 210 | 280 |
|---|---|---|---|---|---|---|
| A1 | 6.36 | 6.36 | 7.13 | 7.91 | 7.48 | 8.30 |
|  | 161.5 | 161.5 | 181.2 | 201.0 | 190 | 210.9 |
| A2 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
|  | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| Number of teeth | 2.09 | On request | 2.28 | 2.40 | 2.52 | 2.80 |
|  | 53 |  | 58 | 61 | 64 | 71 |

### Notice

It is not possible to retrofit existing units with a speed sensor.

## Installation dimensions for coupling assembly

To ensure that rotating components (coupling hub) and
fixed components (housing, snap ring) do not come into
contact with each other, the installation conditions
described here must be observed. This depends on the
pump size and the splined shaft.

**SAE splined shaft (spline according to ANSI B92.1a)**
Splined shaft **V** or **T**
The outer diameter of the coupling hub must be smaller
than the inner diameter of the snap ring (dimension $d_2$) in
the area near the drive shaft collar (dimension $x_2 - x_3$).
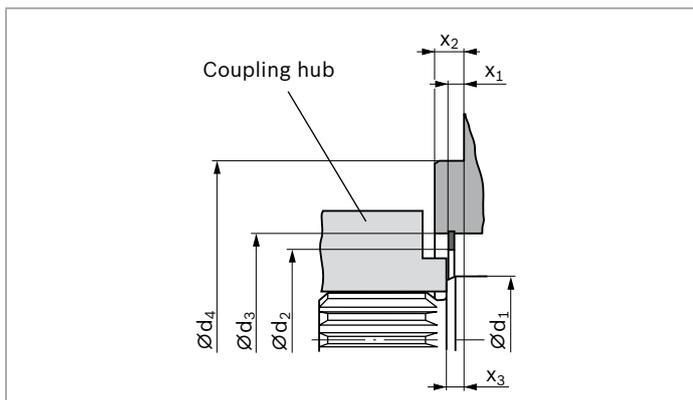


| NG | Mounting flange | $\varnothing d_1$ | $\varnothing d_{2\,min}$ | $\varnothing d_3$ | $\varnothing d_4$ | $x_1$ | $x_2$ | $x_3$ |
|---|---|---|---|---|---|---|---|---|
| **110** | 127-2/4 | 2.17 | 2.93 | 3.976±0.004 | $5.00\,^{0}_{-0.002}$ | 0.236 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (55) | (74.4) | (101±0.1) | $(127\,^{0}_{-0.063})$ | (6.0) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| | 152-2/4 | 2.17 | 2.93 | 3.976±0.004 | $6.00\,^{0}_{-0.002}$ | 0.236 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (55) | (74.4) | (101±0.1) | $(152.4\,^{0}_{-0.063})$ | (6.0) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| **125** | 127-2/4 | 2.17 | 2.93 | 3.976±0.004 | $5.00\,^{0}_{-0.002}$ | 0.236 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (55) | (74.4) | (101±0.1) | $(127\,^{0}_{-0.063})$ | (6.0) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| | 152-2/4 | 2.17 | 2.93 | 3.976±0.004 | $6.00\,^{0}_{-0.002}$ | 0.236 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (55) | (74.4) | (101±0.1) | $(152.4\,^{0}_{-0.063})$ | (6.0) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| **145** | 152-2/4 | 2.36 | 3.32 | 4.370±0.004 | $6.00\,^{0}_{-0.002}$ | 0.291 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (60) | (84.4) | (111±0.1) | $(152.4\,^{0}_{-0.063})$ | (7.4) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| **175** | 152-2/4 | 2.36 | 3.32 | 4.370±0.004 | $6.00\,^{0}_{-0.002}$ | 0.276 | $0.5_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (60) | (84.4) | (111±0.1) | $(152.4\,^{0}_{-0.063})$ | (7.0) | $(12.7_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| | 165-4 | 2.36 | 3.32 | 4.370±0.004 | $6.50\,^{0}_{-0.002}$ | 0.276 | $0.63_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (60) | (84.4) | (111±0.1) | $(165.1\,^{0}_{-0.063})$ | (7.0) | $(15.9_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| **210** | 165-4 | 2.56 | 3.72 | 4.764±0.004 | $6.50\,^{0}_{-0.002}$ | 0.22 | $0.63_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (65) | (94.4) | (121±0.1) | $(165.1\,^{0}_{-0.063})$ | (5.5) | $(15.9_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |
| **280** | 165-4 | 2.56 | 3.72 | 4.764±0.004 | $6.50\,^{0}_{-0.002}$ | 0.276 | $0.63_{-0.02}$ | $0.315\,^{+0.035}_{-0.024}$ |
| | | (65) | (94.4) | (121±0.1) | $(165.1\,^{0}_{-0.063})$ | (7.0) | $(15.9_{-0.5})$ | $(8\,^{+0.9}_{-0.6})$ |

