Axial Piston Variable Pump
A4VG

Data sheet

Series 32
Sizes 28...250
Nominal pressure 400 bar
Peak pressure 450 bar
Closed circuit

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Features
- Variable axial piston pump of swashplate design for hydrostatic closed circuit transmissions
- Flow is proportional to drive speed and displacement and is infinitely variable
- Output flow increases with the swivel angle of the swashplate from 0 to its maximum value
- Flow direction changes smoothly when the swashplate is moved through the neutral position
- A wide range of highly adaptable control devices is available for different control and regulating functions
- The pump is equipped with two pressure-relief valves on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overload
- The high-pressure relief valves also function as boost valves
- The integrated boost pump acts as a feed and control oil pump
- The maximum boost pressure is limited by a built-in boost pressure relief valve
- The integral pressure cut-off is standard
### Ordering Code / Standard Program

<table>
<thead>
<tr>
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<th>G</th>
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<th>/</th>
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**Axial piston unit**
- 01 Variable swashplate design, nominal pressure 400 bar, peak pressure 450 bar

**Operation mode**
- 02 Pump in closed circuit

**Size**
- 03 Approximate displacement $V_{g\text{pe}}$ in cm³

| 28 | 40 | 56 | 71 | 90 | 125 | 180 | 250 |

**Control device**
- 04 Without control unit
- 04 Hydraulic control
  - Pilot-pressure related with supply filtration
    - 04 HD3
  - Mechanical servo
    - 04 HW
  - Direct operated
    - 04 DG
- 04 Speed related (Description DA control valve in Pos. 09)
  - 04 DA1
  - 04 DA2
- 04 Electric control
  - With proportional solenoid
    - 04 EP3
  - With switching solenoid
    - 04 EP4
- 04 U = 12 V DC
- 04 U = 24 V DC
- 04 DA1
- 04 DA2

**Pressure cut-off**
- 05 With pressure cut-off (standard)

| 28 | 40 | 56 | 71 | 90 | 125 | 180 | 250 |

**Neutral position switch (only for HW)**
- 06 Without neutral position switch (without code)
- 06 With neutral position switch (with DEUTSCH connector)

| 28 | 40 | 56 | 71 | 90 | 125 | 180 | 250 |

**Mechanical stroke limiter**
- 07 Without mechanical stroke limiter (without code)
- 07 With mechanical stroke limiter, external variable

| 28 | 40 | 56 | 71 | 90 | 125 | 180 | 250 |

**Ports X₃, X₄ for positioning pressure**
- 08 Without ports $X_3, X_4$ (without code)
- 08 With ports $X_3, X_4$

| 28 | 40 | 56 | 71 | 90 | 125 | 180 | 250 |

**DA control valve**
- 09 Without DA control valve
- 09 With DA control valve, fixed setting
- 09 With DA control valve, mech. Actuating direction - clockwise
  - 09 3R
- 09 With DA control valve, mech. Actuating direction - counterclockwise
  - 09 3L
- 09 With DA control valve, fixed setting and hydraulic inch valve mounted, control with brake fluid according to ISO 4925, no mineral oil
- 09 With DA control valve, fixed setting and ports for pilot control device
- 09 With DA control valve, fixed setting and hydraulic inch valve mounted, control with brake fluid based on mineral oil

<table>
<thead>
<tr>
<th>NV</th>
<th>HD1</th>
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<th>DG</th>
<th>DA</th>
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<tr>
<td>1</td>
<td>2</td>
<td>3R</td>
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</table>

#### Series
10 Series 3, Index 2

#### Direction of rotation
11 Viewed from shaft end
clockwise R
counterclockwise L

#### Seals
12 NBR (nitrile-caoutchouc), shaft seal ring in FKM (fluor-caoutchouc)

#### Shaft end (permissible input torque see page B)
<table>
<thead>
<tr>
<th>Splined shaft DIN 5480 for single pump</th>
<th>28 40 56 71 90 125 180 250</th>
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<tr>
<td>for combination pump - 1st pump</td>
<td>28 40 56 71 90 125 180 250</td>
</tr>
<tr>
<td>Splined shaft ANSI B92.1a–1976</td>
<td>28 40 56 71 90 125 180 250</td>
</tr>
<tr>
<td>for single pump</td>
<td>28 40 56 71 90 125 180 250</td>
</tr>
<tr>
<td>for combination pump - 2nd pump</td>
<td>28 40 56 71 90 125 180 250</td>
</tr>
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</table>

#### Mounting flange
| SAE J744 – 2-bolt                        | 28 40 56 71 90 125 180 250 |
| SAE J744 – 4-bolt                        | 28 40 56 71 90 125 180 250 |
| SAE J744 – 2+4-bolt                      | 28 40 56 71 90 125 180 250 |

#### Service line ports (metric fixing thread)
| SAE flange ports                        | suction port S bottom | 28 40 56 71 90 125 180 250 |
| A/B top and bottom                      | suction port S at top  | 28 40 56 71 90 125 180 250 |
| SAE flange ports                        | suction port S bottom  | 28 40 56 71 90 125 180 250 |
| A/B same side                           | suction port S at top  | 28 40 56 71 90 125 180 250 |

#### Boost pump
| Without integrated boost pump without through drive | 28 40 56 71 90 125 180 250 |
| Without integrated boost pump with through drive   | 28 40 56 71 90 125 180 250 |

#### Through drive (mounting options, see page 53)
<table>
<thead>
<tr>
<th>Flange SAE J744 3)</th>
<th>Hub for splined shaft</th>
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<td>.07</td>
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<tr>
<td>165-4 (E) 1 3/4 in 19T 8/16DP 4)</td>
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<td>.73</td>
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## Ordering Code / Standard Program

### Valves

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</tr>
</tbody>
</table>

**18**

- With high-pressure relief valve, pilot operated:
  - 100...420 bar with bypass: 100...420 bar with bypass
  - 270...420 bar without bypass: 270...420 bar without bypass
  - 100...250 bar without bypass: 100...250 bar without bypass

**19**

- Filtration in the suction line of boost pump (filter not included in supply): Filtration in the suction line of boost pump (filter not included in supply)
- Filtration in pressure line of boost pump:
  - ports for external boost circuit filtration, \( (F_a \text{ and } F_a) \): Filtration in pressure line of boost pump
  - and cold start valve: Filtration in pressure line of boost pump
- Filter mounted with cold start valve but without contamination indicator:
  - window: Filter mounted with cold start valve but without contamination indicator
- Filter mounted with cold start valve and contamination indicator through:
  - electr. signal - DEUTSCH connector: Filter mounted with cold start valve and contamination indicator through
  - without bypass: External supply (version without integral boost pump - N00, K..)

**20**

- Swivel angle indicator:
  - Without swivel angle indicator (without code): Swivel angle indicator
  - Electric swivel angle sensor: Swivel angle indicator

**21**

- Connector for solenoids (only for EP, EZ, DA):
  - DEUTSCH connector:
    - molded, 2-pin: Connector for solenoids (only for EP, EZ, DA)
    - without suppressor diode: Connector for solenoids (only for EP, EZ, DA)
    - with suppressor diode (only for EZ and DA): Connector for solenoids (only for EP, EZ, DA)

**22**

- Standard / special version:
  - Standard version: Special version
  - combined with attachment part or attachment pump: Special version
  - combined with attachment part or attachment pump: Special version
  - combined with attachment part or attachment pump: Special version

### Notes

1) Standard for combination pump – 1st pump: shaft Z
2) Standard for combination pump – 1st pump: shaft S
3) \( 2 = 2\)-bolt; \( 4 = 4\)-bolt
4) Hub for splined shaft acc. to ANSI B92.1a-1976 (splined shaft assigned acc. to SAE J744, see page 50-52)
5) Hub for splined shaft acc. to DIN 5480
6) Adjustment data are included in the material number

- = available  ○ = on request  − = not available

= preferred program
Technical Data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump A4VG is unsuitable for operation with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

For optimum efficiency and service life, select an operating viscosity (at operating temperature) within the optimum range of $\nu_{\text{opt}} = \text{opt. operating viscosity } 16...36 \text{ mm}^2/\text{s}$ depending on the circuit temperature (closed circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

- $\nu_{\text{min}} = 5 \text{ mm}^2/\text{s}$
  - short term ($t < 3 \text{ min}$)
  - at max. perm. temperature of $t_{\text{max}} = +115 \, ^\circ\text{C}$.

- $\nu_{\text{max}} = 1600 \text{ mm}^2/\text{s}$
  - short term ($t < 3 \text{ min}$)
  - at cold start (p $\leq 30 \text{ bar}, n \leq 1000 \text{ rpm}, t_{\text{min}} = -40 \, ^\circ\text{C}$).
  - Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 115 °C must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is dependent on pressure and speed - up to 5 K higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40 °C to -25 °C (cold start phase), please contact us.

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

Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit the circuit temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range ($\nu_{\text{opt}}$) - the shaded area of the selection diagram. We recommend that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C an operating temperature of 60 °C is set. In the optimum operating viscosity range ($\nu_{\text{opt}}$; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Please note: The case drain temperature, which is affected by pressure and speed, is always higher than the circuit temperature. At no point in the system may the temperature be higher than 115 °C.

If the above conditions cannot be maintained due to extreme operating parameters, please consult us.
Technical Data

Filtration

The finer the filtration, the higher the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

To ensure functional reliability of the axial piston unit the hydraulic fluid must have a cleanliness level of at least 20/18/15 according to ISO 4406.

Depending on the system and the application, for the A4VG, we recommend filter elements $\beta_{20} \geq 100$

With a rising differential pressure at the filter elements, the $\beta$-value must not deteriorate.

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

If the above classes cannot be observed, please contact us. For notes on filtration types, see pages 55-58

Operating pressure range

Input

Variable pump (with external supply, E):

For control EP, EZ, HW and HD
boost pressure (at n = 2000 rpm) $p_{Sp}$ ___________ 20 bar

For control DA, DG
boost pressure (at n = 2000 rpm) $p_{Sp}$ ___________ 25 bar

Boost pump:
suction pressure $p_{a \min}$ ($v \leq 30 \text{ mm}^2/\text{s}$) $\geq 0.8$ bar absolute at cold starts, short term (t < 3 min) $\geq 0.5$ bar absolute

Output

Variable pump:
pressure at port A or B

Nominal pressure $p_{N}$ ____________________________ 400 bar

Peak pressure $p_{max}$ ____________________________ 450 bar

Boost pump:
peak pressure $p_{Sp \max}$ ____________________________ 40 bar

(pressure data according to DIN 24312)

Nominal pressure: Max. design pressure at which fatigue strength is ensured.

