Axial Piston
Variable Displacement Motor AA6VM (A6VM)

Open and closed circuits

Sizes 28 to 1000
Series 6
Sizes 28 to 200 Nominal pressure 5800 psi (400 bar)
Maximum pressure 6500 psi (450 bar)
Sizes 250 to 1000 Nominal pressure 5100 psi (350 bar)
Maximum pressure 5800 psi (400 bar)

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Features
- Variable displacement axial piston motor of bent axis design for hydrostatic transmissions in open and closed circuits
- For use in mobile and stationary applications
- The wide control range enables the variable displacement motor to satisfy the requirement for high rotational speed and high torque.
- The displacement is continuously variable from $V_{g\ max}$ to $V_{g\ min} = 0$.
- The output speed depends on the flow capacity of the pumps and the displacement of the motor.
- The torque increases with the pressure differential between the high and low pressure side and with increasing displacement.
- Wide control range with hydrostatic transmissions
- Wide selection of regulating and control devices
- Cost savings as no need for shiftable gearboxes and possibility to use smaller pumps
- Rugged, compact bearing system with long service life
- High power density
- Favorable start-up efficiency
- Low moment of inertia
- Large swivel range
Ordering Code / Standard Program

Pressure fluid
- Petroleum oil (no character), HFD for sizes 250-1000 only in combination with long-life bearing “L”
- HFB, HFC pressure fluid
  - Sizes 28 to 200 (no character)
  - Sizes 250 to 1000 (only in combination with long-life bearing “L”)  

Axial piston unit
- Bent-axis type, variable
  - Version SAE
    - 28 55 80 107 140 160 200 250 355 500 1000
  - Version ISO
    - 28 55 80 107 140 160 200 250 355 500 1000
- Sizes 28 to 200 (no character)
- Sizes 250 to 1000 (only in combination with long-life bearing “L”)

Drive shaft bearing
- Standard bearing (no character)
- Long-life bearing

Operation mode
- Motor (A6VE plug-in motor, see RE 91606)

Size
- Displacement $V_{g\text{ max}}$ in $^3/\text{rev}$

Control device
- Hydraulic control, pilot pressure dependent
  - $\Delta p = 145$ psi (10 bar) HD1
  - $\Delta p = 365$ psi (25 bar) HD2
  - $\Delta p = 508$ psi (35 bar) HD3
- Hydraulic two-point control
  - $\Delta p = 1450$ psi (100 bar) HA1
- Electronic control, with proportional solenoid (sizes 28 to 200)
  - 12 V EP1
  - 24 V EP2
- Electronic two-point control, with solenoid
  - 12 V EZ1
  - 24 V EZ2
  - 12 V EZ3
  - 24 V EZ4
- Automatic control, without pressure rise
  - HA1
  - High-pressure dependent with pressure rise $\Delta p = 1450$ psi (100 bar) HA2
- Hydraulic control, speed dependent
  - $p_{\text{St}}/p_{\text{HD}} = 3/100$, hydraulic travel direction valve DA
  - $p_{\text{St}}/p_{\text{HD}} = 5/100$, hydraulic travel direction valve DA1
  - Electrical travel direction valve 12 V DA2
  - 24 V DA3
  - 12 V DA4
  - 24 V DA5
  - 24 V DA6
- Pressure control (for HD, EP only)
  - without pressure control (no character)
  - Pressure control direct
    - 12 V DA2
    - 24 V DA3
  - Pressure control direct, with 2nd pressure setting
    - 12 V DA2
    - 24 V DA3
  - Pressure control direct, remotely controlled
    - 12 V DA2
    - 24 V DA3
- Overriding HA control (for HA1, HA2 only)
  - without override (no character)
  - Hydraulic override
    - 12 V T
    - 24 V
  - Electrical override
    - 12 V
    - 24 V
  - Electrical travel direction valve
    - 24 V

Series
- Series 6, Index 3

Direction of rotation
- when viewing shaft end, alternating

Setting range for displacement
- $V_{g\text{ min}} = 0$ to $0.8 \cdot V_{g\text{ max}}$ (no character)
- $V_{g\text{ min}} = 0$ to $0.4 \cdot V_{g\text{ max}}$
- $V_{g\text{ min}} > 0.4 \cdot V_{g\text{ max}}$

1) ISO-Version see RE 91604
2) with proportional valve (sizes 250 to 1000)
3) supplied as standard with D version (sizes 250 to 1000)

Please specify precise values for $V_{g\text{ min}}$ and $V_{g\text{ max}}$ in plain text when placing your order: $V_{g\text{ min}} = ...$ cm$^3$, $V_{g\text{ max}} = ...$ cm$^3$
### Pressure fluid
- Axial piston unit
- Transmission shaft bearing
- Operation mode
- Size
- Control device
- Series/Index
- Direction of rotation
- Setting range for displacement

### Seals
- FKM (fluor-caoutchouc)

### Shaft end
| SAE-Version (AA6VM) SAE-splined shaft | - ● ● ● - ● ● ● - - - - S |
| ISO-Version (A6VM) Splined shaft DIN 5480 | ● - - - ● - - - - ● ● ● Z |
| Cylindrical shaft with key DIN 6885 | - - - - - - - ● ● P |

### Mounting flange
| SAE-Version SAJ744 – 2-bolt | - - ● - - - - - - C |
| ISO-Version ISO 3019-2 – 4-bolt | ● - - - ● - - - - - - D |

### Service line connections
| SAE-Version Ports A, B: SAE rear (UN threads) | 51 0 - ● ● ● - ● ● ● - - - - 510 |
| Ports A, B: SAE side, opposite (UN threads) | 52 0 - ● ● ● - ● ● ● - - - - 520 |
| Port plate with pressure relief valve, for fitting a counterbalance valve 1) | 37 0 - - - ● - - - - - - - - 370 |
| ISO-Version Ports A, B: SAE rear (metric threads) | 01 0 ● - - - ● - - - - ● ● ● 010 |
| Ports A, B: SAE side, opposite (metric threads) | 02 0 ● - - - ● - - - - ● ● ● 020 |
| Ports A, B: SAE side, opposite + rear | 15 0 - - - - - - - ● ● ● 150 |

### Valves
- no valves
- with flushing and boost pressure valve
- prepared for speed measurement (ID)
- prepared for speed measurement (HDD)
- with optical swivel angle indicator
- with electrical swivel angle indicator

### Connectors for solenoids
- DEUTSCH DT04-2P-EZ04 injection molded, without bidirectional quenching diode
- Hirschmann according to DIN EN 175 301-803-A, without bidirectional quenching diode 3)

### Start of control
- at Vg min (standard for HA)
- at Vg max (standard for HD, HZ, EP, EZ, DA)

1) only possible in combination with HD, EP, HA control
2) for sizes 250 to 1000, the DIN connector is a Hirschmann one as standard (no character)
3) under development for size 28
4) not for new projects (sizes 28 to 200)

▲ ● = available ○ = under development = = not available
Technical Data

Pressure fluid

Before starting project planning, please refer to our data sheets RA 90220 (mineral oil), RA 90221 (environmentally-friendly pressure fluids) and RA 90223 (HF pressure fluids) for detailed information regarding the choice of pressure fluids and conditions of use.

The AA6VM variable displacement motor is not suitable for use with HFA. If HFB, HFC and HFD or environmentally-friendly pressure fluids are being used, the constraints regarding technical data and seals mentioned in RA 90221 and RA 90223 must be observed.

If necessary, please contact us to discuss the type of pressure fluid you intend to use.

Viscosity range

We recommend that a viscosity (at operating temperature) for optimum efficiency and service life purposes of

\[ \nu_{\text{opt}} = \text{optimum viscosity 80...170 SUS (16 to 36 mm}^2/\text{s}) \]

be chosen, taken the circulation temperature (closed circuit) and reservoir temperature (open circuit) into account.

Limits of viscosity range

The following values apply in extreme cases:

Sizes 28 to 200:

\[ \nu_{\text{min}} = 42 \text{ SUS (5 mm}^2/\text{s}) \]

short-term (t < 3 min) at max. permitted temperature of

\[ t_{\text{max}} = +240^\circ \text{F (+115}^\circ \text{C}) \]

\[ \nu_{\text{max}} = 7400 \text{ SUS (1600 mm}^2/\text{s}) \]

short-term (t < 3 min) at cold start (p < 435 psi / 30 bar, \( n \leq 1000 \text{ rpm, } t_{\text{min}} = -40^\circ \text{F / -40}^\circ \text{C} \)).

Sizes 250 to 1000:

\[ \nu_{\text{min}} = 60 \text{ SUS (10 mm}^2/\text{s}) \]

short-term (t < 3 min) at max. permitted leakage-oil temperature of

\[ t_{\text{max}} = +195^\circ \text{F (+90}^\circ \text{C}) \]

\[ \nu_{\text{max}} = 4600 \text{ SUS (1000 mm}^2/\text{s}) \]

short-term (t < 3 min) at cold start (p < 435 psi / 30 bar, \( n \leq 1000 \text{ rpm, } t_{\text{min}} = -13^\circ \text{F / -25}^\circ \text{C} \)).

Note that the maximum pressure fluid temperature must not be exceeded locally either (e.g. during storage).

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

See RE 90300-03-B for detailed information about use at low temperatures.
Technical Data

Filtering
The finer the filtering, the cleaner the fluid and the greater the service life of the axial piston unit.

To ensure proper function of the axial piston unit, the pressure fluid must have a cleanliness level of at least 20/18/15 according to ISO 4406.

At very high pressure fluid temperatures (195°F to max. 240°F / 90°C to max. 115°C, not permitted for sizes 250 to 1000), a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

Please contact us if these cleanliness levels cannot be achieved.

Temperature range of shaft seal
The FKM shaft seal is suitable for case temperatures of -13°F to 240°F (-25°C to +115°C) for sizes 28 to 200 and -13°F to 195°F (-25°C to +90°C) for sizes 250 to 1000.

Note:
A NBR shaft seal is necessary at temperatures below -13°F / -25°C (permitted temperature range: -40°F to 195°F / -40°C to +90°C). Please contact us.

Operational pressure range
Maximum pressure on port A or B (pressure data to DIN 24312)

for sizes 28 to 200
Nominal pressure \( p_{\text{Nh}} \) 5800 psi (400 bar)*
Maximum pressure \( p_{\text{max}} \) 6525 psi (450 bar)*
Total pressure (pressure A + pressure B) \( p_{\text{max}} \) 10150 psi (700 bar)
*) Size 80: \( p_{\text{Nh}} \) = 5100 psi (350 bar), \( p_{\text{max}} \) = 5800 psi (400 bar)

for sizes 250 to 1000
Nominal pressure \( p_{\text{Nh}} \) 5100 psi (350 bar)
Maximum pressure \( p_{\text{max}} \) 5800 psi (400 bar)
Total pressure (pressure A + pressure B) \( p_{\text{max}} \) 10150 psi (700 bar)

Please note:
Sizes 28 to 200: At the shaft end S or Z, a nominal pressure of \( p_{\text{Nh}} \) = 4570 psi (315 bar) is permitted for the driven shaft end that is subjected to transverse bending (pinions, V-belts)!
Size 80: \( p_{\text{Nh}} \) = 2900 psi (200 bar). Please contact us.
Sizes 250 to 1000: Please contact us.