## Installation instructions

### General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.

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

The leakage in the housing area must be directed to the reservoir via the highest drain port ($T_1$, $T_2$).

For combination pumps, the leakage must be drained off at each pump.

If a shared drain line is used for several units, make sure that the respective case pressure is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating conditions, specifically on cold start. If this is not possible, separate drain lines must be laid if necessary.

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

Under all operating conditions, the suction line and drain line must flow into the reservoir below the minimum fluid level. The permissible suction height $h_S$ results from the overall loss of pressure. However, it must not be higher than $h_{S\,max}$ = 31.5 in (800 mm).

The suction pressure at port **S** must also not fall below the minimum value of 12 psi (0.8 bar) absolute during operation (cold start 7.5 psi (0.5 bar) absolute).

### Installation position

See the following examples 1 to 12.
Further installation positions are available upon request.
Recommended installation position: 1 and 2.

### Notice

▶ If filling the stroking chambers via $X_1$ to $X_4$ is not possible in the final installation position, then this must take place before installation, e.g. in installation position 2.
▶ To prevent unexpected actuation and damage, the stroking chambers must be air bled via the ports $X_1$, $X_2$, or $X_3$, $X_4$ depending on the installation position.
▶ In certain installation positions, an influence on the control or closed loop control can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristic curves and changes in response time.
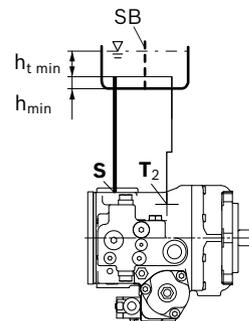
### Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir and below the minimum fluid level of the reservoir.
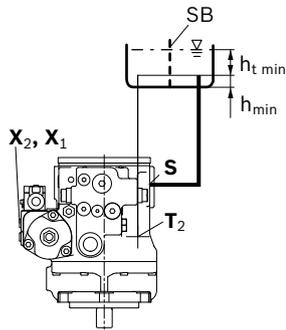
| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 1 | R | $X_1$, $X_2$ | $S + T_1 + X_1 + X_2$ |



| | | | |
|---|---|---|---|
| 2 | – | – | $S + T_2$ |

| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 3 | – | $X_1$, $X_2$ | $S + T_2 + X_1 + X_2$ |



| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 4 | $R_1$ | $X_3$, $X_4$ | $S + T_1 + X_3 + X_4$ |



| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 5 | – | $X_3$ | $S + T_2 + X_3$ |



| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 6 | – | $X_4$ | $S + T_1 + X_4$ |
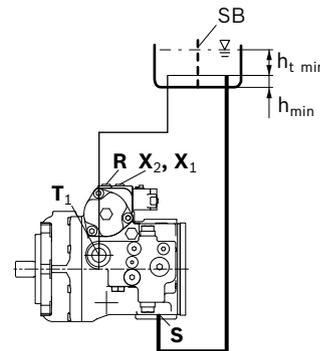


### Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Observe the maximum permissible suction height $h_{S\,max}$ = 31.5 in (800 mm).