Peak pressure: Max. operating pressure which is permissible for short term (t<1s).

Shaft seal ring

Permissible pressure loading

The service life of the shaft seal ring is affected by the speed of the pump and the case drain pressure. It is recommended that the average, continuous case drain pressure at operating temperature 3 bar absolute not be exceeded (max. permissible case drain pressure 6 bar absolute at reduced speed, see diagram). Short term (t < 0.1 s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal ring decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or greater than the external pressure on the shaft seal ring.

Temperature range

The FKM shaft seal ring is permissible for case temperatures of -25 °C to +115 °C.

Note:

For application cases below -25 °C, an NBR shaft seal ring is necessary (permissible temperature range: -40 °C to +90 °C). Please state NBR shaft seal ring in plain text when ordering. Please contact us.
## Technical Data

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

<table>
<thead>
<tr>
<th>Size</th>
<th>Displacement</th>
<th>Speed</th>
<th>Flow</th>
<th>Power</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>variable pump $V_{g\text{ max}}$ cm³</td>
<td>maximum at $V_{g\text{ max}}$ $n_{\text{max continuous}}$ rpm</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $q_{v\text{ max}}$ l/min</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $P_{\text{max}}$ kW</td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>4250</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>4000</td>
<td>107</td>
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<td>56</td>
<td>56</td>
<td>3600</td>
<td>119</td>
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<tr>
<td>71</td>
<td>71</td>
<td>3300</td>
<td>160</td>
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<th>Displacement</th>
<th>Speed</th>
<th>Flow</th>
<th>Power</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>boost pump (at $p = 20$ bar) $V_{g\text{ Sp}}$ cm³</td>
<td>limited maximum ¹ $n_{\text{max limited}}$ rpm</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $q_{v\text{ max}}$ l/min</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $P_{\text{max}}$ kW</td>
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<th>Speed</th>
<th>Flow</th>
<th>Power</th>
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<td>minimum $n_{\text{min}}$ rpm</td>
<td>intermittent maximum ² $n_{\text{max interm.}}$ rpm</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $q_{v\text{ max}}$ l/min</td>
<td>at $n_{\text{max continuous}}$ and $V_{g\text{ max}}$ $P_{\text{max}}$ kW</td>
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### Determining the size

**Flow**

$$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \text{ l/min}$$

- $V_g$ = displacement volume per revolution in cm³
- $\Delta p$ = differential pressure in bar
- $n$ = speed in rpm
- $\eta_v$ = volumetric efficiency
- $\eta_{\text{linh}}$ = mechanical-hydraulic efficiency
- $\eta_t$ = total efficiency

**Torque**

$$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{\text{linh}}} \text{ Nm}$$

**Power**

$$P = \frac{2 \cdot \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \text{ kW}$$

---

¹ Restricted maximum speed: – at half corner power (e.g. at $V_{g\text{ max}}$ and $p_{N/2}$)

² Intermittent maximum speed: – at high idle speed
- at overspeed: $\Delta p = 70...150$ bar and $V_{g\text{ max}}$
- at reversing peaks: $\Delta p < 300$ bar and $t < 0.1$ s.

³ Without boost pump

⁴ – The area of validity is situated between the minimum required and maximum permissible speed.
- It applies for external stimuli (e.g. engine 2-8 times rotary frequency, cardan shaft twice the rotary frequency).
- The limit value applies for a single pump only.
- The load capacity of the connection parts has to be considered.

**Caution:** Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.

A calculation can be performed to determine the permissible values.
Technical Data

Permissible axial and radial loading on drive shaft

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<thead>
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<th>40</th>
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<th>71</th>
<th>90</th>
<th>125</th>
<th>180</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial force, max. at distance (from shaft collar) F_q max N</td>
<td>2500</td>
<td>3600</td>
<td>5000</td>
<td>6300</td>
<td>8000</td>
<td>11000</td>
<td>16000</td>
<td>22000</td>
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<tr>
<td>a mm</td>
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<td>17.5</td>
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<td>22.5</td>
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<tr>
<td>b mm</td>
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<td>35</td>
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<td>42.5</td>
<td>42.5</td>
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<td>50</td>
<td>57.5</td>
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</tr>
</tbody>
</table>

Axial force, max. F_a max N

| a,b,c | F_a max N | 2000 | 2891 | 4046 | 4950 | 6334 | 8594 | 12375 | 16809 |
| mm    |           | 30   | 30   | 35   | 35   | 40   | 45   | 50   | 50   |
| c mm   | 42.5 | 42.5 | 42.5 | 50  | 50  | 57.5 | 60  | 71  |

Permissible input and through-drive torques

<table>
<thead>
<tr>
<th>Size</th>
<th>28</th>
<th>40</th>
<th>56</th>
<th>71</th>
<th>90</th>
<th>125</th>
<th>180</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque (at V_g max and Δp = 400 bar) Tmax Nm</td>
<td>178</td>
<td>254</td>
<td>356</td>
<td>451</td>
<td>572</td>
<td>795</td>
<td>1144</td>
<td>1590</td>
</tr>
<tr>
<td>at shaft end Z T_E perm. Nm</td>
<td>352</td>
<td>522</td>
<td>522</td>
<td>912</td>
<td>912</td>
<td>1460</td>
<td>3140</td>
<td>4350</td>
</tr>
<tr>
<td>DIN 5480 W25 W30 W30 W35 W35 W40 W50 W55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at shaft end A T_E perm. Nm</td>
<td>–</td>
<td>912</td>
<td>912</td>
<td>1460</td>
<td>2190</td>
<td>2190</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>DIN 5480 W35 W35 W40 W45 W45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at shaft end S T_E perm. Nm</td>
<td>314</td>
<td>602</td>
<td>602</td>
<td>602</td>
<td>1640</td>
<td>1640</td>
<td>1640</td>
<td>1640</td>
</tr>
<tr>
<td>ANSI B92.1a-1976 (SAE J744) 1 in 1 1/4 in 1 1/4 in 1 1/4 in 1 3/4 in 1 3/4 in 1 3/4 in 1 3/4 in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at shaft end T T_E perm. Nm</td>
<td>–</td>
<td>–</td>
<td>970</td>
<td>970</td>
<td>–</td>
<td>2670</td>
<td>4070</td>
<td>4070</td>
</tr>
<tr>
<td>ANSI B92.1a-1976 (SAE J744) 1 3/8 in 1 3/8 in 2 in 2 1/4 in 2 1/4 in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at shaft end U T_E perm. Nm</td>
<td>–</td>
<td>314</td>
<td>–</td>
<td>602</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>ANSI B92.1a-1976 (SAE J744) 1 in 1 1/4 in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Through-drive torque, max. T_D perm. Nm</td>
<td>231</td>
<td>314</td>
<td>521</td>
<td>660</td>
<td>822</td>
<td>1110</td>
<td>1760</td>
<td>2230</td>
</tr>
</tbody>
</table>

1) Efficiency not considered
2) For drive shafts with no radial force
3) Shaft “U” is only permitted as a shaft end on the 2nd pump in a combination pump of the same size.
4) Note max. input torque for shaft S!

Torque distribution

Note: special requirements apply in the case of belt drives. Please contact us.
# High-Pressure Relief Valves

## Setting ranges

<table>
<thead>
<tr>
<th>High-pressure relief valve, direct operated (size 28...56)</th>
<th>Differential pressure setting $\Delta p_{HP}$</th>
</tr>
</thead>
</table>
| Setting range for valve 3, 5  
$\Delta p$ 270 - 420 bar  
(refer to ordering code) | 420 bar                                    |
|                                                          | 400 bar $^1$                              |
|                                                          | 360 bar                                    |
|                                                          | 340 bar                                    |
|                                                          | 320 bar                                    |
|                                                          | 300 bar                                    |
|                                                          | 270 bar                                    |
| Setting range for valve 4, 6  
$\Delta p$ 100 - 250 bar  
(refer to ordering code) | 250 bar                                    |
|                                                          | 230 bar $^1$                              |
|                                                          | 200 bar                                    |
|                                                          | 150 bar                                    |
|                                                          | 100 bar                                    |

<table>
<thead>
<tr>
<th>High-pressure relief valve, pilot operated (size 71...250)</th>
<th>Differential pressure setting $\Delta p_{HP}$</th>
</tr>
</thead>
</table>
| Setting range for valve 1  
$\Delta p$ 100 - 420 bar  
(refer to ordering code) | 420 bar                                    |
|                                                          | 400 bar $^1$                              |
|                                                          | 360 bar                                    |
|                                                          | 340 bar                                    |
|                                                          | 320 bar                                    |
|                                                          | 300 bar                                    |
|                                                          | 270 bar                                    |
|                                                          | 250 bar                                    |
|                                                          | 230 bar                                    |
|                                                          | 200 bar                                    |
|                                                          | 150 bar                                    |
|                                                          | 100 bar                                    |

$^1$ Standard differential pressure setting. The valves will be set to this value if the differential pressure is not specified on ordering.

## Setting diagram

Example: boost pressure 30 bar; operating pressure 400 bar  
Operating pressure $p_{AB}$ : boost pressure $p_{Sp}$ + safety = differential pressure $\Delta p_{HD}$  
400 bar - 30 bar + 30 bar = 400 bar

## Bypass function

The bypass function can only be used for short periods with reduced displacement, e.g. to tow a vehicle out of an immediate danger zone.

**Note:**  
The bypass function and the pilot operated high-pressure valves (size 71...250) are not shown in these circuit diagrams.