In cases of pulsating loading above 4570 psi (315 bar), we recommend the version with splined shaft.

Direction of flow
Clockwise direction of rotation  |  Counterclockwise direction of rotation
A to B  |  B to A

Speed range
No limit to minimum speed \( n_{\text{min}} \). If uniform motion is required, \( n_{\text{min}} \) must not be less than 50 rpm. See table on page 6 for maximum speed.

Long-Life bearing (sizes 250 to 1000)
For long service life and use with HF pressure fluids. Same external dimensions as motor with standard bearing. A long-life bearing can be retrofitted.
Flushing of bearing and case via port U recommended.
Flow (recommended)

<table>
<thead>
<tr>
<th>Size</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>q_{v} flow (gpm)</td>
<td>2.6</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>L/min</td>
<td>10</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

Case drain pressure
The service life of the sealing ring is affected by the speed of the motor and the case drain pressure. The permitted loading with intermittent case drain pressure depends on the rotational speed (see chart). Short-term (t < 5 s) pressure spikes of up to 90 psi (6 bar) absolute are permitted.
The average permanent case drain pressure must not exceed 45 psi (3 bar) absolute.
The pressure in the case must be equal to or greater than the external pressure on the shaft seal. The pure mechanical resistance to case pressure is approximately 290 psi (20 bar).

Sizes 28 to 200
\[ q_{v} = \text{gpm} \]

Sizes 250 to 1000
\[ q_{v} = \text{gpm} \]

Effect of case pressure on start of control
An increase in the case pressure has an effect on the following settings when control of the variable displacement motor begins:
HA1T (sizes 28 to 200) \( \text{increase} \)
HD, EP, HA, HA.T (sizes 250 to 1000): \( \text{increase} \)
DA : \( \text{reduction} \)

The start of control is set in the factory at a case pressure of \( p_{\text{abs}} = 30 \text{ psi (2 bar)} \) for sizes 28 to 200 and \( p_{\text{abs}} = 15 \text{ psi (1 bar)} \) for sizes 250 to 1000.
Minimum inlet pressure on service line port A(B)

To prevent damage to the variable displacement motor, there has to be a minimum inlet pressure in the inlet area. The minimum inlet pressure depends on the speed and swivel angle (displacement) of the variable displacement motor.

Please contact us if these conditions cannot be satisfied.
## Technical Data

### Permissible transverse and axial forces on drive shaft

<table>
<thead>
<tr>
<th>Size</th>
<th>28</th>
<th>55</th>
<th>80</th>
<th>107</th>
<th>140</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse force, max 1) $F_{q \text{ max}}$</td>
<td>1280</td>
<td>2347</td>
<td>3434</td>
<td>4568</td>
<td>5147</td>
<td>270</td>
<td>337</td>
<td>427</td>
<td>584</td>
<td>584</td>
<td>584</td>
</tr>
<tr>
<td>N</td>
<td>5696</td>
<td>10440</td>
<td>13114</td>
<td>15278</td>
<td>17808</td>
<td>20320</td>
<td>22866</td>
<td>26000</td>
<td>19000</td>
<td>15000</td>
<td>12000</td>
</tr>
<tr>
<td>at distance of (from shaft collar) a</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.49</td>
<td>0.59</td>
<td>0.69</td>
<td>0.79</td>
<td>0.89</td>
<td>0.98</td>
<td>1.61</td>
<td>2.07</td>
<td>2.07</td>
<td>2.66</td>
<td>2.66</td>
<td>2.66</td>
</tr>
<tr>
<td>12.5</td>
<td>15</td>
<td>17.5</td>
<td>20</td>
<td>22.5</td>
<td>25</td>
<td>41</td>
<td>52.5</td>
<td>52.5</td>
<td>67.5</td>
<td>67.5</td>
<td>67.5</td>
</tr>
<tr>
<td>Axial force, max 3) $F_{\text{ax max}}$</td>
<td>71</td>
<td>112</td>
<td>160</td>
<td>202</td>
<td>231</td>
<td>252</td>
<td>281</td>
<td>337</td>
<td>427</td>
<td>584</td>
<td>584</td>
</tr>
<tr>
<td>N</td>
<td>315</td>
<td>500</td>
<td>710</td>
<td>900</td>
<td>1030</td>
<td>1120</td>
<td>1250</td>
<td>1500</td>
<td>1900</td>
<td>2600</td>
<td>2600</td>
</tr>
<tr>
<td>+ $F_{\text{ax max}}$</td>
<td>71</td>
<td>112</td>
<td>160</td>
<td>202</td>
<td>231</td>
<td>252</td>
<td>281</td>
<td>337</td>
<td>427</td>
<td>584</td>
<td>584</td>
</tr>
<tr>
<td>N</td>
<td>315</td>
<td>500</td>
<td>710</td>
<td>900</td>
<td>1030</td>
<td>1120</td>
<td>1250</td>
<td>1500</td>
<td>1900</td>
<td>2600</td>
<td>2600</td>
</tr>
<tr>
<td>Permissible axial force/bar operating pressure</td>
<td>± $F_{\text{ax perm./bar}}$</td>
<td>lbf/psi</td>
<td>0.07</td>
<td>0.12</td>
<td>0.15</td>
<td>0.18</td>
<td>0.21</td>
<td>0.23</td>
<td>0.26</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>± $F_{\text{ax perm./psi}}$</td>
<td>N/bar</td>
<td>4.6</td>
<td>7.5</td>
<td>9.6</td>
<td>11.3</td>
<td>13.3</td>
<td>15.1</td>
<td>17.0</td>
<td>24.0</td>
<td>40.0</td>
<td>60.0</td>
</tr>
</tbody>
</table>

1) During intermittent operation (sizes 28 to 200).
2) When stopped or when axial piston unit working in pressureless conditions. Higher forces are permitted when under pressure. Please contact us.
3) Max. permissible axial force when stopped or when axial piston unit working in pressureless conditions.
4) Please contact us.

When considering the permissible axial force, the force-transfer direction must be taken into account.

- $-F_{\text{ax max}}$ = increase in service life of bearings
- $+F_{\text{ax max}}$ = reduction in service life of bearings (avoid if at all possible)

### Determining the size

\[
\text{Flow} \quad q_V = \frac{V_g \cdot n}{231 \cdot \eta_v} \quad \text{gpm} \quad \left( q_v = \frac{V_g \cdot n}{1000 \cdot \eta_v} \quad \text{L/min} \right)
\]

\[
\text{Output speed} \quad n = \frac{q_V \cdot 231 \cdot \eta_v}{V_g} \quad \text{rpm} \quad \left( n = \frac{q_v \cdot 1000 \cdot \eta_v}{V_g} \quad \text{rpm} \right)
\]

\[
\text{Output torque} \quad T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{24 \cdot \pi} \quad \text{lb-ft} \quad \left( T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi} \quad \text{Nm} \right)
\]

\[
\text{Output power} \quad P = \frac{2\pi \cdot T \cdot n}{33000} = \frac{q_v \cdot \Delta p \cdot \eta_l}{1714} \quad \text{HP} \quad \left( P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_l}{600} \quad \text{kW} \right)
\]

$V_g$ = Displacement per revolution in in³ (cm³)

$\Delta p$ = Differential pressure in psi (bar)

$\eta_v$ = Volumetric efficiency

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

$\eta_l$ = Overall efficiency

**Effect of transverse force $F_q$ on the service life of the bearings**

By selecting a suitable force-transfer direction of $F_q$, the stress on the bearing caused by the internal transmission forces can be reduced, thus achieving the optimum service life for the bearing.

Recommended position of mating gear depending on direction of rotation. Examples:

- **Toothed gear output**
  - **Counter-clockwise direction of rotation**
    - Pressure on port B
    - $\phi_{opt} = 45^\circ$
  - **Clockwise direction of rotation**
    - Pressure on port A
    - $\phi_{opt} = 70^\circ$

- **V-belt output**
  - **Counter-clockwise direction of rotation**
    - Pressure on port A
    - $\phi_{opt} = 70^\circ$
  - **Clockwise direction of rotation**
    - Pressure on port B
    - $\phi_{opt} = 45^\circ$
The pilot pressure dependent hydraulic system permits continuous control of the displacement according to the pilot pressure present on port X.

**Normal version:**
- start of control at $V_g\text{ max}$ (max. torque, min. speed)
- end of control at $V_g\text{ min}$ (min. torque, max. permitted speed)

**Please note:**
- Maximum permitted pilot pressure: 1450 psi (100 bar)
- The required control oil is taken from the high pressure. Therefore, a $\Delta p$ of at least 218 psi (15 bar) on the supply pressure is needed. If the $\Delta p$ on the supply pressure is < 218 psi (15 bar) (e.g. when idle), an auxiliary pressure of at least 218 psi (15 bar) above the supply pressure must be applied on port G via an external check valve (valid for size 28...200, for size 250...1000 see page 11).
- Please state the required start of control in plain text when placing your order, e.g.: start of control at 145 psi (10 bar)

The following only applies to sizes 250 to 1000:
- The start of control and the HD characteristic are influenced by the pressure in the case. A rise in pressure in the case causes an increase in the start of control and a corresponding parallel movement of the performance curve (see page 5).
- Fluid will escape from port X at the rate of 0.08 gpm (0.3 l/min) due to internal leakage (operating pressure > pilot pressure). The actuation must be designed appropriately to ensure correct control pressure.

**HD1: pilot pressure rise $\Delta p_s = 145$ psi (10 bar)**

A rise in pilot pressure of 145 psi (10 bar) on port X causes a reduction in the displacement from $V_g\text{ max}$ to 0 cm³ (sizes 28 to 200) or from $V_g\text{ max}$ to 0.2 $V_g\text{ max}$ (sizes 250 to 1000).

Start of control (setting range) _____ 30 – 290 psi (2 – 20 bar)

Default setting: start of control at 45 psi (3 bar)
end of control at 190 psi (13 bar)

**HD2: pilot pressure rise $\Delta p_s = 365$ psi (25 bar)**

A rise in pilot pressure of 365 psi (25 bar) on port X causes a reduction in the displacement from $V_g\text{ max}$ to 0 cm³ (sizes 28 to 200) or from $V_g\text{ max}$ to 0.2 $V_g\text{ max}$ (sizes 250 to 1000).