Recommendation for installation position 10 (drive shaft upward): A check valve in the drain line (cracking pressure 7.5 psi (0.5 bar)) can prevent the housing area from draining.
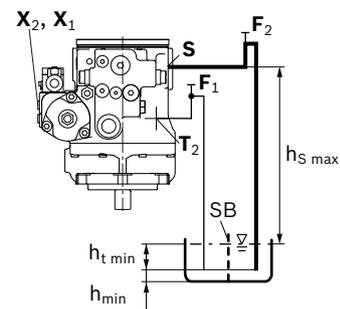
| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 7 | $F_2 + R$ | $X_1$, $X_2$ | $F_1 + F_2 + X_1 + X_2$ |



| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 8 | $F_2$ (**S**) + $F_1$ ($T_2$) | – | $F_2$ (**S**) + $F_1$ ($T_2$) |



| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| 9 | $F_2$ (**S**) + $F_1$ ($T_2$) | $X_1$, $X_2$ | $F_2$ (**S**) + $F_1$ ($T_2$) + $X_1$ + $X_2$ |

| Installation position | Air bleeding the housing | Air bleeding the stroking chamber | Filling |
|---|---|---|---|
| **10** | $F_2 + R_1$ | $X_3, X_4$ | $F_1 + F_2 + X_3 + X_4$ |



| **11** | $F_2 (S) + F_1 (T_2)$ | $X_3$ | $F_2 (S) + F_1 (T_2) + X_3$ |
|---|---|---|---|



| **12** | $F_2 (S) + F_1 (T_1)$ | $X_4$ | $F_2 (S) + F_1 (T_1) + X_4$ |
|---|---|---|---|



| Key | |
|---|---|
| $F_1, F_2$ | Filling / air bleeding |
| $R$ | Air bleed port |
| $R_1$ | Air bleed port (special version) |
| $S$ | Suction port |
| $T_1, T_2$ | Drain port |
| $X_1, X_2$ | Control pressure port |
| $X_3, X_4$ | Stroking chamber pressure port |
| SB | Baffle (baffle plate) |
| $h_{t\ min}$ | Minimum required immersion depth 7.87 in (200 mm) |
| $h_{min}$ | Minimum required distance to reservoir bottom 3.94 in (100 mm) |
| $h_{S\ max}$ | Maximum permissible suction height 31.5 in (800 mm) |
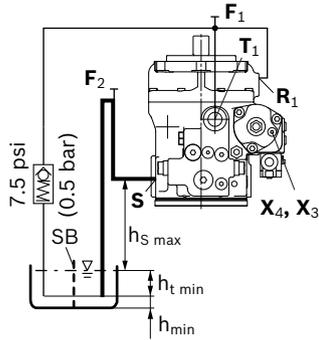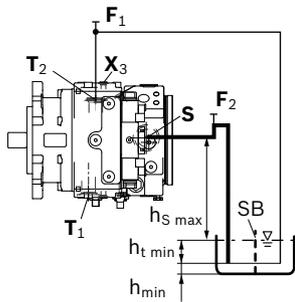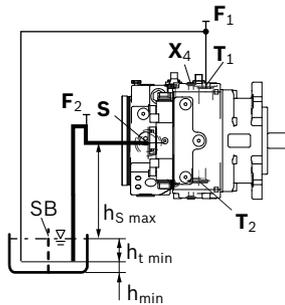
### Notice

Ports $F_1$ and $F_2$ are part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

## Project planning notes

- The pump A4VG is designed to be used in closed circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these 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.
- Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative 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 instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying the recommended direct voltage 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 voltage 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.
- The pressure cut-off is not a safeguard against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- With dynamic power flow (switch of pumps to operation as a motor) a maximum of 95% $V_{g\ max}$ is permissible. We recommend configuring the software accordingly.

- For drives that are operated for a long period with constant rotational speed, the natural frequency of the hydraulic system can be excited by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports are only intended to accommodate hydraulic lines.

## 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 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. impure 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 set the consumer being driven to a safe position (e.g. safe stop) and if necessary to ensure it is properly implemented.

▶ Moving parts in high-pressure relief valves may in certain circumstances become stuck in an undefined position due to contamination (e.g. impure hydraulic fluid). This can result in restriction or loss of the load holding function in lifting winches.
The machine/system manufacturer must check whether additional measures are required on the machine for the relevant application in order to keep the load in a safe position and ensure they are properly implemented.