---

Please state in plain text when ordering:  
(only the $\Delta p_{HP}$ values shown in the table are possible)

**High-pressure relief valve A**

Differential pressure setting : $\Delta p_{HD} =$ ... bar
opening pressure of the HD valve (at $q_v$) : $p_{max} =$ ... bar  
($p_{max} = \Delta p_{HD} + p_{Sp}$)

**High-pressure relief valve B**

Differential pressure setting : $\Delta p_{HD} =$ ... bar
opening pressure of the HD valve (at $q_v$) : $p_{max} =$ ... bar  
($p_{max} = \Delta p_{HD} + p_{Sp}$)
Pressure Cut-Off, D

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

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

Both the pressure peaks occurring when the swashplate is swiveled rapidly and also the maximum pressure in the system are safeguarded by the high-pressure relief valves.

The setting range of the pressure cut-off may be anywhere within the entire operating pressure range. However, it must be set 30 bar lower than the setting of the high-pressure relief valves (see setting diagram, page 9).

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

Circuit diagram with pressure cut-off.
Example: Electric two-position control, EZ1D/EZ2D
NV - Version Without Control Unit

The mounting surface for the control unit is machined and is sealed with the standard seal for control units and a cover plate. This version is ready for retrofitting to control units (HD, HW, EP, EZ). When used directly for “DA” control and in combinations with “DA” control, the appropriate adjustments must be made to the spring assembly of the adjusting cylinder and control plate.

DG - Hydraulic Control, Direct Operated

With the Direct Operated Hydraulic Control (DG), pump displacement is controlled by a hydraulic control pressure applied directly to the stroke cylinder through either the X1 or X2 port. In this way, the swashplate and thus the displacement is switchable from \( V_g = 0 \) to \( V_g \max \). Each direction of throughput flow is assigned to a port.

Pilot pressure 0 bar \( \triangle \) position \( V_g = 0 \)

The required pilot pressure for position \( V_g \max \) depends on operating pressure and speed.

Max. permissible pilot pressure 40 bar

For project planning, please consult us.

The pressure cut-off and the DA control valve only become effective if the pilot control unit used for controlling the DG control is supplied from port PS.

Assignment of direction of rotation – control – direction of throughput flow refer to HD control, page 12 (control pressure X1; X2).

EZ - Electric Two-Position Control, With Switching Solenoid

By energizing or de-energizing a control current to either switching solenoid a or b, the stroke cylinders of the pump are supplied with control pressure by the EZ control unit. In this way, the swashplate and thus the displacement is switchable without intermediate settings from \( V_g = 0 \) to \( V_g \max \). Each direction of throughput flow is assigned to a solenoid.

Solenoid technical data

<table>
<thead>
<tr>
<th>Solenoid technical data</th>
<th>EZ1</th>
<th>EZ2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V DC (±20 %)</td>
<td>24 V DC (±20 %)</td>
</tr>
<tr>
<td>Neutral position ( V_g = 0 )</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Position ( V_g \max )</td>
<td>current energized</td>
<td>current energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>5.5 Ω</td>
<td>21.7 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Current required, minimum effective</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Actuated time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see range of connectors on page 60</td>
<td></td>
</tr>
</tbody>
</table>

Standard: switching solenoid without manual emergency operation.

On request: manual emergency operation with spring reset available.
HD - Hydraulic Control, Pilot-Pressure Related

Depending on the pressure difference of the pilot pressure \( p_{St} \) in the two control lines (ports Y1 and Y2), the stroke cylinder of the pump is supplied with control pressure via the HD control unit. Thus, the swashplate – and, therefore, the displacement – to be infinitely adjustable. A different through put flow direction is associated with each control line.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.

![Graph showing the relationship between pilot pressure and displacement](image)

\[
\frac{V_g}{V_{g\text{ max}}} = \frac{p_{St}}{18 \text{ bar}}
\]

\( p_{St} \) in bar

V_\text{g} \quad \text{displacement at} \quad p_{St}

\( V_{g\text{ max}} \) \quad \text{displacement at} \quad p_{St} = 18 \text{ bar}

Pilot pressure \( p_{St} = 6 \text{ - } 18 \text{ bar} \) at ports Y1, Y2

Start of control 6 bar

End of control 18 bar (max. displacement \( V_{g\text{ max}} \))

Please note:
The external control device must vent the Y1 and Y2 ports to tank pressure in neutral.

**Note**

The spring return feature in the control unit is not a safety device

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop).

**Assignment**

<table>
<thead>
<tr>
<th>Direction of rotation</th>
<th>Control pressure</th>
<th>Throughput flow</th>
<th>Operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28...56</td>
<td>( Y_1 ) X_1</td>
<td>A to B</td>
<td>( M_B )</td>
</tr>
<tr>
<td></td>
<td>( Y_2 ) X_2</td>
<td>B to A</td>
<td>( M_A )</td>
</tr>
<tr>
<td>71...250</td>
<td>( Y_1 ) X_1</td>
<td>B to A</td>
<td>( M_A )</td>
</tr>
<tr>
<td></td>
<td>( Y_2 ) X_2</td>
<td>A to B</td>
<td>( M_B )</td>
</tr>
<tr>
<td>CCW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28...56</td>
<td>( Y_1 ) X_1</td>
<td>A to B</td>
<td>( M_B )</td>
</tr>
<tr>
<td></td>
<td>( Y_2 ) X_2</td>
<td>B to A</td>
<td>( M_A )</td>
</tr>
<tr>
<td>71...250</td>
<td>( Y_1 ) X_1</td>
<td>A to B</td>
<td>( M_B )</td>
</tr>
<tr>
<td></td>
<td>( Y_2 ) X_2</td>
<td>B to A</td>
<td>( M_A )</td>
</tr>
</tbody>
</table>

Sizes 28, 250

Sizes 40...180

Standard version 1)

Version with DA control valve 1)

1) Size 28 and 250 without port \( F_{St} \) and \( F_S \)
HW - Hydraulic Control, Mechanical Servo

Depending on the actuation direction a or b of the control lever, the stroke cylinder of the pump is supplied with control pressure via the HW control unit. Thus, the swashplate – and, therefore, the displacement – to be infinitely adjustable. A different throughput flow direction is associated with each direction of control lever actuation.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.

Swivel angle $\beta$ at the control lever for deflection:
- Start of control at $\beta = 3^\circ$
- End of control at $\beta = 29^\circ$ (max. displacement $V_g$ max)

Mech. stop: sizes 28...71 _______ ±40°
sizes 90...250 ______ ±35°

The maximum required torque at the lever is 170 Ncm. To prevent damage to the HW control module a positive mechanical stop must be provided for the HW control linkage.

Note:
Spring centering enables the pump to move automatically into neutral position ($V_g = 0$) as soon as there is no longer any torque on the control lever of the HW control unit (regardless of deflection angle).

Variation: Neutral position switch, L

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

The neutral position switch provides a safety function for drive units that require zero flow under certain operating conditions (e.g. starting diesel engines).

Technical data of neutral position switch

<table>
<thead>
<tr>
<th>Load capacity</th>
<th>20 A (continuous), without switching operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching capacity</td>
<td>15 A / 32 V (ohm’s load)</td>
</tr>
<tr>
<td></td>
<td>4 A / 32 V (inductive load)</td>
</tr>
<tr>
<td>Connector version</td>
<td>DEUTSCH connector DT04-2P-EP04</td>
</tr>
</tbody>
</table>

Note:
1) Size 28 and 250 without port $F_a$ and $F_S$
EP - Electric Control, With Proportional Solenoid

Depending on the preselected current I at the two proportional solenoids (a and b), the stroke cylinder of the pump is supplied with control pressure via the EP control unit. Thus, the swashplate – and, therefore, the displacement – to be infinitely adjustable. One direction of throughput flow is assigned to each proportional solenoid.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.

The following electronic controllers and amplifiers are available for actuating the proportional solenoids (details also available at www.boschrexroth.com/mobile-electronics):

- BODAS controller RC
  series 20 RE 95200
  series 21 RE 95201
  series 22 RE 95202
  series 30 RE 95203
  and application software

- Analog amplifier RA RE 95230

Note

The spring return feature in the control unit is not a safety device.

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop).

Solenoid technical data EP3 EP4

<table>
<thead>
<tr>
<th>Voltage</th>
<th>12 V DC (±20 %) 24 V DC (±20 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control current</td>
<td></td>
</tr>
<tr>
<td>Start of control at $V_g$</td>
<td>400 mA</td>
</tr>
<tr>
<td>End of control at $V_{g \text{max}}$</td>
<td>1200 mA</td>
</tr>
<tr>
<td>Limiting current</td>
<td>1.54 A</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
</tr>
<tr>
<td>Dither frequency</td>
<td>100 Hz</td>
</tr>
<tr>
<td>Actuated time</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Type of protection see range of connectors on page 60

The following electronic controllers and amplifiers are available for actuating the proportional solenoids (details also available at www.boschrexroth.com/mobile-electronics):

- BODAS controller RC
  series 20 RE 95200
  series 21 RE 95201
  series 22 RE 95202
  series 30 RE 95203
  and application software

- Analog amplifier RA RE 95230

EP - Electric Control, With Proportional Solenoid

Standard version 1)

Version with DA control valve 1)

1) Size 28 and 250 without port Fa1 and F6
DA - Hydraulic Control, Speed Related

The DA control is an engine speed-dependent, or automotive, type control system. The built-in DA regulating cartridge generates a pilot pressure that is proportional to pump (engine) drive speed. This pilot pressure is directed to the positioning cylinder of the pump by a solenoid actuated 4/3 way directional valve. Pump displacement is infinitely variable in each direction of flow, and is influenced by both pump drive speed and discharge pressure. Flow direction (i.e. machine forward or reverse) is controlled by energizing solenoid a or b.

Increasing pump drive speed generates a higher pilot pressure from the DA cartridge, with a subsequent increase in pump flow and/or pressure.

Dependent on the selected pump operating characteristics, increasing system pressure (i.e. machine load) causes the pump to swivel back towards a smaller displacement. Engine overload (anti-stall) protection is achieved by the combination of this pressure-related pump de-stroking, and the reduction of pilot pressure as the engine speed drops.

Any additional power requirement, such as implement hydraulics, may result in further engine pull down. This causes a further reduction in pilot pressure and therefore pump displacement. Automatic power division and full utilization of available power is thus achieved for both the vehicle transmission and the implement hydraulics, with priority given to the implement hydraulics.