Start of control, setting range _____ 75 – 725 psi (5 – 50 bar)

Default setting: start of control at 145 psi (10 bar)
end of control at 510 psi (35 bar)

**HD3: pilot pressure rise $\Delta p_s = 508$ psi (35 bar)**

A rise in pilot pressure of 508 psi (35 bar) on port X causes a reduction in the displacement from $V_g\text{ max}$ auf 0 cm³ (sizes 28 to 200) or from $V_g\text{ max}$ to 0.2 $V_g\text{ max}$ (sizes 250 to 1000).

Start of control, setting range _____ 102 – 725 psi (7 – 50 bar)

Default setting: start of control at 145 psi (10 bar)
end of control at 653 psi (45 bar)
HD - Hydraulic Control, Pilot Pressure Dependent

**HD1, HD2, HD3:**
Hydraulic control, pilot pressure dependent

*Sizes 28 to 200*

**HD.D:** pressure control, direct

The pressure control overlays the HD function. If the load moment or a reduction in the swivel angle of the motor causes the system pressure to rise, the motor will start to swivel to a greater angle when the pressure reaches the value set on the pressure control.

The increase in the displacement and the resulting reduction in pressure cause the controller deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range on pressure control valve:

*Sizes 28 to 200* | 1160 – 5800 psi (80 – 400 bar)
*Sizes 250 to 1000* | 1160 – 5100 psi (80 – 350 bar)

*Sizes 28 to 200*

*Sizes 250 to 1000*
HD - Hydraulic Control, Pilot Pressure Dependent

**HD.E: pressure control, direct with 2nd pressure setting**

**Sizes 28 to 200**

Connecting an external pilot pressure to port G2 allows the pressure regulator setting to be overridden and a second pressure setting to be used.

Required pilot pressure on port G2:

Sizes 28 to 200 ________ $p_{st} = 290 – 725$ psi ($20 – 50$ bar)

Please specify the 2nd pressure setting in plain text when placing your order.

**Sizes 250 to 1000 (HD.D)**

Pressure control with 2nd pressure setting provided as standard with HD.D (see page 9).

Connecting an external pilot pressure to port G2 allows the pressure regulator setting to be overridden and a second pressure setting to be used.

Required pilot pressure on port G2:

Sizes 250 to 1000 ________ $p_{st} \geq 1450$ psi ($100$ bar)

Please specify the 2nd pressure setting in plain text when placing your order.

**HD.G: pressure control, remote**

**Sizes 250 to 1000**

When the specified pressure is reached, the remote pressure control regulates the motor continuously up to the maximum displacement $V_{g_{max}}$. A pressure relief valve (not in the scope of supply) controls the internal discharge stop valve. The pressure relief valve is separate from the motor and is connected to X3. If the pressure setpoint value is not reached, the valve is subjected to even pressure from both sides, in addition to the spring force, and remains closed. The pressure setpoint lies between 1160 and 5100 psi ($80$ and $350$ bar). When this pressure is obtained on the separate pressure relief valve, the pressure relief valve opens and the pressure on the reservoir side of the spring reduces. The internal control valve switches and the motor swivels to maximum displacement $V_{g_{max}}$.

The default value for the differential pressure on the control valve is 365 psi ($25$ bar). We recommend the following external pressure relief valve:

DBD 6 (hydraulic) to RE 25402

The max. line length must not exceed 6 ft ($2$ m).

**Sizes 28 to 200**

[Diagram of HD.E control system]

**Sizes 250 to 1000**

[Diagram of HD.G control system]
HZ - Hydraulic Two-Point Control

Hydraulic two-point control allows the displacement to be set to $V_{g_{\text{min}}}$ or $V_{g_{\text{max}}}$ by switching the pilot pressure on port X on or off.

- No pilot pressure $\Rightarrow$ position at $V_{g_{\text{max}}}$
- Pilot pressure switched $> 145$ psi (10 bar) $\Rightarrow$ position at $V_{g_{\text{max}}}$

Normal version:
- Start of control at $V_{g_{\text{max}}}$ (max. torque, min. speed)
- End of control at $V_{g_{\text{min}}}$ (min. torque, max. permitted speed)

Please note:
- Maximum permitted pilot pressure: 1450 psi (100 bar)
- Size 28...200:
  The required control oil is taken from the high pressure. Therefore, a $\Delta p$ of at least 218 psi (15 bar) on the supply pressure is needed. If the $\Delta p$ on the supply pressure is $< 218$ psi (15 bar) (e.g. when idle), an auxiliary pressure of at least 218 psi (15 bar) above the supply pressure must be applied on port G via an external check valve.
- Size 250...1000:
  The required control oil is taken from the high pressure side. For this a minimum operating pressure of 218 psi (15 bar) is needed. If the operating pressure is $< 218$ psi (15 bar), an auxiliary pressure of at least 218 psi (15 bar) must be applied on port G via an external check valve.

The following only applies to sizes 250 to 1000:
- Fluid will escape from port X at the rate of 0.08 gpm (0.3 l/min) due to internal leakage (operating pressure $>\Delta p$).
  The actuation must be designed appropriately to ensure correct control pressure.
EP - Electrical Control With Proportional Solenoid

Electrical control using a proportional solenoid (sizes 28 to 200) or proportional valve (sizes 250 to 1000) permits continuous control of the displacement according to an electrical signal. The control is proportional to the applied electrical control current. In the case of sizes 250 to 1000, an external pressure of \( p_{min} = 435 \text{ psi} \) (30 bar) is necessary for the control oil supply to port P (\( p_{max} = 1450 \text{ psi} \) (100 bar)).

Normal version:
- start of control at \( V_g \max \) (max. torque, min. speed)
- end of control at \( V_g \min \) (min. torque, max. permitted speed)

The rate of control or limiting of the displacement (limiting the swiveling range) can be achieved electrically using the following control units:
- RC control unit (see RE 95200)
- PV proportional amplifier (see RE 95023)
- VT 2000 electrical amplifier, series 5X (see RE 29904) (for industrial application)

Please note:
- The required control oil is taken from the high pressure, so a \( \Delta p \) of at least 218 psi (15 bar) on the supply pressure is needed. If the \( \Delta p \) on the supply pressure is < 218 psi (15 bar) (when idle), an auxiliary pressure of at least 218 psi (15 bar) above the supply pressure must be applied on port G via an external check valve (valid for size 28...200, for size 250...1000 see page 11).
- The start of control and the EP characteristic are influenced by the pressure in the case. A rise in pressure in the case causes an increase in the start of control and a corresponding parallel movement of the performance curve (sizes 250 to 1000, see page 5).

### Technical data, solenoid in EP1, EP2

<table>
<thead>
<tr>
<th></th>
<th>EP1</th>
<th>EP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (±20 %)</td>
<td>24 V (±20 %)</td>
</tr>
<tr>
<td>Control current sizes 28 to 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control starts at ( V_g \max )</td>
<td>400 mA</td>
<td>200 mA</td>
</tr>
<tr>
<td>Control ends at ( V_g \min )</td>
<td>1200 mA</td>
<td>600 mA</td>
</tr>
<tr>
<td>Control current sizes 250 to 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control starts at ( V_g \max )</td>
<td>900 mA</td>
<td>450 mA</td>
</tr>
<tr>
<td>Control ends at ( V_g \min )</td>
<td>1400 mA</td>
<td>700 mA</td>
</tr>
<tr>
<td>Maximum current</td>
<td>1,54 A</td>
<td>0,77 A</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>5,5 Ω</td>
<td>22,7 Ω</td>
</tr>
<tr>
<td>Dither frequency</td>
<td>100 Hz</td>
<td>100 Hz</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>

### EP1, EP2: Electrical control with proportional solenoid

Sizes 28 to 200

### EP1, EP2: Electrical control with proportional valve

Sizes 250 to 1000

Proportional pressure reduction valve DRE 4K (see RE 29181)
**EP - Electrical Control With Proportional Solenoid**

**EP.D: Electrical control with pressure control, direct**

The pressure control overlays the EP function. If the load moment or a reduction in the swivel angle of the motor causes the system pressure to rise, the motor will start to swivel to a greater angle when the pressure reaches the value set on the pressure control.

The increase in the displacement and the resulting reduction in pressure cause the controller deviation to decrease. With the increase in displacement the motor develops more torque, while the pressure remains constant.

Setting range on pressure-control valve:
- Sizes 28 to 200: 1160 – 5800 psi (80 – 400 bar)
- Sizes 250 to 1000: 1160 – 5100 psi (80 – 350 bar)

---

**EP.E: pressure control, direct with 2nd pressure setting**

**Sizes 28 to 200**

Connecting an external pilot pressure to port G2 allows the pressure regulator setting to be overridden and a second pressure setting to be used.

Required pilot pressure on port G2:
- Sizes 28 to 200: $p_{St} = 290 – 725$ psi (20 – 50 bar)

Please specify the 2nd pressure setting in plain text when placing your order.

---

**Sizes 250 to 1000 (EP.D)**

Pressure control with 2nd pressure setting provided as standard with EP.D (see circuit diagram).

Connecting an external pilot pressure to port G2 allows the pressure regulator setting to be overridden and a second pressure setting to be used.

Required pilot pressure on port G2:
- Sizes 250 to 1000: $p_{St} \geq 1450$ psi (100 bar)

Please specify the 2nd pressure setting in plain text when placing your order.
EP - Electrical Control With Proportional Solenoid

EP.G: Electrical control with pressure control, remote

Sizes 250 to 1000

When the specified pressure is reached, the remote pressure control regulates the motor continuously up to the maximum displacement $V_{g\ max}$. A pressure relief valve (not in the scope of supply) controls the internal discharge stop valve. The pressure relief valve is separate from the motor and is connected to X3.

If the specified pressure value is not reached, the valve is subjected to even pressure from both sides, in addition to the spring force, and remains closed. The pressure setpoint lies between 1160 and 5100 psi (80 and 350 bar). When this pressure is reached on the separate pressure relief valve, the limiter opens and the pressure on the reservoir side of the spring reduces. The internal control valve switches and the motor swivels to maximum displacement $V_{g\ max}$. The default value for the differential pressure on the control valve is 365 psi (25 bar). We recommend the following external pressure relief valve:

DBD 6 (hydraulic) to RE 25402

The max. line length must not exceed 6 ft (2 m).

Sizes 250 to 1000

[Diagram of the electrical control system with labels and connections]
Electrical two-point control with a solenoid allows the displacement to be set to $V_g_{\text{min}}$ or $V_g_{\text{max}}$ by switching the electrical current to the solenoids on or off.

Please note:

- **Size 28...200:**
  The required control oil is taken from the high pressure. Therefore, a $\Delta p$ of at least 218 psi (15 bar) on the supply pressure is needed. If the $\Delta p$ on the supply pressure is $< 218$ psi (15 bar) (e.g. when idle), an auxiliary pressure of at least 218 psi (15 bar) above the supply pressure must be applied on port G via an external check valve.

- **Size 250...1000:**
  The required control oil is taken from the high pressure side. For this a minimum operating pressure of 218 psi (15 bar) is needed. If the operating pressure is $< 218$ psi (15 bar), an auxiliary pressure of at least 218 psi (15 bar) must be applied on port G via an external check valve.

### Technical data, solenoid in EZ1, EZ2

<table>
<thead>
<tr>
<th></th>
<th>EZ1 (12 V ± 20 %)</th>
<th>EZ2 (24 V ± 20 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Neutral position $V_g_{\text{max}}$</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>$V_g_{\text{min}}$ position</td>
<td>Current on</td>
<td>Current on</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>5.5 Ω</td>
<td>21.7 Ω</td>
</tr>
<tr>
<td>Nominal output</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Active current, minimum required</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>

### Technical data, solenoid in EZ3, EZ4

<table>
<thead>
<tr>
<th></th>
<th>EZ3 (12 V ± 20 %)</th>
<th>EZ4 (24 V ± 20 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Neutral position $V_g_{\text{max}}$</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>$V_g_{\text{min}}$ position</td>
<td>Current on</td>
<td>Current on</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal output</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Active current, minimum required</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>
HA - Automatic Control, High-Pressure Dependent

In the case of automatic high-pressure dependent control, the displacement is set automatically according to the operating pressure.

The control unit measures the internal operating pressure at A or B (no control line required) and, when the pressure reaches the setpoint value of \( V_g \) min set on the controller, swivels with increasing operating pressure to \( V_g \) max.

Normal version HA1, HA2:
- Start of control at \( V_g \) max (min. torque, max. speed)
- End of control at \( V_g \) max (max. torque, min. speed)

**Please note:**
- For safety reasons, winch drives are not permitted with start of control at \( V_g \) min (default with HA).

**HA1: approximate with no pressure rise**

A rise in operating pressure of \( \Delta p \leq 145 \) psi (10 bar) causes an increase in the displacement from 0 cm³ to \( V_g \) max (sizes 28 to 200) or from 0.2 \( V_g \) max to \( V_g \) max (sizes 250 to 1000).

**Start of control, setting range**

Sizes 28 to 200 _______ 1160 – 5100 psi (80 – 350 bar)
Sizes 250 to 1000 _______ 1160 – 4930 psi (80 – 340 bar)

Please state the required start of control in plain text when placing your order, e.g.: start of control at 4350 psi (300 bar)

- The required control oil is taken from the high pressure, so a \( \Delta p \) of at least 218 psi (15 bar) on the supply pressure is needed. If the \( \Delta p \) on the supply pressure is < 218 psi (15 bar) (when idle), an auxiliary pressure of at least 218 psi (15 bar) above the supply pressure must be applied on port G via an external check valve (valid for size 28...200, for size 250...1000 see page 11).

- The start of control and the HA characteristic are influenced by the pressure in the case. A rise in pressure in the case causes an increase in the start of control and a corresponding parallel movement of the performance curve. Only with HA1, HA2, HAT (sizes 250 to 1000) and HA1T (sizes 28 to 200), see page 5.

- Fluid will escape from port X at the rate of 0.08 gpm (0.3 l/min) due to internal leakage (operating pressure > pilot pressure). The actuation must be designed appropriately to ensure correct control pressure.

Only with HAT control.
HA - Automatic Control, High-Pressure Dependent

**HA2: pressure rise** $\Delta p = 1450$ psi (100 bar)

A rise in operating pressure of $\Delta p = 1450$ psi (100 bar) causes an increase in the displacement from 0 cm$^3$ to $V_{g \text{ max}}$ (sizes 28 to 200) or from 0.2 $V_{g \text{ max}}$ to $V_{g \text{ max}}$ (sizes 250 to 1000).

Start of control, setting range

Sizes 28 to 200 ________ 1160 – 5100 psi (80 – 350 bar)
Sizes 250 to 1000 _______ 1160 – 3600 psi (80 – 250 bar)

Please state the required start of control in plain text when placing your order, e.g.: start of control at 2900 psi (200 bar)
HA - Automatic Control, High-Pressure Dependent (override)

**HA.T: Hydraulic override of pressure setpoint**

In the case of HA control, the start of control can be influenced by applying a pilot pressure to port X.

For each 14.5 psi (1 bar) of pilot pressure, the start of control is reduced by 247 psi (17 bar) for sizes 28 to 200 or 116 psi (8 bar) for sizes 250 to 1000.

Examples (sizes 28 to 200):

- **Start of control setting**
  - 4350 psi (300 bar)
- **Pilot pressure on port X**
  - 0 psi (0 bar)
- **gives start of control at**
  - 4350 psi (300 bar)

If the override is only intended to set the max. displacement (motor swivels to $V_{g\text{ max}}$), a maximum pilot pressure of 1450 psi (100 bar) is permitted.

**Sizes 28 to 200**

---

**HA.U1, U2: Electrical override of pressure setpoint**

With the HA control, high-pressure dependent control can be overridden by an electrical signal on a solenoid. In the case of an override, the variable displacement motor swivels to the maximum swivel angle.

The start of control can be set to between 1160 and 4350 psi (80 and 300 bar) (specify value in plain text when placing your order).

**Technical data solenoid b (electrical override)**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>U1 (±20 %)</th>
<th>U2 (±20 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Position at $V_{g\text{ max}}$</td>
<td>Current on</td>
<td>Current on</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal output</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Active current, minimum required</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>

**Sizes 250 to 1000**

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**HA1U1, HA1U2: Sizes 28 to 200**

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**HA2U1, HA2U2: Sizes 28 to 200**
HA - Automatic Control, High-Pressure Dependent (override)

HA.R1, R2: Electrical override of pressure setpoint using electrical travel direction valve

With the HA control, high-pressure dependent control can be overridden by an electrical signal on solenoid b. In the case of an override, the variable displacement motor swivels to the maximum swivel angle.

The travel direction valve ensures that the preselected pressure outlet of the hydraulic motor always controls the swivel angle, even if the high pressure side changes (e.g. during a descent). This therefore prevents an undesirable swiveling of the variable displacement motor to a greater displacement.

Depending on the direction of rotation (direction of travel), the travel direction valve (see page 21) can be actuated through the compression spring or solenoid a.

### Technical data, solenoid a (travel direction valve)

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (± 20 %)</td>
<td>24 V (± 20 %)</td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Solenoid a</td>
<td></td>
</tr>
<tr>
<td>counter-clockwise B</td>
<td>actuated</td>
<td>de-energized</td>
</tr>
<tr>
<td>clockwise   A</td>
<td>de-energized</td>
<td>de-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 output</td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td>Active current, minimum required</td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>

### Technical data, solenoid b (electrical override)

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>12 V (± 20 %)</td>
<td>24 V (± 20 %)</td>
</tr>
<tr>
<td>No override</td>
<td>de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>Position at $V_g$ max</td>
<td>Current on</td>
<td>Current on</td>
</tr>
<tr>
<td>Nominal resistance (at 20°C)</td>
<td>4.8 Ω</td>
<td>19.2 Ω</td>
</tr>
<tr>
<td>Nominal output</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Active current, minimum required</td>
<td>1.5 A</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Operating time</td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>
DA - Hydraulic Control, Speed Dependent

The AA6VM (A6VM) variable displacement motor with speed-dependent hydraulic control is best used for hydrostatic transmissions in combination with the AA4VG variable displacement pump with DA control.

The pilot pressure derived from the driving speed of the AA4VG variable displacement pump, together with the operating pressure, regulate the swivel angle of the hydraulic motor.

Increasing driving speed, i.e. rising pilot pressure, causes the motor to swivel to a lower displacement (lower torque, higher speed), depending on the operating pressure.

If the operating pressure rises above the value set on the controller, the motor swivels to a higher displacement (higher torque, lower speed).

The design of a drive with DA control must be carried out using the technical data relating to the AA4VG variable displacement pump with DA control.

Detailed Information can be obtained from our sales departments and on the Internet at www.boschrexroth.com/da-control.

Please note:
- The start of control and the DA characteristic are influenced by the pressure in the case. A rise in pressure in the case causes a drop in the start of control and a corresponding parallel movement of the performance curve (see page 5).

DA, DA1, DA4:
Hydraulic control, speed dependent with hydraulic travel direction valve

The travel direction valve is operated according to the direction of rotation (direction of travel) using the control pressures $X_1$ or $X_2$.

<table>
<thead>
<tr>
<th>Direction of rotation</th>
<th>Operating pressure in</th>
<th>Pilot pressure in</th>
</tr>
</thead>
<tbody>
<tr>
<td>clockwise</td>
<td>A</td>
<td>$X_1$</td>
</tr>
<tr>
<td>counter-clockwise</td>
<td>B</td>
<td>$X_2$</td>
</tr>
</tbody>
</table>

Sizes 28 to 200

Sizes 250 to 1000
DA - Hydraulic Control, Speed Dependent

**DA2, DA3, DA5, DA6:**
Hydraulic control, speed dependent with electrical travel direction valve + electrical \( V_{g \text{ max}} \) switch

Depending on the direction of rotation (direction of travel), the travel direction valve can be actuated through the compression spring or solenoid a.

By connecting an electrical current to solenoid b, the controller can be overridden and the motor adjusted to max. displacement (high torque, low speed) (so called “electrical \( V_{g \text{ max}} \) switch”).

### Technical data, solenoids a and b

<table>
<thead>
<tr>
<th></th>
<th>DA2, DA5</th>
<th>DA3, DA6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
<td>12 V (± 20 %)</td>
<td>24 V (± 20 %)</td>
</tr>
<tr>
<td><strong>Direction of rotation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>counter-clockwise</td>
<td>B de-energized</td>
<td>de-energized</td>
</tr>
<tr>
<td>clockwise</td>
<td>A actuated</td>
<td>actuated</td>
</tr>
<tr>
<td><strong>Nominal resistance (at 20°C)</strong></td>
<td>5.5 Ω</td>
<td>21.7 Ω</td>
</tr>
<tr>
<td><strong>Nominal output</strong></td>
<td>26.2 W</td>
<td>26.5 W</td>
</tr>
<tr>
<td><strong>Active current, minimum required</strong></td>
<td>1.32 A</td>
<td>0.67 A</td>
</tr>
<tr>
<td><strong>Operating time</strong></td>
<td>100 %</td>
<td>100 %</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>see connector design, page 60</td>
<td></td>
</tr>
</tbody>
</table>

**Sizes 28 to 200**

### Electrical travel direction valve (for DA, HA.R)

The travel direction valve of the motor is switched using the 4/3 directional-control valve on the control unit of the driving pump. Usually, this provides trouble-free drivability of the driven machine.

However, with unfavorable operating parameters this can lead to undesired conditions (jerky, uncontrolled braking when switching the drive lever into neutral). The reason is that the travel direction valve of the motor operates as soon as the pump is in the neutral position, causing the motor controller to detect a braking pressure, which is then used to control the swivel angle.

To prevent this, the existing switching position on the travel direction valve must be retained while the pump is being put into the neutral position, i.e. an energized valve must remain energized. This can be done using the circuit shown below.