To provide controllable reduced vehicle speed operation when high engine speeds are required for fast implement hydraulics, various inching options are available.

The DA regulating cartridge can also be used in pumps with conventional control devices, such as EP, HW or HD, to provide an engine anti-stall function, or as a combination of automotive and displacement control functions.

Application of the DA control is only appropriate on certain types of vehicle drive systems, and requires a review of the engine and vehicle parameters to ensure proper application of the pump, and safe and efficient machine operation. All DA applications must therefore be reviewed by a Rexroth Application Engineer.

### Solenoid technical data

<table>
<thead>
<tr>
<th>DA1</th>
<th>DA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V DC (±20 %)</td>
</tr>
<tr>
<td>Neutral position V₉₀</td>
<td>de-energized</td>
</tr>
<tr>
<td>Position V₉ₐₘₐₓ</td>
<td>current energized</td>
</tr>
<tr>
<td>Nominal resistance (at 20 °C)</td>
<td>5.5 Ω</td>
</tr>
<tr>
<td>Nominal power</td>
<td>26.2 W</td>
</tr>
<tr>
<td>Current required, minimum effective</td>
<td>1.32 A</td>
</tr>
<tr>
<td>Actuated time</td>
<td>100 %</td>
</tr>
<tr>
<td>Type of protection</td>
<td>see range of connectors on page 60</td>
</tr>
</tbody>
</table>

1) Size 28 and 250 without port F₁ and F₅
DA - Hydraulic Control, Speed Related

Function and control of DA control calves

DA control valve, fixed setting (2)
Pilot pressure is generated in relation to drive speed. When ordering, please state in plain text: Start of control (set at factory).

DA control valve, mechanically adjustable with position lever (3)
Pilot pressure is generated in relation to drive speed. When ordering, please state in plain text: Start of control (set at factory).
Pilot pressure may be reduced, independently of drive speed, through mechanical operation of the position lever (inch function).
Max. perm. operating torque at the position lever $T_{\text{max}} = 4 \text{ Nm}$
Max. angle of rotation $70^\circ$, lever position: any.

Variation 3R ______ actuating direction of the position lever
- clockwise

Variation 3L ______ actuating direction of the position lever
- counterclockwise

DA control valve, fixed setting and hydraulic inch valve mounted, (4, 8)
(only for pumps with DA control unit)
- Version with throttle valve sizes 28, 40, 56, 71
- Version with pressure-reducing valve sizes 90, 125, 180, 250
Permits the pilot pressure to be reduced independently of the drive speed via hydraulic control (port Z).

Variation 4:
Control at port Z by means of brake fluid according to ISO 4925 (no mineral oil) from the vehicle braking system (hydraulically linked with the service brake).

Variation 8:
Control at port Z by means of brake fluid based on mineral oil.

DA control valve with fixed setting, ports for pilot control device as inch valve (7)
Any reduction of pilot pressure, independent from the drive speed through the mechanical operation of the pilot control device.
The pilot control device is installed separately from the pump (for example in the driver’s cabin) and connected with the pump by 2 hydraulic control lines via ports $P_S$ and $Y$.
A suitable pilot control device must be ordered separately and is not included in supply.
Detailed information is available from our sales department and on our website www.boschrexroth.com/da-control. Use our computer program to work out the input design that meets your needs. A DA control must be approved by Rexroth.

Note: see page 61 for rotary inch valves.

Circuit diagrams 1):

DA1D3/DA2D3
Hydraulic control, speed related, DA control valve, mech. adjustable with position lever

DA1D4/DA2D4
Hydraulic control, speed related, DA control valve, fixed setting, with hydraulic inch valve
With throttle valve, sizes 28...71

DA1D7/DA2D7
Hydraulic control, speed related, DA control valve, fixed setting, with separately installed pilot control device as inch valve
Pilot control device (is not included in supply)

1) Size 28 and 250 without port $F_S$ and $F_{S1}$
Unit Dimensions, Size 28

Version without control unit NV

Standard: suction port S at bottom (10)
Option: suction port S at top (13): port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 28

Shaft ends

Z  Splined shaft DIN 5480
   W25x1.25x30x18x9g

S  Splined shaft 1in
   15T 16/32DP 3)
   (SAE J744 – 25-4 (B-B))

Ports

A, B  service line ports (high-pressure series)  
      fixing thread A/B  
      SAE J518 3/4 in  
      DIN 13 M10x1.5; 17 deep 2)

T1  case drain or fill  
    DIN 3852 M22x1.5; 14 deep 210 Nm 2)

T2  case drain 4)
    DIN 3852 M22x1.5; 14 deep 210 Nm 2)

M_A, M_B  pressure gauge - operating pressure A, B 4)
    DIN 3852 M22x1.5; 12 deep 50 Nm 2)

R  air bleed 4)
    DIN 3852 M12x1.5; 12 deep 50 Nm 2)

S  boost suction port  
    DIN 3852 M33x2; 18 deep 540 Nm 2)

X1, X2  port for control pressures (before orifice) 4)
    DIN 3852 M12x1.5; 12 deep 50 Nm 2)

G  pressure port for auxiliary circuits 4)
    DIN 3852 M12x1.5; 12 deep 50 Nm 2)

P_S  control pressure supply 4)
    DIN 3852 M14x1.5; 12 deep 80 Nm 2)

F_a  filter output 4)
    DIN 3852 M18x1.5; 12 deep 140 Nm 2)

F_e  filter input 4)
    DIN 3852 M18x1.5; 12 deep 140 Nm 2)

M_H  port for balanced high pressure 4)
    DIN 3852 M12x1.5; 12 deep 50 Nm 2)

Y1, Y2  remote control ports (only HD)  
        DIN 3852 M14x1.5; 12 deep 80 Nm 2)

Z  pilot pressure port (only DA4/8) 4)
    DIN 3852 M10x1.5; 8 deep 30 Nm 2)

Y  pilot pressure port (only DA7)
    DIN 3852 M14x1.5; 12 deep 80 Nm 2)

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 28

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 28

Hydraulic control, speed related, DA

Control valve, fixed setting, DA2

Control valve, mech. adjustable with position lever, DA3

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, fixed setting and ports for pilot control device, DA7

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 40

Version without control unit NV

**Standard:** suction port S at bottom (02)

**Option:** suction port S at top (03); port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 40

Shaft ends

<table>
<thead>
<tr>
<th>Z</th>
<th>Splined shaft DIN 5480 W30x2x30x14x9g</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Splined shaft DIN 5480 W35x2x30x16x9g</td>
</tr>
<tr>
<td>S</td>
<td>Splined shaft 1 1/4 in 14T 12/24DP 3) (SAE J744 – 32-4 (C))</td>
</tr>
<tr>
<td>U</td>
<td>Splined shaft 1in 15T 16/32DP 3) (SAE J744 – 25-4 (B-B))</td>
</tr>
</tbody>
</table>

Ports

<table>
<thead>
<tr>
<th>A, B</th>
<th>service line ports (high-pressure series)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>case drain or fill</td>
</tr>
<tr>
<td>T₂</td>
<td>case drain 4)</td>
</tr>
<tr>
<td>Mₐ, Mₐ</td>
<td>pressure gauge - operating pressure A, B 4)</td>
</tr>
<tr>
<td>R</td>
<td>air bleed 4)</td>
</tr>
<tr>
<td>S</td>
<td>boost suction port</td>
</tr>
<tr>
<td>X₁, X₂</td>
<td>port for control pressures (before orifice) 4)</td>
</tr>
<tr>
<td>G</td>
<td>pressure port for auxiliary circuits 4)</td>
</tr>
<tr>
<td>Pₛ</td>
<td>control pressure supply 4)</td>
</tr>
<tr>
<td>Fₛ</td>
<td>filter output 4)</td>
</tr>
<tr>
<td>Fₛ₁</td>
<td>filter output (mountable filter) 4)</td>
</tr>
<tr>
<td>Fₛ</td>
<td>filter input 4)</td>
</tr>
<tr>
<td>Fₛ</td>
<td>port from filter to suction line (cold start) 4)</td>
</tr>
<tr>
<td>Mₜ</td>
<td>port for balanced high pressure 4)</td>
</tr>
<tr>
<td>Y₁, Y₂</td>
<td>remote control ports (only HD)</td>
</tr>
<tr>
<td>Z</td>
<td>pilot pressure port (only DA4/8) 4)</td>
</tr>
<tr>
<td>Y</td>
<td>pilot pressure port (only DA7)</td>
</tr>
</tbody>
</table>

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)  
2) Please observe the general notes for the max. tightening torques on page 64  
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5  
4) Plugged
Unit Dimensions, Size 40

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 40

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, fixed setting and ports for pilot control device, DA7

Control valve, mech. adjustable with position lever, DA3

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 56

Version without control unit NV

Standard: suction port S at bottom (02)
Option: suction port S at top (03): port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 56

Shaft ends

- **Z** Splined shaft DIN 5480
  - W30x2x30x14x9g

- **A** Splined shaft DIN 5480
  - W35x2x30x16x9g

- **S** Splined shaft 1 1/4 in
  - 14T 12/24DP ³) (SAE J744 – 32-4 (C))

- **T** Splined shaft 1 3/8in
  - 21T 16/32DP ³)

Ports

- **A, B** service line ports (high-pressure series)
  - fixing thread A/B
  - SAE J518 3/4 in
  - DIN 13 M10x1.5; 17 deep ²)

- **T₁** case drain or fill
  - DIN 3852 M22x1.5; 14 deep 210 Nm ²)

- **T₂** case drain ⁴)
  - DIN 3852 M22x1.5; 14 deep 210 Nm ²)

- **Mₐ, Mₐ** pressure gauge - operating pressure A, B ⁴)
  - DIN 3852 M12x1.5; 12 deep 50 Nm ²)

- **R** air bleed ⁴)
  - DIN 3852 M12x1.5; 12 deep 50 Nm ²)

- **S** boost suction port
  - DIN 3852 M33x2; 18 deep 540 Nm ²)

- **X₁, X₂** port for control pressures (before orifice) ⁴)
  - DIN 3852 M12x1.5; 12 deep 50 Nm ²)