The motor should swivel more slowly than the pump.
We therefore recommend that actuation be delayed by approximately 0.8s. This prevents too long a delay when reversing lightweight units.

**DA2, DA3, DA5, DA6 control**

**HA1R.,HA2R. control (see page 19)**

Solenoid a on travel direction valve
Unit Dimensions, Size 28 (ISO Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Hydraulic two-point control HZ1
Service line ports A/B at side, opposite (02)

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Service line ports (high pressure series)</td>
<td>SAE J518, 3/4 in</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Service line ports (high pressure series)</td>
<td>SAE J518, 3/4 in</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Leakage fitting A/B</td>
<td>DIN 13</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Leakage fluid/oil drain 2)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Pilot pressure port</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure 2)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting 2)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Flow port 2)</td>
<td>DIN 3852</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>Measuring port for charge pressure 2)</td>
<td>DIN 3852</td>
<td></td>
</tr>
</tbody>
</table>

Shaft ends

A Splined shaft
DIN 5480
W30x2x30x14x9g

Z Splined shaft
DIN 5480
W25x1.25x30x18x9g

View Z
Service line ports A/B at side, opposite (02)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Unit Dimensions, Size 28 (ISO Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 28 (ISO Version)

Electrical two-point control with solenoid EZ1, EZ2

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

HA1 and HA2, X closed
HA1T and HA2T, X open

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Hydraulic control, speed dependent, elec. travel direction valve and elec. Vₘₜₙ max switch DA2, DA3, DA5, DA6

X₁, X₂ with 8B-ST threaded connection to DIN 2353-CL

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 55 (SAE Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Service line ports A/B at side, opposite (52)

Shaft ends

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

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Standard</th>
<th>Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line port (high pressure series)</td>
<td>SAE J518, ISO 68</td>
<td>3/4 in</td>
<td>10.39 (264)</td>
</tr>
<tr>
<td>T1</td>
<td>Leakage-oil port</td>
<td>ISO 11926</td>
<td>1 1/16 in -12 UN-2B</td>
<td>9.21 (234)</td>
</tr>
<tr>
<td>T2</td>
<td>Leakage fluid/oil drain (^2)</td>
<td>ISO 11926</td>
<td>1 1/16 in -12 UN-2B</td>
<td>8.15 (207)</td>
</tr>
<tr>
<td>X</td>
<td>Pilot pressure port</td>
<td>ISO 11926</td>
<td>9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>3.90 (99)</td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure (^2)</td>
<td>ISO 11926</td>
<td>9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>3.58 (91)</td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting (^2)</td>
<td>ISO 11926</td>
<td>9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>0.71 (18)</td>
</tr>
<tr>
<td>U</td>
<td>Flow port (^2)</td>
<td>ISO 11926</td>
<td>7/16 in -14 UNF-2B; 0.67 (17) deep</td>
<td>0.28 (7)</td>
</tr>
<tr>
<td>M1</td>
<td>Measuring port for charge pressure (^2)</td>
<td>ISO 11926</td>
<td>9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>0.94 (24)</td>
</tr>
</tbody>
</table>

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).

1) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5
2) plugged
3) note safety instructions, page 62
Unit Dimensions, Size 55 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Hydraulic control, pilot pressure dependent, with pressure control, direct and 2nd pressure setting HD.E

Electrical control with proportional solenoid EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

**Unit Dimensions, Size 55 (SAE Version)**

**Electrical two-point control with solenoid EZ3, EZ4**

**Automatic control, high-pressure dependent and hydraulic override HA1, HA2, and HA1T, HA2T**

**Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2**

**Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4**

**Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2**

**Hydraulic control, speed dependent, elec. travel direction valve and elec. Vₙₘₙₜ switch DA2, DA3, DA5, DA6**
Unit Dimensions, Size 80 (SAE Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Service line ports A/B at side, opposite (52)

Dimensions in inches and (millimeters).

Before finalising your design, please request a certified drawing.

Shaft ends

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

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Thread</th>
<th>Size</th>
<th>Depth</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line port (high pressure series)</td>
<td>SAE J518</td>
<td>1 in</td>
<td>7/16 in-14 UNC-2B; 0.87 (22) deep</td>
<td>see safety instructions</td>
</tr>
<tr>
<td>T1</td>
<td>Leakage-oil port</td>
<td>ISO 68</td>
<td>7/16 in-12 UN-2B; 0.79 (20) deep</td>
<td>265 lb-ft (360 Nm)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Leakage fluid/oil drain 2)</td>
<td>ISO 11926</td>
<td>1 1/16 in-12 UN-2B; 0.79 (20) deep</td>
<td>140 Nm</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Pilot pressure port</td>
<td>ISO 11926</td>
<td>9/16 in-18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure 2)</td>
<td>ISO 11926</td>
<td>9/16 in-18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting 2)</td>
<td>ISO 11926</td>
<td>9/16 in-18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Flow port 2)</td>
<td>ISO 11926</td>
<td>7/8 in-14 UNC-2B; 0.67 (17) deep</td>
<td>180 lb-ft (240 Nm)</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>Measuring port for charge pressure 2)</td>
<td>ISO 11926</td>
<td>9/16 in-18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
</tbody>
</table>

1) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5  
2) plugged  
3) note safety instructions, page 62

Tightening torque, max. 3)
Unit Dimensions, Size 80 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Hydraulic control, pilot pressure dependent, with pressure control, direct and 2nd pressure setting HD.E

Electrical control with proportional solenoid EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Unit Dimensions, Size 80 (SAE Version)

Electrical two-point control with solenoid EZ3, EZ4

Automatic control, high-pressure dependent and electric override HA1U1, HA2U2

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Hydraulic control, speed dependent, elec. travel direction valve and elec. \( V \max \) switch DA2, DA3, DA5, DA6

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Unit Dimensions, Size 107 (SAE Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Service line ports A/B at side, opposite (52)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).

Shaft ends

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

Ports

A, B Service line port (high pressure series) SAE J518, 1 in
Threaded fitting A/B ISO 68 7/16 in -14 UNC-2B; 0.87 (22) deep
T1 Leakage-oil port ISO 11926 1 1/16 in -12 UN-2B; 0.79 (20) deep
T2 Leakage fluid/oil drain 2) ISO 11926 1 1/16 in -12 UN-2B; 0.79 (20) deep
X Pilot pressure port ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep
G Port for synchronous control of several units and for remote charge pressure 2) ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep
G2 Port for 2nd pressure setting 2) ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep
U Flow port 2) ISO 11926 7/8 in -14 UNF-2B; 0.67 (17) deep
M1 Measuring port for charge pressure 2) ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep

1) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5
2) plugged
3) note safety instructions, page 62

Tightening torque, max. 3)

<table>
<thead>
<tr>
<th>Port</th>
<th>Thread</th>
<th>Diameter</th>
<th>Length</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>7/16 in -14 UNC-2B</td>
<td>0.87 (22)</td>
<td>265 lb-ft (360 Nm)</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>1 1/16 in -12 UN-2B</td>
<td>0.79 (20)</td>
<td>265 lb-ft (360 Nm)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>1 1/16 in -12 UN-2B</td>
<td>0.79 (20)</td>
<td>265 lb-ft (360 Nm)</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>9/16 in -18 UNF-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>9/16 in -18 UNF-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>9/16 in -18 UNF-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>7/8 in -14 UNF-2B</td>
<td>0.67 (17)</td>
<td>180 lb-ft (240 Nm)</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>9/16 in -18 UNF-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
</tbody>
</table>

1) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5
2) plugged
3) note safety instructions, page 62
Unit Dimensions, Size 107 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Hydraulic control, pilot pressure dependent, with pressure control, direct and 2nd pressure setting HD.E

Electrical control with proportional solenoid EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 107 (SAE Version)

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

Electrical two-point control with solenoid EZ3, EZ4

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

Automatic control, high-pressure dependent and electric override HA1U1, HA2U2

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Hydraulic control, speed dependent, elec. travel direction valve and elec. $V_{\text{g max}}$ switch DA2, DA3, DA5, DA6
Unit Dimensions, Size 140 (ISO Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Hydraulic two-point control HZ1
Service line ports A/B at side, opposite (02)

Shaft ends

Z Splined shaft
DIN 5480
W45x2x30x21x9g

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Thread</th>
<th>Diameter</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line port (high pressure series)</td>
<td>SAE J518, 1 in</td>
<td>M14x2; 0.75 (19)</td>
<td>170 lb-ft (230 Nm)</td>
</tr>
<tr>
<td>T1</td>
<td>Leakage port</td>
<td>DIN 13</td>
<td>M26x1.5; 0.63 (16)</td>
<td>170 lb-ft (230 Nm)</td>
</tr>
<tr>
<td>T2</td>
<td>Leakage fluid/oil drain ²)</td>
<td>DIN 3852</td>
<td>M26x1.5; 0.63 (16)</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>X, X1, X3</td>
<td>Pilot pressure port</td>
<td>DIN 3852</td>
<td>M14x1.5; 0.47 (12)</td>
<td>155 lb-ft (210 Nm)</td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure ²)</td>
<td>DIN 3852</td>
<td>M14x1.5; 0.47 (12)</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting ²)</td>
<td>DIN 3852</td>
<td>M14x1.5; 0.47 (12)</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>U</td>
<td>Flow port ³)</td>
<td>DIN 3852</td>
<td>M22x1.5; 0.55 (14)</td>
<td>155 lb-ft (210 Nm)</td>
</tr>
<tr>
<td>M1</td>
<td>Measuring port for charge pressure ³)</td>
<td>DIN 3852</td>
<td>M14x1.5; 0.47 (12)</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
</tbody>
</table>

²) plugged
³) note safety instructions, page 62

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 140 (ISO Version)

Hydraulic control, pilot pressure dependent, with pressure control HD.D

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

Electrical control with proportional solenoid EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, remote EP.E
Unit Dimensions, Size 140 (ISO Version)

Electrical two-point control with solenoid EZ1, EZ2

Automatic control, high-pressure dependent and electric override HA1, HA2, and hydraulic override HA1T, HA2T

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Hydraulic control, speed dependent, electric travel direction valve and elec. Vg max switch DA2, DA3, DA5, DA6

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

X1, X2 with 8B-ST threaded connection to DIN 2353-CL
Unit Dimensions, Size 160 (SAE Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Hydraulic two-point control HZ1
Service line ports A/B at side, opposite (52)

Shaft ends

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

Ports

<table>
<thead>
<tr>
<th>A, B</th>
<th>Service line port (high pressure series)</th>
<th>SAE J518, 11/4 in 1/2 in -13 UNC-2B; 0.75 (19) deep</th>
<th>see safety instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Threaded fitting A/B</td>
<td>ISO 68</td>
<td></td>
</tr>
<tr>
<td>T₁</td>
<td>Leakage-oil port</td>
<td>ISO 11926 1 1/16 in -12 UN-2B; 0.79 (20) deep</td>
<td>265 lb-ft (360 Nm)</td>
</tr>
<tr>
<td>T₂</td>
<td>Leakage fluid/oil drain (^2)</td>
<td>ISO 11926 1 1/16 in -12 UN-2B; 0.79 (20) deep</td>
<td>265 lb-ft (360 Nm)</td>
</tr>
<tr>
<td>X</td>
<td>Pilot pressure port</td>
<td>ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure (^2)</td>
<td>ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>G₂</td>
<td>Port for 2nd pressure setting (^2)</td>
<td>ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td>U</td>
<td>Flow port (^2)</td>
<td>ISO 11926 7/8 in -14 UNF-2B; 0.67 (17) deep</td>
<td>180 lb-ft (240 Nm)</td>
</tr>
<tr>
<td>M₁</td>
<td>Measuring port for charge pressure (^2)</td>
<td>ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
</tbody>
</table>

Tightening torque, max. \(^3\)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).

1) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5
2) plugged
3) note safety instructions, page 62
Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).

Unit Dimensions, Size 160 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Hydraulic control, pilot pressure dependent, with pressure control, direct and 2nd pressure setting HD.E

Electrical control with proportional solenoid EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E
Unit Dimensions, Size 160 (SAE Version)

Electrical two-point control with solenoid EZ1, EZ2

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

Automatic control, high-pressure dependent and electric override HA1U1, HA2U2

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Hydraulic control, speed dependent, elec. travel direction valve and elec. \( V_{g_{\text{max}}} \) switch DA2, DA3, DA5, DA6

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 200 (SAE Version)

Hydraulic control, pilot pressure dependent HD1, HD2
Hydraulic two-point control HZ1
Service line ports A/B at side, opposite (52)

Shaft ends

S Splined shaft
2in 15T 8/16DP ¹)
Similar to SAE J744 – 50-4 (F)
Length (2.64 in) deviates from standard (3.125 in)

Ports

A, B Service line port (high pressure series) SAE J518, 11/4 in
Threaded fitting A/B ISO 68 1/2 in -13 UNC-2B; 0.75 (19) deep
T₂ Leakage-oil port ISO 11926 1 1/16 in -12 UN-2B; 0.79 (20) deep
T₁ Leakage fluid/oil drain ²)
X Pilot pressure port ISO 11926 9/16 in -18 UNF-2B; 0.51 (13) deep
G Port for synchronous control of several units and for remote charge pressure ²)
G₂ Port for 2nd pressure setting ²)
U Flow port ³)
M₁ Measuring port for charge pressure ²)

Tightening torque, max. ³)

A, B 265 lb-ft (360 Nm)
T₁ 265 lb-ft (360 Nm)
T₂ 60 lb-ft (80 Nm)
X 60 lb-ft (80 Nm)
G 60 lb-ft (80 Nm)
G₂ 60 lb-ft (80 Nm)
U 180 lb-ft (240 Nm)
M₁ 60 lb-ft (80 Nm)

¹) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5
²) plugged
³) note safety instructions, page 62

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Unit Dimensions, Size 200 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D

Hydraulic control, pilot pressure dependent, with pressure control, direct and 2nd pressure setting HD.E

Electrical control with proportional solenoid
EP1, EP2

Electrical control (proportional solenoid) with pressure control, direct EP.D

Electrical control (proportional solenoid) with pressure control, direct and 2nd pressure setting EP.E

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 200 (SAE Version)

Electrical two-point control with solenoid EZ1, EZ2

Automatic control, high-pressure dependent HA1, HA2, and hydraulic override HA1T, HA2T

Automatic control, high-pressure dependent and electric override HA1U1, HA2U2

Automatic control, high-pressure dependent, electric override and elec. travel direction valve HA1R1, HA2R2

Hydraulic control, speed dependent and hydraulic travel direction valve DA1, DA4

Hydraulic control, speed dependent, elec. travel direction valve and elec. V_{g \text{ max}} switch DA2, DA3, DA5, DA6

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Unit Dimensions, Size 250 (SAE Version)

Hydraulic control, control-pressure dependent HD1, HD2, HD3
Hydraulic two-point control HZ
Service line ports A/B at side, opposite (52)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
# Unit Dimensions, Size 250 (SAE Version)

## Shaft ends

**S** Splined shaft  
2in 15T 8/16DP  \(^1\)  
*Similar to SAE J744 – 50-4 (F)*  
*Length (2.64 in) deviates from standard (3.125 in)*

## Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Standard</th>
<th>Thread</th>
<th>Diameter</th>
<th>Depth</th>
<th>Torque</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line port (high pressure series)</td>
<td>SAE J518,</td>
<td>1/2 in</td>
<td>-13 UNC-2B</td>
<td>0.75 (19)</td>
<td>180 lb-ft (240 Nm)</td>
<td>see safety instructions</td>
</tr>
<tr>
<td></td>
<td>Threaded fitting A/B</td>
<td>ISO 68</td>
<td>7/8 in</td>
<td>-14 UNC-2B</td>
<td>0.67 (17)</td>
<td>180 lb-ft (240 Nm)</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Leakage-oil port</td>
<td>ISO 6926</td>
<td>7/8 in</td>
<td>-14 UNC-2B</td>
<td>0.67 (17)</td>
<td>180 lb-ft (240 Nm)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Leakage fluid/oil drain (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>X, X1, X2</td>
<td>Pilot pressure port</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>Port for remote control valve</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Connection for control oil supply</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Flow port (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Measuring port for charge pressure (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M0, MB</td>
<td>Measuring port for operating pressure (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M0, MB</td>
<td>Measuring port for pilot pressure (^2)</td>
<td>ISO 6926</td>
<td>9/16 in</td>
<td>-18 UNC-2B</td>
<td>0.51 (13)</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) ANSI B92.1a-1976, pressure angle 30°, flat root side fit, tolerance class 5  
\(^2\) plugged  
\(^3\) note safety instructions, page 62
Unit Dimensions, Size 250 (SAE Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D, remote control HD.G

1.91 (48.5)  
M  
1.38 G2  
35  
1.38 X3  
35  
16.73 (425)  
14.49 (368)  
G  
X  
G  
G2 X3  
10.08 (256)  
10.71 (272)  
11.57 (294)  
HD.D with G2, without X3; HD.G with X3, without G2

Electrical control (proportional valve) with pressure control, direct EP.D, remote EP.G

4.65 (118)  
1.42 (36)  
G  
P  
G  
G2  
X  
10.08 (256)  
10.71 (272)  
11.57 (294)  
EP.D with G2, without X3; EP.G with X3, without G2

Automatic control, high-pressure dependent HA1, HA2, with hydraulic override HA1T, HA2T

16.77 (426)  
M  
M  
M  
X  
G  
X  
G  
11.42 (290)  
HA1 and HA2, X closed; HA1T and HA2T, X open

Electrical control with proportional valve EP1, EP2

5.56 (138)  
G  
P  
G  
G  
X  
9.76 (248)  
9.76 (248)  
16.73 (425)  
14.76 (375)  
10.08 (256)  
10.71 (272)  
11.57 (294)  
EP.D with G2, without X3; EP.G with X3, without G2

Electrical two-point control with solenoid EZ1, EZ2

5.06 (128.5)  
G  
P  
G  
G  
X  
9.76 (248)  
9.76 (248)  
16.73 (425)  
14.76 (375)  
10.08 (256)  
10.71 (272)  
11.57 (294)  
EP.D with G2, without X3; EP.G with X3, without G2

Hydraulic control, speed dependent DA

5.51 (140)  
G  
M  
G  
X  
16.73 (425)  
13.74 (349)  
10.08 (256)  
10.71 (272)  
11.57 (294)  
HA1 and HA2, X closed; HA1T and HA2T, X open

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 355 (ISO Version)

Hydraulic control, pilot pressure dependent HD1, HD2, HD3
Hydraulic two-point control HZ
Service line ports A/B at side, opposite (02)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
## Unit Dimensions, Size 355 (ISO Version)

### Shaft ends

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Thread</th>
<th>Depth</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>Splined shaft</td>
<td>DIN 5480</td>
<td>0.47 (12)</td>
<td>60 lb-ft (80 Nm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W60x2x30x28x9g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Cyl. shaft, with adjusting spring</td>
<td>DIN 6885 AS18x11x100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Thread</th>
<th>Depth</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Service line port (high pressure series)</td>
<td>SAE J518, 11/2 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1/B1</td>
<td>Additional service line ports for plate 15</td>
<td>DIN 13 M16x2; 0.94 (24) deep</td>
<td>400 lb-ft (540 Nm)</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Leakage-oil port</td>
<td>DIN 3852 M33x2; 0.71 (18) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Leakage-fluid/oil drain 2)</td>
<td>DIN 3852 M33x2; 0.71 (18) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>X, X1, X2</td>
<td>Pilot pressure port</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>Port for remote control valve</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Connection for control oil supply</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Port for synchronous control of several units and for remote charge pressure 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>Port for 2nd pressure setting 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>Flow port 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Measuring port for charge pressure 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M1, M6</td>
<td>Measuring port for operating pressure 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
<tr>
<td>M21</td>
<td>Measuring port for pilot pressure 2)</td>
<td>DIN 3852 M14x1.5; 0.47 (12) deep</td>
<td>60 lb-ft (80 Nm)</td>
<td></td>
</tr>
</tbody>
</table>

2) plugged 3) note safety instructions, page 62
Unit Dimensions, Size 355 (ISO Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D, remote control HD.G

Electrical control with proportional valve EP1, EP2

Electrical two-point control with solenoid EZ1, EZ2

Automatic control, high-pressure dependent HA1, HA2, with hydraulic override HA1T, HA2T

Hydraulic control, speed dependent DA

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Unit Dimensions, Size 500 (ISO Version)

Hydraulic control, pilot pressure dependent HD1, HD2, HD3
Hydraulic two-point control HZ
Service line ports A/B at side, opposite (02)

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

View Z
Service line ports A/B at side, opposite (02)  Service line ports A/B at rear (01)  Service line ports A/B / A₁ / B₁ at side, opposite + at rear (15)
Unit Dimensions, Size 500 (ISO Version)

Shaft ends

Z  Splined shaft  
   DIN 5480  
   W70x3x30x22x9g  

P  Cyl. shaft, with adjusting spring  
   DIN 6885  
   AS20x12x100

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Thread</th>
<th>Dimensions (in)</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
</table>
| A, B | Service line port (high pressure series)  
   Additional service line ports for plate 15  
   Threaded fitting A/B | SAE J518, 11/2 in | M20x1.5; 1.65 (42) | 42
| A1, B1 |  
   Service line port (high pressure series)  
   Additional service line ports for plate 15 | SAE J518, 11/2 in | M20x1.5; 1.65 (42) | 42
| T1, T2 | Leakage-oil port  
   Leakage fluid/oil drain | DIN 3852  
   M33x2; 0.94 (24) deep | 42
| X1, X2 | Pilot pressure port | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38
| X3 | Port for remote control valve | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38
| P | Connection for control oil supply | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38
| G | Port for synchronous control of several units and for remote charge pressure | DIN 3852  
   M18x1.5; 0.47 (12) deep | 38
| G2 | Port for 2nd pressure setting | DIN 3852  
   M18x1.5; 0.47 (12) deep | 38
| U | Flow port | DIN 3852  
   M18x1.5; 0.47 (12) deep | 38
| M | Measuring port for charge pressure  
   Measuring ports, operating pressure | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38
| M1, M2 | Measuring ports, operating pressure | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38
| Mtot | Measuring port for pilot pressure | DIN 3852  
   M14x1.5; 0.47 (12) deep | 38

Dimensions:  
1) DIN 332 center hole  
2) plugged  
3) note safety instructions, page 62

Before finalising your design, please request a certified drawing.  
Dimensions in inches and (millimeters).
Unit Dimensions, Size 500 (ISO Version)

Hydraulic control, pilot pressure dependent, with pressure control, direct HD.D, remote control HD.G

Electrical control with proportional valve
EP1, EP2

Electrical two-point control with solenoid
EZ1, EZ2

Automatic control, high-pressure dependent HA1, HA2, with hydraulic override HA1T, HA2T

Hydraulic control, speed dependent DA

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
**Unit Dimensions, Size 1000 (ISO Version)**

**Hydraulic control, pilot pressure dependent** HD1, HD2, HD3  
**Hydraulic two-point control** HZ  
Service line ports A/B at side, opposite (02), at side, opposite + at rear (15)

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).