- **G** pressure port for auxiliary circuits ⁴)
  - DIN 3852 M12x1.5; 12 deep 80 Nm ²)

- **Pₛ** control pressure supply ⁴)
  - DIN 3852 M14x1.5; 12 deep 80 Nm ²)

- **Fₛ** filter output ⁴)
  - DIN 3852 M18x1.5; 12 deep 140 Nm ²)

- **Fₛ₁** filter output (mountable filter) ⁴)
  - DIN 3852 M18x1.5; 12 deep 140 Nm ²)

- **Fₛ** filter input ⁴)
  - DIN 3852 M18x1.5; 12 deep 140 Nm ²)

- **Fₛ** port from filter to suction line (cold start) ⁴)
  - DIN 3852 M18x1.5; 12 deep 140 Nm ²)

- **Mₙ** port for balanced high pressure ⁴)
  - DIN 3852 M18x1.5; 12 deep 140 Nm ²)

- **Y₁, Y₂** remote control ports (only HD)
  - DIN 3852 M14x1.5; 12 deep 80 Nm ²)

- **Z** pilot pressure port (only DA4/8) ⁴)
  - DIN 3852 M10x1; 8 deep 30 Nm ²)

- **Y** pilot pressure port (only DA7)
  - DIN 3852 M14x1.5; 12 deep 80 Nm ²)

¹) Center bore acc. to DIN 332 (thread acc. to DIN 13)
²) Please observe the general notes for the max. tightening torques on page 64
³) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
⁴) Plugged
Unit Dimensions, Size 56

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG

Version with neutral position switch, HWL

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 56

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, fixed setting and ports for pilot control device, DA7

Control valve, mech. adjustable with position lever, DA3

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 71

Version without control unit NV

Standard: suction port S at bottom (02)
Option: suction port S at top (03); port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 71

Shaft ends

| Z | Splined shaft DIN 5480  
<table>
<thead>
<tr>
<th></th>
<th>W35x2x30x16x9g</th>
</tr>
</thead>
</table>
| A | Splined shaft DIN 5480  
|   | W40x2x30x18x9g |
| S | Splined shaft 1 1/4 in  
|   | 14T 12/24DP  
|   | (SAE J744 – 32-4 (C)) |
| T | Splined shaft 1 3/8in  
|   | 21T 16/32DP  
|   | (SAE J744 – 32-4 (C)) |

Ports

- **A, B** service line ports (high-pressure series)
  - fixing thread A/B
- **T<sub>1</sub>** case drain or fill
- **T<sub>2</sub>** case drain 4)
- **M<sub>a</sub>**, **M<sub>B</sub>** pressure gauge - operating pressure A, B 4)
- **R** air bleed 4)
- **S** boost suction port
- **X<sub>1</sub>**, **X<sub>2</sub>** port for control pressures (before orifice) 4)
- **G** pressure port for auxiliary circuits 4)
- **P<sub>S</sub>** control pressure supply 4)
- **F<sub>a</sub>** filter output 4)
- **F<sub>a1</sub>** filter output (mountable filter) 4)
- **F<sub>s</sub>** filter input 4)
- **F<sub>S</sub>** port from filter to suction line (cold start) 4)
- **M<sub>H</sub>** port for balanced high pressure 4)
- **Y<sub>1</sub>**, **Y<sub>2</sub>** remote control ports (only HD)
- **Z** pilot pressure port (only DA4/8) 4)
- **Y** pilot pressure port (only DA7) 4)

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 71

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 71

Hydraulic control, speed related, DA

Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, mech. adjustable with position lever, DA3

Control valve, fixed setting and ports for pilot control device, DA7

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 90

Version without control unit NV

Standard: suction port S at bottom (02)
Option: suction port S at top (03): port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
## Unit Dimensions, Size 90

### Shaft ends

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>Z</td>
<td>Splined shaft DIN 5480 W35x2x30x16x9g</td>
</tr>
<tr>
<td>A</td>
<td>Splined shaft DIN 5480 W45x2x30x21x9g</td>
</tr>
<tr>
<td>S</td>
<td>Splined shaft 1 3/4 in 13T 8/16 DP 3) (SAE J744 – 44-4 (D))</td>
</tr>
<tr>
<td>U</td>
<td>Splined shaft 1 1/4in 14T 12/24DP 3) (SAE J744 – 32-4 (C))</td>
</tr>
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</table>

### Ports

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A, B</td>
<td>service line ports (high-pressure series) fixing thread A/B</td>
</tr>
<tr>
<td>T₁</td>
<td>case drain or fill</td>
</tr>
<tr>
<td>T₂</td>
<td>case drain 4)</td>
</tr>
<tr>
<td>Mₐ, Mₐ</td>
<td>pressure gauge - operating pressure A, B 4)</td>
</tr>
<tr>
<td>R</td>
<td>air bleed 4)</td>
</tr>
<tr>
<td>S</td>
<td>boost suction port</td>
</tr>
<tr>
<td>X₁, X₂</td>
<td>ports for control pressure (before orifice) 4)</td>
</tr>
<tr>
<td>G</td>
<td>pressure port for auxiliary circuits 4)</td>
</tr>
<tr>
<td>Pₛ</td>
<td>control pressure supply 4)</td>
</tr>
<tr>
<td>Fₛ</td>
<td>filter output 4)</td>
</tr>
<tr>
<td>Fₛ₁</td>
<td>filter output (mountable filter) 4)</td>
</tr>
<tr>
<td>Fₛ₂</td>
<td>filter input 4)</td>
</tr>
<tr>
<td>Fₛ₃</td>
<td>port from filter to suction line (cold start) 4)</td>
</tr>
<tr>
<td>Mₛ₃</td>
<td>port for balanced high pressure 4)</td>
</tr>
<tr>
<td>Y₁, Y₂</td>
<td>remote control ports (only HD)</td>
</tr>
<tr>
<td>Z</td>
<td>pilot pressure port (only DA4/8) 4)</td>
</tr>
<tr>
<td>Y</td>
<td>pilot pressure port (only DA?) 4)</td>
</tr>
</tbody>
</table>

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged
Unit Dimensions, Size 90

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

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

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG
Unit Dimensions, Size 90

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, fixed setting and ports for pilot control device, DA7

Control valve, mech. adjustable with position lever, DA3

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 125

Version without control unit NV

Standard: suction port S at bottom (02)
Option: suction port S at top (03): port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 125

Shaft ends

Z Splined shaft DIN 5480
W40x2x30x18x9g

A Splined shaft DIN 5480
W45x2x30x21x9g

S Splined shaft 1 3/4 in
13T 8/16 DP 3)
(SAE J744 – 44-4 (D))

T Splined shaft 2in
15T 8/16DP 3)
(SAE J744 – 50-4 (F))

Ports

A, B service line ports (high-pressure series)
fixing thread A/B

T1 case drain or fill

T2 case drain 4)

Mₐ, Mₐ pressure gauge - operating pressure A, B 4)

R air bleed 4)

S boost suction port

X₁, X₂ port for control pressures (before orifice) 4)

G pressure port for auxiliary circuits 4)

Pₛ control pressure supply 4)

Fₐ filter output 4)

Fₐ₁ filter output (mountable filter) 4)

Fₛ filter input 4)

Fₛ port from filter to suction line (cold start) 4)

Mₖ port for balanced high pressure 4)

Y₁, Y₂ remote control ports (only HD)

Z pilot pressure port (only DA4/8) 4)

Y pilot pressure port (only DA7)

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 125

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 125

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, mech. adjustable with position lever, DA3

Actuating direction "counterclockwise" (3L)

Actuating direction "clockwise" (3R)

Control valve, fixed setting and ports for pilot control device, DA7
Unit Dimensions, Size 180

Version without control unit NV

Standard: suction port S at bottom (02)
Option: suction port S at top (03); port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 180

Shaft ends

Z Splined shaft DIN 5480
   W50x2x30x24x9g

S Splined shaft 1 3/4 in
   13T 8/16 DP 3)
   (SAE J744 – 44-4 (D))

T Splined shaft 2 1/4 in
   1 7T 8/16DP 3)

Ports

A, B service line ports (high-pressure series)
   fixing thread A/B
T1 case drain or fill
T2 case drain 4)
Mn, MB pressure gauge - operating pressure A/B 4)
R air bleed 4)
S boost suction port
X1, X2 ports for control pressure (before orifice) 4)
G pressure port for auxiliary circuits 4)
P1 control pressure supply 4)
Fa filter output 4)
Fa1 filter output (mountable filter) 4)
Fs filter input 4)
FS port from filter to suction line (cold start) 4)
Mh port for balanced high pressure 4)
Y1, Y2 remote control ports (only HD)
Z pilot pressure port (only DA4/B) 4)
Y pilot pressure port (only DA7)

SAE J518 1 1/4 in
DIN 13 M14x2; 19 deep 2)
DIN 3852 M42x2; 20 deep 720 Nm 2)
DIN 3852 M42x2; 20 deep 720 Nm 2)
DIN 3852 M12x1.5; 12 deep 100 Nm 2)
DIN 3852 M16x1.5; 12 deep 100 Nm 2)
DIN 3852 M48x2; 22 deep 960 Nm 2)
DIN 3852 M16x1.5; 12 deep 100 Nm 2)
DIN 3852 M16x1.5; 12 deep 100 Nm 2)
DIN 3852 M48x2; 22 deep 960 Nm 2)
DIN 3852 M18x1.5; 12 deep 140 Nm 2)
DIN 3852 M18x1.5; 12 deep 140 Nm 2)
DIN 3852 M33x2; 18 deep 540 Nm 2)
DIN 3852 M33x2; 18 deep 540 Nm 2)
DIN 3852 M33x2; 18 deep 540 Nm 2)
DIN 3852 M33x2; 18 deep 540 Nm 2)
DIN 3852 M14x1.5; 12 deep 80 Nm 2)
DIN 3852 M18x1.5; 12 deep 140 Nm 2)

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 180

Hydraulic control, pilot-pressure related, HD

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

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG
Unit Dimensions, Size 180

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

Control valve, fixed setting and ports for pilot control device, DA7

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 250

Version without control unit NV

Standard: suction port S at bottom (10)
Option: suction port S at top (13): port plate turned through 180°

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 250

Shaft ends

Z  Splined shaft DIN 5480
   W55x2x30x26x9g

S  Splined shaft 1 3/4 in
   13T 8/16 DP 3)
   (SAE J744 – 44-4 (D))

T  Splined shaft 2 1/4 in
   1 7T 8/16DP 3)

Ports

A, B  service line ports (high-pressure series)
      fixing thread A/B

T₁  case drain or fill

T₂  case drain 4)

Mₐ, Mₐ  pressure gauge - operating pressure A/B 4)

R  air bleed 4)

S  boost suction port

X₁, X₂  ports for control pressure (before orifice) 4)

G  pressure port for auxiliary circuits 4)

Pₛ  control pressure supply 4)

Fₛ  filter output 4)

Fₒ  filter input 4)

Mₜ  port for balanced high pressure 4)

Y₁, Y₂  remote control ports (only HD)

Z  pilot pressure port (only DA4/8 4)

Y  pilot pressure port (only DA7)

1) Center bore acc. to DIN 332 (thread acc. to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5
4) Plugged

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 250

Hydraulic control, pilot-pressure related, HD

Hydraulic control, mechanical servo, HW

Electric two-position control with switching solenoid, EZ

Electric control with proportional solenoid, EP

Hydraulic control, direct operated, DG

Before finalizing your design, please request a binding installation drawing. Dimensions in mm.
Unit Dimensions, Size 250

Hydraulic control, speed related, DA
Control valve, fixed setting, DA2

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

N00  Without boost pump, without through drive
F00  With boost pump, without through drive

### Size N00 A1 (N00) A1 (F00)

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**F01/K01** Flange SAE J744 – 82-2 (A)

**Hub** for splined shaft according to ANSI B92.1a-1976  5/8 in 9T 16/32DP  

<table>
<thead>
<tr>
<th>Size</th>
<th>A1 (F01)</th>
<th>A1 (K01)</th>
<th>A2</th>
<th>A3</th>
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<td>7.5</td>
<td>15.5</td>
</tr>
<tr>
<td>250</td>
<td>426.9</td>
<td>426.2</td>
<td>11</td>
<td>11</td>
<td>18</td>
</tr>
</tbody>
</table>

Shown is the 2-bolt version

Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

### Size F02/K02 Flange SAE J744 – 101-2 (B)

**Hub** for splined shaft according to ANSI B92.1a-1976  7/8 in 13T 16/32DP  

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
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<tr>
<td>28</td>
<td>230.4</td>
<td>9.7</td>
<td>9.7</td>
<td>16.2</td>
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<tr>
<td>40</td>
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<td>56</td>
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<tr>
<td>71</td>
<td>300.6</td>
<td>13</td>
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<td>17</td>
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<tr>
<td>90</td>
<td>305</td>
<td>11</td>
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<td>17</td>
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<tr>
<td>125</td>
<td>330.9</td>
<td>10</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>180</td>
<td>381.4</td>
<td>11</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>250</td>
<td>428.9</td>
<td>11</td>
<td>11</td>
<td>16</td>
</tr>
</tbody>
</table>

Shown is the 2-bolt version

Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

---

1. 30° pressure angle, flat root; side fit, tolerance class 5
2. Thread acc. to DIN 13, please observe the general notes for the max. tightening torques on page 64
3. O-ring included in supply
Through Drive Dimensions

**F04/K04** Flange SAE J744 – 101-2 (B)
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP 1) (SAE J744 – 25-4 (B-B))

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
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<tbody>
<tr>
<td>28</td>
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<td>9.7</td>
<td>13.7</td>
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<tr>
<td>40</td>
<td>240.7</td>
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<tr>
<td>56</td>
<td>262.4</td>
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<td>18.5</td>
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<td>71</td>
<td>300.6</td>
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<td>90</td>
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<td>15</td>
</tr>
<tr>
<td>125</td>
<td>330.9</td>
<td>10</td>
<td>11</td>
<td>16.5</td>
</tr>
<tr>
<td>180</td>
<td>381.4</td>
<td>11</td>
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<td>18</td>
</tr>
<tr>
<td>250</td>
<td>428.9</td>
<td>11</td>
<td>11</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Shown is the 2-bolt version
Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

**F09/K09** Flange SAE J744 – 127-2 (C)
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP 1) (SAE J744 – 25-4 (B-B))

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
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<tbody>
<tr>
<td>40</td>
<td>244.7</td>
<td>14</td>
<td>14</td>
<td>19.5</td>
</tr>
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</table>

**F07/K07** Flange SAE J744 – 127-2 (C)
Hub for splined shaft according to ANSI B92.1a-1976 1 1/4 in 14T 12/24DP 1) (SAE J744 – 32-4 (C))

<table>
<thead>
<tr>
<th>Size</th>
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<th>A2</th>
<th>A3</th>
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<tbody>
<tr>
<td>56</td>
<td>266.4</td>
<td>15</td>
<td>14</td>
<td>17.5</td>
</tr>
<tr>
<td>71</td>
<td>303.6</td>
<td>15</td>
<td>13.5</td>
<td>20</td>
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<tr>
<td>90</td>
<td>309</td>
<td>13</td>
<td>14</td>
<td>20.5</td>
</tr>
<tr>
<td>125</td>
<td>335.9</td>
<td>15</td>
<td>15.5</td>
<td>22.5</td>
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<tr>
<td>180</td>
<td>384.4</td>
<td>14</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>250</td>
<td>425.9</td>
<td>16</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

Shown is the 4-bolt and 2-bolt version
Please specify in plain text whether the 4-bolt, 2-bolt horizontal or 2-bolt vertical version is used.

---

1) 30° pressure angle, flat root; side fit, tolerance class 5
2) Thread acc. to DIN 13, please observe the general notes for the max. tightening torques on page 64
3) O-ring included in supply
4) Size 180 only with SAE 2-bolt flange
5) Size 56: ø32.7
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

### Through Drive Dimensions

**F73/K73**  
**Flange** SAE J744 – 152-2/4 (D)  
**Hub** for splined shaft acc. to DIN 5480  
W35x2x30x16x9g

**F69/K69**  
**Flange** SAE J744 – 152-2/4 (D)  
**Hub** for splined shaft according to ANSI B92.1a-1976  
1 3/4 in 13T B/16DP \(^1\)  
(SAE J744 – 44-4 (D))

**F72/K72**  
**Flange** SAE J744 – 165-4 (E)  
**Hub** for splined shaft according to ANSI B92.1a-1976  
1 3/4 in 13T B/16DP \(^1\)  
(SAE J744 – 44-4 (D))

---

1) 30° pressure angle, flat root; side fit, tolerance class 5  
2) Thread acc. to DIN 13, please observe the general notes for the max. tightening torques on page 64  
3) O-ring included in supply

---

---

### Tables

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>309</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

Shown is the 4+2-bolt version  
Please specify in plain text whether the 2-bolt, 4-bolt or 4+2-bolt version is used.

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
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<tr>
<td>125</td>
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<tr>
<td>180</td>
<td>391.9</td>
<td>20.9</td>
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<tr>
<td>250</td>
<td>444.9</td>
<td>9</td>
<td>17</td>
</tr>
</tbody>
</table>

Shown is the 4+2-bolt version  
Please specify in plain text whether the 2-bolt, 4-bolt or 4+2-bolt version is used.

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>391.9</td>
<td>20.9</td>
<td>18</td>
</tr>
<tr>
<td>250</td>
<td>444.9</td>
<td>9</td>
<td>17</td>
</tr>
</tbody>
</table>
Overview of Attachments on A4VG

<table>
<thead>
<tr>
<th>Through drive – A4VG</th>
<th>A4VG (1st pump)</th>
<th>A4VG (2nd pump)</th>
<th>Through drive for size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hub for splined shaft</td>
<td>A4VG size</td>
<td>A10V(S)/O/31 size</td>
<td>A10V(S)/O/53 size</td>
</tr>
<tr>
<td>Flange 82-2 (A) 5/8 in F/K01</td>
<td>–</td>
<td>18 (U)</td>
<td>10 (U)</td>
</tr>
<tr>
<td>Flange 101-2 (B) 7/8 in F/K02</td>
<td>–</td>
<td>28 (S,R)</td>
<td>28 (S,R)</td>
</tr>
<tr>
<td>Flange 1 in F/K04</td>
<td>–</td>
<td>45 (U)</td>
<td>45 (U,W)</td>
</tr>
<tr>
<td>Flange 127-2 (C) 1 in F/K09</td>
<td>40 (U)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Flange 1 1/4 in F/K07</td>
<td>40 (S)</td>
<td>56 (S)</td>
<td>71 (S,R)</td>
</tr>
<tr>
<td>Flange 1 3/4 in F/K69</td>
<td>90 (S)</td>
<td>140 (S)</td>
<td>125 (S)</td>
</tr>
<tr>
<td>Flange 1 3/4 in F/K72</td>
<td>180 (S)</td>
<td>250 (S)</td>
<td>–</td>
</tr>
</tbody>
</table>

1) Rexroth recommends special gear pump versions. Please contact us.

Combination Pumps A4VG + A4VG

Overall length A

<table>
<thead>
<tr>
<th>A4VG (1st pump)</th>
<th>Size 28</th>
<th>Size 40</th>
<th>Size 56</th>
<th>Size 71</th>
<th>Size 90</th>
<th>Size 125</th>
<th>Size 180</th>
<th>Size 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size 28</td>
<td>453.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Size 40</td>
<td>464.1</td>
<td>480.4</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Size 56</td>
<td>485.8</td>
<td>502.1</td>
<td>522.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Size 71</td>
<td>524.0</td>
<td>539.3</td>
<td>560.0</td>
<td>597.2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
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<td>Size 90</td>
<td>528.4</td>
<td>544.7</td>
<td>565.4</td>
<td>602.6</td>
<td>610.0</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Size 125</td>
<td>554.3</td>
<td>571.6</td>
<td>592.3</td>
<td>629.5</td>
<td>644.9</td>
<td>670.3</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Size 180</td>
<td>604.8</td>
<td>620.1</td>
<td>640.8</td>
<td>678.0</td>
<td>692.9</td>
<td>718.3</td>
<td>762.8</td>
<td>–</td>
</tr>
<tr>
<td>Size 250</td>
<td>652.3</td>
<td>661.6</td>
<td>682.3</td>
<td>719.5</td>
<td>745.9</td>
<td>771.3</td>
<td>815.8</td>
<td>854.8</td>
</tr>
</tbody>
</table>

1) 2nd pump without through drive and with boost pump, F00

Combination pumps make it possible to have independent circuits without the need to fit splitter gearboxes.