<table>
<thead>
<tr>
<th>View Z</th>
<th>Service line ports A/B</th>
<th>Service line ports A/B</th>
<th>Service line ports A/B / A1 / B1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at side, opposite (02)</td>
<td>at rear (01)</td>
<td>at side, opposite + at rear (15)</td>
</tr>
</tbody>
</table>

[Diagram with dimensions]
Unit Dimensions, Size 1000 (ISO Version)

Shaft ends
Z Splined shaft
   DIN 5480
   W90x3x30x26x9g

P Cyl. shaft,
   with adjusting spring
   DIN 5480
   AS25x14x125

1) DIN 332 center hole

Ports
A, B Service line port (high pressure series)  
   SAE J518,  2 in
A1, B1 Additional service line ports for plate 15
   SAE J518,  2 in
   Threaded fitting A/B
T1 Leakage-oil port
   DIN 3852
   M42x2;  0.94 (20) deep
T2 Leakage fluid/oil drain 2)
   DIN 3852
   M42x2;  0.79 (20) deep
X1, X2, X3 Pilot pressure port
   DIN 3852
   M14x1.5;  0.47 (12) deep
X4 Port for remote control valve
   DIN 3852
   M14x1.5;  0.47 (12) deep
P Port for control oil supply
   DIN 3852
   M14x1.5;  0.47 (12) deep
G Port for synchronous control of several
   units and for remote charge pressure 2)
   DIN 3852
   M18x1.5;  0.47 (12) deep
G2 Port for 2nd pressure setting 2)
   DIN 3852
   M18x1.5;  0.47 (12) deep
U Flow port 2)
   DIN 3852
   M18x1.5;  0.47 (12) deep
M Measuring port for charge pressure 2)
   DIN 3852
   M18x1.5;  0.47 (12) deep
Mh Measuring ports, operating pressure 2)
   DIN 3852
   M14x1.5;  0.47 (12) deep
Mh Measuring port for pilot pressure 2)
   DIN 3852
   M14x1.5;  0.47 (12) deep

2) plugged
3) note safety instructions, page 62

Tightening torque, max. 3)
530 lb-ft (720 Nm)
530 lb-ft (720 Nm)
60 lb-ft (80 Nm)
60 lb-ft (80 Nm)
60 lb-ft (80 Nm)
100 lb-ft (140 Nm)
100 lb-ft (140 Nm)
60 lb-ft (80 Nm)
60 lb-ft (80 Nm)
60 lb-ft (80 Nm)
Unit Dimensions, Size 1000 (ISO Version)

Hydraulic control, pilot pressure dependent,
with pressure control, direct HD.D, remote control HD.G

Electrical control with proportional valve
EP1, EP2

Electrical two-point control with solenoid
EZ1, EZ2

Automatic control, high-pressure dependent HA1, HA2,
with hydraulic override HA1T, HA2T

Hydraulic control, speed dependent DA
(under development)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Flushing and Boost Pressure Valve

The flushing and boost pressure valve is used to remove heat from the closed circuit and to ensure that a minimum charge pressure is present (opening pressure 230 psi/16 bar, fixed; note when setting primary valve). A side effect is flushing of the case.

Warm pressure fluid is removed from the relevant low pressure side into the motor case. This is then fed into the reservoir, together with the leakage fluid. The pressure fluid drawn out of the closed circuit in this way has to be replaced by cooled oil that is pumped in by the charge pump.

In the open circuit, the flushing and boost pressure valve is used solely to flush the case from the return line.

The valve is fitted to the variable displacement motor (or integrated into the servo unit, depending on the type of control and the size).

Orifices can be used to adjust the flow as required.

**Standard flow at low pressure** $\Delta p_{ND} = 365$ psi (25 bar)

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Mat. no. of orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>28, 55</td>
<td>0.9 gpm (3.5 l/min)</td>
<td>R909651766</td>
</tr>
<tr>
<td>80</td>
<td>1.3 gpm (5 l/min)</td>
<td>R909419695</td>
</tr>
<tr>
<td>107</td>
<td>2.1 gpm (8 l/min)</td>
<td>R909419696</td>
</tr>
<tr>
<td>140, 160, 200</td>
<td>2.6 gpm (10 l/min)</td>
<td>R909419697</td>
</tr>
<tr>
<td>250</td>
<td>2.6 gpm (10 l/min)</td>
<td>On request</td>
</tr>
<tr>
<td>355-1000</td>
<td>4.2 gpm (16 l/min)</td>
<td>On request</td>
</tr>
</tbody>
</table>

For sizes 28 to 200, orifices for flows of 1.3 - 2.6 gpm (3.5 - 10 l/min) can be supplied. In the case of non-standard flows, please specify the orifice you require when placing your order.

**Sizes 250 to 1000**

<table>
<thead>
<tr>
<th>Size</th>
<th>Quantity</th>
<th>Mat. no. of orifice</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA6VM 250</td>
<td>15.71 (399)</td>
<td>17.48 (444)</td>
</tr>
<tr>
<td>A6VM 355</td>
<td>15.63 (397)</td>
<td>17.56 (446)</td>
</tr>
<tr>
<td>500</td>
<td>17.32 (440)</td>
<td>19.84 (504)</td>
</tr>
<tr>
<td>1000</td>
<td>21.73 (552)</td>
<td>24.76 (629)</td>
</tr>
</tbody>
</table>
Counterbalance Valve BVD (sizes 55 to 160)

Function
Driving/winch counterbalance valves prevent the motor speeding up out of control during descents/load reduction and consequently cavitation of axial piston motors operating in an open circuit. Cavitation occurs in axial piston motors as soon as the speed from the drive element on the outside exceeds the speed governed by the incoming flow volume.

Please note
- BVD counterbalance valve must be specified explicitly in the order. We recommend ordering the counterbalance valve and the motor as a set. Ordering example: AA6VM80HA1T/63W–VSC380A + BVD20F27S/41B–V03K16D0400S12
- For safety reasons, winch drive are forbidden with start of control at $V_{g\,\text{min}}$ (e.g. HA)!
- The counterbalance valve does not replace the mechanical service brake and parking brake.
- Note the detailed information about the BVD counterbalance valve contained in RE 95522

Driving counterbalance valve BVD..F
Version with start of control at $V_{g\,\text{min}}$ (standard for HA).

Example of application
- Transmission on wheeled excavators

Example circuit diagram for transmission on wheeled excavators
AA6VM80HA1T/63W–VSC380A + BVD20F27S/41B–V03K16D0400S12

Winch counterbalance valve BVD..W
Version with start of control at $V_{g\,\text{min}}$ (standard for HD, EP).

Typical applications
- Winch gears in cranes
- Slew gears in excavator crawlers

Example circuit diagram for winch gears in cranes
AA6VM80HD1D/63W–VSC380B + BVD20W27L/41B–V01K00D0600S00
Counterbalance Valve BVD (sizes 55 to 160)

Unit dimensions

<table>
<thead>
<tr>
<th>(A)A6VM Size...Plate</th>
<th>Counterbalance valve Type</th>
<th>Conn. A, B</th>
<th>Conn. S</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>55...38</td>
<td>BVD20...17</td>
<td>3/4 in</td>
<td>M22x1.5;0.55 (14) deep</td>
<td>A1  A2  A3  A4  A5  A6  A7  A8  A9  A10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.19 12.83 5.63 1.97 3.86 5.47 2.95 8.74 13.78 1.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(335) (326) (143) (50) (98) (139) (75) (222) (350) (50)</td>
</tr>
<tr>
<td>80...38</td>
<td>BVD20...27</td>
<td>1 in</td>
<td>M22x1.5;0.55 (14) deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.33 13.98 5.83 2.17 3.86 5.47 2.95 8.74 14.92 1.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(364) (355) 148 55 (98) (139) (75) (222) (379) (46)</td>
</tr>
<tr>
<td>107...37</td>
<td>BVD20...28</td>
<td>1 in</td>
<td>M22x1.5;0.55 (14) deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15.51 15.16 5.98 2.32 3.86 5.47 3.31 9.21 16.10 1.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(394) (385) (152) (59) (98) (139) (84) (234) (409) (41)</td>
</tr>
<tr>
<td>107...38</td>
<td>BVD25...38</td>
<td>1 1/4 in</td>
<td>M27x2; 0.63 (16) deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.22 15.83 6.50 2.48 4.74 6.89 3.31 9.37 16.81 2.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(412) (402) (165) (63) (120.5) (175) (84) (238) (427) (56)</td>
</tr>
<tr>
<td>140...38</td>
<td>BVD25...38</td>
<td>1 1/4 in</td>
<td>M27x2; 0.63 (16) deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.18 15.79 6.61 2.64 4.74 6.89 3.31 9.37 17.56 2.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(411) (401) (168) (67) (120.5) (175) (84) (238) (446) (53)</td>
</tr>
<tr>
<td>160...38</td>
<td>BVD25...38</td>
<td>1 1/4 in</td>
<td>M27x2; 0.63 (16) deep</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.68 17.28 6.99 2.68 4.74 6.89 3.31 9.37 18.27 2.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(449) (439) (170) (68) (120.5) (175) (84) (238) (464) (51)</td>
</tr>
<tr>
<td>250...08</td>
<td>On request</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Fastening the counterbalance valve

When delivered, the counterbalance valve is fastened to the motor by 2 tacking bolts. Do not remove the tacking bolts when attaching the working lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be fastened to the motor port plate using the tacking bolts provided. In both cases, the final fastening of the counterbalance valve to the motor is done using the threaded connection of the working lines, e.g., using SAE flanges. A total of 6 bolts with thread lengths B1+B2+B3 and 2 bolts with thread lengths B3+B4 will be required.