When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a “+”.

Example of order:
A4VG56EP3D1/32R-NAC02F073SP + A4VG56EP3D1/32R-NSC02F003SP

A tandem pump combined of two equal sizes is permissible without additional supports where the dynamic acceleration does not exceed max. 10 g (≈ 98.1 m/s²).

We recommend the use of 4-bolt mounting flanges from size 71 and larger.

For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque.
Mechanical Stroke Limiter, M

The mechanical stroke limiter is an additional function allowing continuous reduction of the maximum displacement of the pump, regardless of the control unit used.

The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.

### Dimensions

<table>
<thead>
<tr>
<th>Size</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>110.6 max.</td>
<td>40.1</td>
<td>24</td>
<td>–</td>
</tr>
<tr>
<td>40</td>
<td>110.6 max.</td>
<td>38.1</td>
<td>24</td>
<td>–</td>
</tr>
<tr>
<td>56</td>
<td>130.5 max.</td>
<td>44</td>
<td>25.5</td>
<td>–</td>
</tr>
<tr>
<td>71</td>
<td>135.4 max.</td>
<td>86.3</td>
<td>–</td>
<td>28.5</td>
</tr>
<tr>
<td>90</td>
<td>147 max.</td>
<td>95.7</td>
<td>31.5</td>
<td>–</td>
</tr>
<tr>
<td>125</td>
<td>162 max.</td>
<td>104.5</td>
<td>–</td>
<td>35.5</td>
</tr>
<tr>
<td>180</td>
<td>181.6 max.</td>
<td>138.7</td>
<td>38</td>
<td>–</td>
</tr>
<tr>
<td>250</td>
<td>198.9 max.</td>
<td>174.8</td>
<td>39.5</td>
<td>–</td>
</tr>
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</table>

Circuit diagram 1)

Ports X₃ and X₄ for Positioning Pressure, T

### Dimensions

<table>
<thead>
<tr>
<th>Size</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>X₃, X₄</th>
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</thead>
<tbody>
<tr>
<td>28</td>
<td>92</td>
<td>40.1</td>
<td>–</td>
<td>24</td>
<td>M12x1.5</td>
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<tr>
<td>40</td>
<td>92</td>
<td>38.1</td>
<td>–</td>
<td>24</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>56</td>
<td>104.5</td>
<td>44</td>
<td>–</td>
<td>25</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>71</td>
<td>113.5</td>
<td>86.3</td>
<td>28</td>
<td>–</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>90</td>
<td>111.5</td>
<td>95.7</td>
<td>–</td>
<td>30</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>125</td>
<td>136</td>
<td>104.5</td>
<td>34</td>
<td>–</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>180</td>
<td>146.5</td>
<td>138.7</td>
<td>–</td>
<td>35</td>
<td>M12x1.5</td>
</tr>
<tr>
<td>250</td>
<td>164.5</td>
<td>174.8</td>
<td>–</td>
<td>38</td>
<td>M16x1.5</td>
</tr>
</tbody>
</table>

Circuit diagram 1)

1) Size 28 and 250 without port Fₐ₁ and Fₕ
Filtration Types

Standard: Filtration in the suction line of the boost pump, S
Standard version (preferred)

Filter type: __________________________filter without bypass
Recommendation: ____________with contamination indicator

Flow resistance at the filter element:
- at \( \nu = 30 \text{ mm}^2/\text{s} \), \( n = n_{\text{max}} \) \( \Delta p \leq 0.1 \text{ bar} \)
- at \( \nu = 1000 \text{ mm}^2/\text{s} \), \( n = n_{\text{max}} \) \( \Delta p \leq 0.3 \text{ bar} \)

Pressure at port S of the boost pump:
- at \( \nu = 30 \text{ mm}^2/\text{s} \) \( p \geq 0.8 \text{ bar} \)
- at cold start (\( \nu = 1600 \text{ mm}^2/\text{s} \), \( n \leq 1000 \text{ rpm} \)) \( p \geq 0.5 \text{ bar} \)

Filter is not included in supply.

Circuit diagram - standard version S

Variation: External supply, E
This variation should be used in versions without integral boost pump (N00 or K...).
Port S is plugged.
Supply comes from port \( F_a \).
Filter arrangement: ____________separate
For functional reliability ensure required cleanliness level for the boost pressure fluid at port \( F_a \) (see page 6).

Circuit diagram variation E (external supply)

Variation:
Filtration in the pressure line of the boost pump, ports for external boost circuit filter, D

Filter input: Port \( F_e \)
Filter output: Port \( F_a \)
Filter type: Filter with bypass are not recommended. When applying with bypass please consult us.

Recommendation: with contamination indicator

Note:
For versions with DG control (with pilot-pressure not from boost circuit), the following filter type should be employed:

Filter with bypass and with contamination indicator

Filter arrangement: separately in the pressure line (line filter)
Flow resistance at the filter element:
- at \( \nu = 30 \text{ mm}^2/\text{s} \) \( \Delta p \leq 1 \text{ bar} \)
- for cold start \( \Delta p \leq 3 \text{ bar} \)
(valid for entire speed range \( n_{\text{min}} - n_{\text{max}} \))

Filter is not included in supply.

Circuit diagram variation D
Filtration Types

Variation:
Filtration in the pressure line of the boost pump, with cold start valve and ports for external boost circuit filter, K

Version similar to variation D, however additionally with cold start valve:
- Port plate is equipped with cold start valve and therefore protects the pump from damage.
  The valve opens at flow resistance $\Delta p \geq 6$ bar.

Port $F_e$: Filter input (at the cold start valve)
Port $F_a$: Filter output

Filter arrangement ______ separately in the pressure line (line filter)
Filter is not included in supply.

Circuit diagram variation K (with cold start valve)

Dimensions variation K (with cold start valve)

<table>
<thead>
<tr>
<th>Size</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>Fe</th>
<th>$T_{max}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>122.5</td>
<td>198.7</td>
<td>0</td>
<td>M18x1.5; 15 deep</td>
<td>140 Nm</td>
</tr>
<tr>
<td>56</td>
<td>125.5</td>
<td>215.4</td>
<td>0</td>
<td>M18x1.5; 15 deep</td>
<td>140 Nm</td>
</tr>
<tr>
<td>71</td>
<td>145.5</td>
<td>239.0</td>
<td>8</td>
<td>M26x1.5; 16 deep</td>
<td>230 Nm</td>
</tr>
<tr>
<td>90</td>
<td>139.5</td>
<td>248.5</td>
<td>24</td>
<td>M26x1.5; 16 deep</td>
<td>230 Nm</td>
</tr>
<tr>
<td>125</td>
<td>172.0</td>
<td>267.9</td>
<td>20</td>
<td>M33x2; 18 deep</td>
<td>540 Nm</td>
</tr>
<tr>
<td>180</td>
<td>173.0</td>
<td>311.9</td>
<td>3</td>
<td>M33x2; 18 deep</td>
<td>540 Nm</td>
</tr>
</tbody>
</table>

1) DIN 3852
2) Please observe the general notes for the max. tightening torques on page 64

Filter characteristic

Differential pressure/volumetric flow characteristics conforming to ISO 3968 (valid for new filter element).

Circuit diagram variation F (with mountable filter)
Filtration Types

Variation:
Filtration in pressure line of the boost pump, filter mounted, supplied, with visual contamination indicator, P

Version similar to variation F, however additionally with visual contamination indicator.

Indication: green/red window

Differential pressure (switching pressure) $\Delta p = 5$ bar

Circuit diagram variation P

Variation:
Filtration in the pressure line of the boost pump, filter mounted, supplied, with Electric contamination indicator

with DEUTSCH connector, B

Version similar to variation F, however additionally with Electric contamination indicator.

Indication: Electric

Differential pressure (switching pressure) $\Delta p = 5$ bar

Max. switching power at 24 V DC 60 W

Circuit diagram variation B
Filtration Types

Dimensions with mountable filter

Variation F

Variation P: viewing window

Variation B: electr. signal with DEUTSCH connector

<table>
<thead>
<tr>
<th>Size</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
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</thead>
<tbody>
<tr>
<td>40</td>
<td>201.7</td>
<td>47.7</td>
<td>160</td>
<td>175</td>
<td>135</td>
<td>0</td>
<td>42</td>
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</tr>
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<td>56</td>
<td>218.4</td>
<td>64.4</td>
<td>163</td>
<td>178</td>
<td>138</td>
<td>0</td>
<td>42</td>
<td>78.5</td>
</tr>
<tr>
<td>71</td>
<td>239</td>
<td>46.5</td>
<td>185</td>
<td>203.5</td>
<td>155</td>
<td>16</td>
<td>29</td>
<td>65.5</td>
</tr>
<tr>
<td>90</td>
<td>248.5</td>
<td>56</td>
<td>179</td>
<td>197.5</td>
<td>149</td>
<td>0</td>
<td>45</td>
<td>81.5</td>
</tr>
<tr>
<td>125</td>
<td>235.9</td>
<td>59.4</td>
<td>201</td>
<td>219.5</td>
<td>171</td>
<td>0</td>
<td>53</td>
<td>89.5</td>
</tr>
<tr>
<td>180</td>
<td>279.9</td>
<td>40.3</td>
<td>202</td>
<td>220.4</td>
<td>171.9</td>
<td>17</td>
<td>36</td>
<td>72.5</td>
</tr>
</tbody>
</table>
Swivel Angle Indicator

Electric swivel angle sensor, R

For swivel angle indicator, the pump swivel position is measured by an electric swivel angle sensor. The sensor has a robust, sealed case and a built-in electronic specially developed for automotive applications.

As an output parameter, the hall effect swivel angle sensor delivers a voltage proportional to the swivel angle (see table of output voltages).

### Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage $U_b$</td>
<td>10...30 V DC</td>
</tr>
<tr>
<td>Output voltage $U_a$</td>
<td>0.5 V (Vg max a), 2.5 V (Vg 0), 4.5 V (Vg max b)</td>
</tr>
<tr>
<td>Reserve-conntet protection</td>
<td>Short circuit-resistant</td>
</tr>
<tr>
<td>EMC resistance</td>
<td>Details on request</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 °C...+125 °C</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>EN 60068-2-6</td>
</tr>
<tr>
<td>Shock resistance: continuous shock IEC 68-2-29</td>
<td>25 g</td>
</tr>
<tr>
<td>Salt spray resistance (DIN 50 021-SS)</td>
<td>96 h</td>
</tr>
<tr>
<td>Type of protection DIN/EN 60529</td>
<td>IP67 and IP69K</td>
</tr>
<tr>
<td>Case material</td>
<td>Plastic</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Direction of rotation</td>
</tr>
<tr>
<td>clockwise</td>
<td>A to B</td>
</tr>
<tr>
<td>B to A</td>
<td>2.5 V</td>
</tr>
<tr>
<td>counterclockwise</td>
<td>B to A</td>
</tr>
<tr>
<td>A to B</td>
<td>2.5 V</td>
</tr>
</tbody>
</table>

### Circuit diagram

Electric swivel angle sensor

![Circuit diagram](image)

### Mating connector

AMP Superseal 1.5; 3-pin, Rexroth mat. no. R902602132

comprising:

- 1 socket case, 3-pins 282087-1
- 3 single wire seal, yellow 281934-2
- 3 socket contact 1.8 - 3.3 mm 283025-1

The mating connector is not included in supply. This can be supplied by Rexroth on request.
Connector for Solenoids (Only for EP, EZ, DA)

DEUTSCH DT04-2P-EP04, 2-pin
Molded, without bi-directional suppressor diode (standard) _P
Molded, with bi-directional suppressor diode
(only for switching solenoids on control unit EZ1/2, DA) ___Q

Type of protection according to DIN/EN 60529: IP67 and IP69K

The protection circuit with a bi-directional suppressor diode is necessary for limiting overvoltages. Overvoltages are generated by disconnecting the current using switches, relay contacts or by unplugging an energized mating connector.

Circuit symbol

without bi-directional suppressor diode

with bi-directional suppressor diode

Mating connector
DEUTSCH DT06-2S-EP04
Rexroth Mat. No. R902601804
consisting of:
- 1 case ____________________ DT06-2S-EP04
- 1 wedge ______________________ W2S
- 2 sockets ______________________ 0462-201-16141

The mating connector is not included in supply. This can be supplied by Rexroth on request.

Note for round solenoids:
The position of the connector can be changed by turning the solenoid body.
Proceed as follows:
1. Loosen the fixing nut (1)
2. Turn the solenoid body (2) to the desired position
3. Tighten the fixing nut
   Tightening torque of the fixing nut: 5+1 Nm
   (width across flats WAF26, 12-sided DIN 3124)
Rotary Inch Valve

The rotary inch valve permits the control pressure to be reduced independent from the drive speed through the mechanical operation of the actuating lever. Maximum rotation angle 90°. The lever may be fixed in any position.

The valve is mounted separately from the pump and connected with a pump by the hydraulic control line at port PS (max. line length approximately 2 meters).

The rotary inch valve must be ordered separately.

<table>
<thead>
<tr>
<th>Size</th>
<th>Material no.</th>
<th>Direction of actuation of position lever</th>
</tr>
</thead>
<tbody>
<tr>
<td>28, 40, 56, 71, 90</td>
<td>R902048734</td>
<td>clockwise</td>
</tr>
<tr>
<td></td>
<td>R902048735</td>
<td>counterclockwise</td>
</tr>
<tr>
<td>125</td>
<td>R902048740</td>
<td>clockwise</td>
</tr>
<tr>
<td></td>
<td>R902048741</td>
<td>counterclockwise</td>
</tr>
<tr>
<td>180, 250</td>
<td>R902048744</td>
<td>clockwise</td>
</tr>
<tr>
<td></td>
<td>R902048745</td>
<td>counterclockwise</td>
</tr>
</tbody>
</table>

Attention:
The rotary inch valve can be used independently from the control unit.

Circuit diagram:
hydraulic control, speed related, DA with separate rotary inching valve

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Material No.</th>
<th>Connection</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
</tr>
<tr>
<td>T</td>
<td>DIN 3852</td>
<td>M14x1.5; 12 deep</td>
<td>80 Nm</td>
</tr>
</tbody>
</table>

1) Please observe the general notes for the max. tightening torques on page 64.
Installation Situation for Coupling Assembly

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

Size 28 and 40 (with free turning):

- SAE and DIN splined shaft
  Please observe diameter of the free turning (size 28: ø72, size 40: ø80).

Size 56 to 250 (without free turning):

- SAE splined shaft (shaft S or T)
  The outer diameter of the coupling hub must be smaller than the inner diameter of the retaining ring \( d_2 \) at the zone of the drive shaft collar (measure \( x_2 - x_3 \)).

- DIN splined shaft (shaft Z or AT)
  The outer diameter of the coupling hub must be smaller than the case diameter \( d_3 \) at the zone of the drive shaft collar (measure \( x_2 - x_4 \)).

**SAE splined shaft** (spline acc. to ANSI B92.1a-1976)  
**DIN splined shaft** (spline acc. to DIN 5480)

<table>
<thead>
<tr>
<th>Size</th>
<th>( \phi d_1 )</th>
<th>( \phi d_2 \text{ min} )</th>
<th>( \phi d_3 )</th>
<th>( \phi d_4 )</th>
<th>( x_1 )</th>
<th>( x_2 )</th>
<th>( x_3 )</th>
<th>( x_4 )</th>
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</thead>
<tbody>
<tr>
<td>28</td>
<td>35</td>
<td>43.4</td>
<td>55 ( \pm 0.1 )</td>
<td>101.6</td>
<td>3.3 ( +0.2 )</td>
<td>9.5 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>51.4</td>
<td>63 ( \pm 0.1 )</td>
<td>127</td>
<td>4.3 ( +0.2 )</td>
<td>12.7 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>56</td>
<td>40</td>
<td>54.4</td>
<td>68 ( \pm 0.1 )</td>
<td>127</td>
<td>7.0 ( +0.2 )</td>
<td>12.7 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>71</td>
<td>45</td>
<td>66.5</td>
<td>81 ( \pm 0.1 )</td>
<td>127</td>
<td>7.0 ( +0.2 )</td>
<td>12.7 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>90</td>
<td>50</td>
<td>66.5</td>
<td>81 ( \pm 0.1 )</td>
<td>152.4</td>
<td>6.8 ( +0.2 )</td>
<td>12.7 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>125</td>
<td>55</td>
<td>76.3</td>
<td>91 ( \pm 0.1 )</td>
<td>152.4</td>
<td>7.0 ( +0.2 )</td>
<td>12.7 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>180</td>
<td>60</td>
<td>88</td>
<td>107 ( \pm 0.1 )</td>
<td>165.1</td>
<td>7.4 ( +0.2 )</td>
<td>15.9 ( -0.5 )</td>
<td>8 ( -0.6 )</td>
<td>10 ( -0.6 )</td>
</tr>
<tr>
<td>250</td>
<td>75</td>
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<td>121</td>
<td>165.1</td>
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<td>15.9 ( -0.5 )</td>
<td>8 ( +0.9 )</td>
<td>10 ( -0.6 )</td>
</tr>
</tbody>
</table>
## Installation Notes

### General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This is also to be observed following a relatively long standstill as the system may empty via the hydraulic lines.

The pump case drain connection (i.e.-T1/T2) must be directed to the tank via the highest case drain port. The minimum suction pressure at port S must not fall below 0.8 bar abs. (cold start 0.5 bar absolute).

In all operating states, the suction line and case drain line must flow into the tank below the minimum fluid level.

### Installation position

See examples below. Additional installation positions are available upon request.

**Note:**
With size 71...250, installation position “shaft at top” must be specified at time of order (pump is supplied with additional vent port R1 in flange area).

**Below-tank installation (standard)**

Pump below the minimum fluid level of the tank.

Recommended installation positions: 1 and 2.

**Above-tank installation**

Pump above the min. fluid level of the tank

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

Recommendation for installation position 8 (shaft upwards):
A check valve in the case drain line (opening pressure 0.5 bar) can prevent draining of the case interior.

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleeding</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>S + T₁ (L₂)</td>
</tr>
<tr>
<td>2</td>
<td>L₂</td>
<td>S + T₂ (L₂)</td>
</tr>
<tr>
<td>3</td>
<td>L₂</td>
<td>S + T₂ (L₂)</td>
</tr>
<tr>
<td>4</td>
<td>R + L₂ (size 28 - 56)</td>
<td>S + T₂ (L₂)</td>
</tr>
<tr>
<td></td>
<td>R₁+L₂ (size 71-250)</td>
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</table>

<table>
<thead>
<tr>
<th>Installation position</th>
<th>Air bleeding</th>
<th>Filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>R</td>
<td>T₁ + (L₃)</td>
</tr>
<tr>
<td>6</td>
<td>L₂</td>
<td>S (L₃) + T₂ (L₂)</td>
</tr>
<tr>
<td>7</td>
<td>L₂ + L₃</td>
<td>S (L₃) + T₂ (L₂)</td>
</tr>
<tr>
<td>8</td>
<td>R + L₃ (size 28 - 56)</td>
<td>S (L₃) + T₂</td>
</tr>
<tr>
<td></td>
<td>R₁+L₃ (size 71-250)</td>
<td></td>
</tr>
</tbody>
</table>
General Notes

- The A4VG pump is designed to be used in closed circuits.
- Project planning, assembly and commissioning of the pump require the involvement of qualified personnel.
- The service line ports and function ports are only designed to accommodate hydraulic lines.
- During and shortly after operation, there is a risk of burns on the pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing.
- There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).
- Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
  - Manufacturer’s instruction for the max. permissible tightening torques of the used fittings must be observed!
  - For DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.
- The data and information contained herein must be adhered to.