When tightening the bolts, it is vital that the sequence (1 to 8) as shown in the diagram is adhered to and carried out in two phases. In the first phase the bolts should be tightened to 50% of their tightening torque before being tightened to maximum tightening torque in a second phase (see table below).

<table>
<thead>
<tr>
<th>Thread</th>
<th>Property class</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>10.9</td>
<td>55 lb-ft (75 Nm)</td>
</tr>
<tr>
<td>M12</td>
<td>10.9</td>
<td>95 lb-ft (130 Nm)</td>
</tr>
<tr>
<td>M14</td>
<td>10.9</td>
<td>150 lb-ft (205 Nm)</td>
</tr>
</tbody>
</table>

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Speed Measurement (sizes 28 to 200)

The (A)A6VM...D and (A)A6VM...F ("prepared for speed measurement") versions have teeth on the drive shaft. The rotating, toothed shaft generates a signal in proportion to the speed. The signal is picked up by a sensor and forwarded for evaluation.

The sensor is screwed into (inductive speed sensor ID) or flanged onto (Hall effect speed sensor HDD) the upper leakage-oil port T₁ (sizes 28 to 200). The spacering (sizes 28 to 107) or thread reducing adapter (sizes 140 to 200) required for the inductive speed sensor is supplied with the sensor. For the sizes 55, 80, 107, 160 and 200 the port T₁ is equipped with an adapter piece (M18x1.5) for the installation of the inductive speed sensor ID.

We recommended ordering the speed sensor and motor as a set.

Suitable sensors:
- Inductive speed sensor ID (see RE 95130) version “D”
- Hall-effect speed sensor HDD (see RE 95135) version “F”

On units employing speed measurement, port T₂ must be used to drain the leakage-oil (sizes 28 to 200).

<table>
<thead>
<tr>
<th>Size</th>
<th>Sensor selection</th>
<th>Type designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>IDR 18/20 - L250</td>
<td>HDD.L16/20</td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of teeth</th>
<th>40</th>
<th>54</th>
<th>58</th>
<th>67</th>
<th>72</th>
<th>75</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD A</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>B</td>
<td>2.31</td>
<td>2.86</td>
<td>3.02</td>
<td>3.37</td>
<td>3.57</td>
<td>3.69</td>
<td>3.88</td>
</tr>
<tr>
<td>C</td>
<td>3.82</td>
<td>4.37</td>
<td>4.53</td>
<td>4.88</td>
<td>5.08</td>
<td>5.20</td>
<td>5.39</td>
</tr>
<tr>
<td>ID: A</td>
<td>0.69</td>
<td>0.69</td>
<td>0.69</td>
<td>0.69</td>
<td>0.96</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>B</td>
<td>2.36</td>
<td>2.91</td>
<td>3.07</td>
<td>3.43</td>
<td>3.90</td>
<td>4.02</td>
<td>4.21</td>
</tr>
<tr>
<td>C</td>
<td>4.72</td>
<td>5.28</td>
<td>5.43</td>
<td>5.79</td>
<td>6.18</td>
<td>6.30</td>
<td>6.50</td>
</tr>
<tr>
<td>C₁ with 90° mating connector</td>
<td>6.89</td>
<td>7.44</td>
<td>7.60</td>
<td>7.95</td>
<td>8.35</td>
<td>8.46</td>
<td>8.66</td>
</tr>
<tr>
<td>C₂ with 180° mating connector</td>
<td>8.04</td>
<td>8.59</td>
<td>8.75</td>
<td>7.11</td>
<td>7.50</td>
<td>7.62</td>
<td>7.81</td>
</tr>
<tr>
<td>D</td>
<td>2.28</td>
<td>3.58</td>
<td>3.94</td>
<td>4.33</td>
<td>3.62</td>
<td>4.90</td>
<td>5.04</td>
</tr>
<tr>
<td>E</td>
<td>1.26</td>
<td>1.57</td>
<td>1.57</td>
<td>1.65</td>
<td>1.65</td>
<td>1.77</td>
<td>1.77</td>
</tr>
</tbody>
</table>

1) Clearance required for attaching/detaching the mating connector: min. 0.51 in (13 mm)

Before finalising your design, please request a certified drawing.
Dimensions in inches and (millimeters).
Swivel Angle Indicator (sizes 250 to 1000)

**Optical swivel angle indicator (V)**

The swivel position is indicated by a pin on the side of the port plate. The length of pin protruding out of the plate depends on the position of the control lens.

If it lies flush with the port plate, the motor is at start of control. At maximum swivel, the pin is 0.31 inches (8 mm) long (visible after removing the cap nut).

**Sizes 250 to 1000**

*Example: Start of control at $V_{g_{\text{max}}}$*

![Diagram of Optical swivel angle indicator (V)](image)

**Electrical swivel angle indicator (E)**

The position of the motor is signaled by an inductive position sensor. It converts the travel of the control device into an electrical signal.

The swivel position can be transmitted to an electrical control unit by means of this signal.

**Inductive position sensor, model IW9–03–01**

**Sizes 250 to 1000**

*Example: Start of control at $V_{g_{\text{min}}}$*

![Diagram of Electrical swivel angle indicator (E)](image)

### Table: Sizes 250 to 1000

<table>
<thead>
<tr>
<th>Size</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA6VM 250</td>
<td>5.37</td>
<td>11.73</td>
<td>2.67</td>
<td>11.02</td>
<td>0.43</td>
<td>0.20</td>
</tr>
<tr>
<td>A6VM 355</td>
<td>6.28</td>
<td>11.34</td>
<td>3.31</td>
<td>10.47</td>
<td>0.43</td>
<td>0.31</td>
</tr>
<tr>
<td>500</td>
<td>6.79</td>
<td>13.03</td>
<td>3.50</td>
<td>12.17</td>
<td>0.43</td>
<td>0.12</td>
</tr>
<tr>
<td>1000</td>
<td>8.21</td>
<td>16.93</td>
<td>4.49</td>
<td>15.83</td>
<td>0.43</td>
<td>0.12</td>
</tr>
</tbody>
</table>

2) Distance to mounting flange
3) Clearance required for removing cap nut

Before finalising your design, please request a certified drawing. Dimensions in inches and (millimeters).
Connectors for Solenoids (for EP, EZ, HA.U, HA.R, DA only)

**DEUTSCH DT04-2P-EP04, 2-pin**

- Injection molded, without bidirectional quenching diode (for EP, EZ1/2, DA)  **P**
- Injection molded, with bidirectional quenching diode (for EZ1/2, DA)  **Q**
- With lead, without bidirectional quenching diode (for EP, EZ, HA.U, HA.R, DA; not for new projects)  **T**

Degree of protection to DIN/EN 60529: IP67 and IP69K

The Q version with a bidirectional quenching diode is only available as an option for solenoids for the EZ1/2, DA-controls. The protection circuit with a bidirectional quenching diode is required to limit overvoltages. Overvoltages are generated by disconnecting the current using switches, relay contacts or by unplugging an energized mating connector.

**Switch symbol**

- **without** bidirectional quenching diode
- **with** bidirectional quenching diode

**Mating connector**

Female connector DEUTSCH DT06-2S-EP04
Rexroth Mat. no. R902601804
comprising:
- 1 case  **DT** designation
- 1 wedge  **W2S**
- 2 sockets  **0462-201-16141**

The female connector is not part of the scope of supply. It can be supplied by Rexroth on request.

**Hirschmann DIN EN 175 301-803-A/ISO 4400**

(not for new projects using sizes 28 to 200)

- Without bidirectional quenching diode (for EP, EZ, HA.U, HA.R, DA)  **H**

Degree of protection to DIN/EN 60529: IP65

The sealing ring in the cable gland (M16x1.5) is suitable for cables 0.18 in to 0.39 in (4.5 mm to 10 mm) in diameter.

The female connector is part of the scope of supply of the motor.

1) Solenoid with DIA 1.77 (ø45) for following controls: HA.U, HA.R (for elec. override), EZ3 and EZ4.

Degree of protection to DIN EN 60529: IP65

2) Solenoid with DIA 1.77 (ø45) for following controls: HA.U, HA.R (for elec. override), EZ3 and EZ4.
Not for new projects.
Installation and Startup Instructions

General

The motor case must be completely filled up with hydraulic fluid during startup and during operation (filling the case chamber). The motor must be started up at low speed and no load until the system has been bled completely.

If stopped for an extended period, fluid may drain out of the case through the working lines. When restarting, make sure that the case contains sufficient fluid.

The leakage fluid inside the case chamber must be drained off to the reservoir through the highest leakage-oil port.

The motor is designed to operate in any position.

Installation below the reservoir

Motor below minimum oil level in reservoir (standard)

- Fill axial piston motor before startup via the highest leakage-oil port
- Run the motor at low speed until the system is bled completely (bleed through service line port A, B if tubing is long)
- Minimum immersion depth of leakage line in reservoir: 7.87 in/200 mm (relative to the min. oil level in the reservoir)
- Additional measures required for installation position 2 (shaft facing up)

With installation position 2, make sure that the motor case is completely full before starting up. In this installation position the system must be bled via U. An air cushion in the vicinity of the bearing will damage the axial piston unit.

- Bleed the AA6VM variable displacement motor in a closed circuit:
  - via port G
  - no bleeding required if flushing valve fitted

Installation above the reservoir

Motor above minimum oil level in reservoir

- Proceed in same way as below the reservoir installation
- Additional measures for installation positions 1 and 2

If stopped for an extended period, fluid may drain out of the case chamber through the working lines (air enters through the shaft seal). The bearings will therefore not be properly lubricated when the motor is started up again. Fill the axial piston unit before restarting via the highest leakage-oil port.

In installation position 2 the system must be bled via U.

- Additional measures required for installation position 2 (shaft facing up)

In this installation position the bearings will not be properly lubricated, even if there is still some fluid in the case chamber. Putting a check valve (opening pressure 7.25 psi/0.5 bar) in the leakage line can prevent the system emptying through the line.
Safety Instructions

- The AA6VM motor is designed to be used in open and closed circuits.
- Project planning, assembly, and startup of the motor require the involvement of trained personnel.
- The working and functional ports are only designed to accommodate hydraulic piping.
- Tightening torques: The tightening torques mentioned in this data sheet are maximum values and must not be exceeded (max. values for thread).
  Manufacturer’s information concerning the maximum permitted tightening torques of the various fittings is to be observed!
  For ISO 68 / DIN 13 mounting bolts, we recommend that tightening torques be checked on a case by case basis in accordance with VDI 2230, published 2003.
- There is a danger of burning while the motor is running and for a short time afterwards.
- The data and information contained herein must be adhered to.