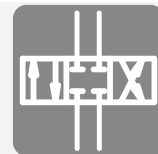


# Directional spool valve type SG and SP

## Product documentation



Single valve for pipe connection or manifold mounting

Operating pressure  $p_{\max}$ : 400 bar

Flow rate  $Q_{\max}$ : 100 lpm



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**1****Overview of directional spool valves type SG and SP**

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.

The directional spool valve type SG is available as a single valve for pipe connection. Type SP is available as a manifold mounting valve. Due to its robust design, operating pressures up to 400 bar are achievable. They are flexible in use and are available with various different circuit symbols and types of actuation. Intended applications include mobile hydraulics, in particular in special vehicles, in municipal trucks and in shipbuilding.

**Features and benefits**

- Sturdy design
- For general purpose use
- Wide variety of circuit symbols and types of actuation
- Proven for use even in the maritime environment

**Intended applications**

- Mining machinery
- Municipal trucks
- Shipbuilding
- Cranes and lifting equipment



*Directional spool valve type SG*

## 2 Available versions

### Ordering example

|      |   |    |      |  |
|------|---|----|------|--|
| SG 3 | L | 3E | - AK | - 120  |
|      |   |    |      | 2.5 "Pressure setting"                       |
|      |   |    |      | 2.4 "Actuation"                              |
|      |   |    |      | 2.3 "Pressure-limiting valve (only type SG)" |
|      |   |    |      | 2.2 "Circuit symbol"                         |
|      |   |    |      | 2.1 "Basic type and size"                    |

### 2.1 Basic type and size

| Type                                      | Ports to ISO 228-1 |       | Flow rate<br>$Q_{max}$ (lpm) | Pressure $p_{max}$ (bar)<br>at port |    | Circuit symbol |  |
|---|--------------------|-------|------------------------------|-------------------------------------|----|----------------|--|
|   | P, A, B            | R     |                              | P, A, B                             | R  |                |  |
| <b>Single valve for pipe connection</b>   |                    |       |                              |                                     |    |                |  |
| SG 0                                      | G 1/4              | G 3/8 | 12                           | 400                                 | ** |                |  |
| SG 1                                      | G 3/8              |       | 20                           |                                     |    |                |  |
| SG 2                                      | G 3/8              |       | 30                           |                                     |    |                |  |
| SG 3                                      | G 1/2              |       | 50                           |                                     |    |                |  |
| SG 5                                      | G 1                |       | 100                          | 315                                 | ** |                |  |
| <b>Single valve for manifold mounting</b> |                    |       |                              |                                     |    |                |  |
| SP 1                                      | *                  |       | 12                           | 400                                 | ** |                |  |
| SP 3                                      | *                  |       | 50                           |                                     |    |                |  |
| SP 5                                      | *                  |       | 100                          | 315                                 | ** |                |  |

#### ! DAMAGE

\* Ports for a single valve for manifold mounting see Chapter 4.2, "Single valve for manifold mounting, type SP"

\*\* The maximum return pressure is dependent on the pressure-limiting valve and actuation.

see Chapter 2.3, "Pressure-limiting valve (only type SG)"

see Chapter 2.4.1, "Manual actuation"

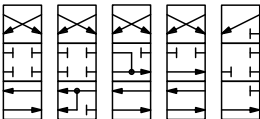
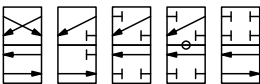


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## 2.2 Circuit symbol

| Coding               | Description   | Circuit symbol   |
|----------------------|---|--|
| <b>G, C, D, E, N</b> | <p>4/3 or 3/3 directional spool valve for parallel circuit</p> <p>Coding C:</p> <ul style="list-style-type: none"> <li>Only for size 0, 1</li> </ul> <p>Coding N:</p> <ul style="list-style-type: none"> <li>Only for size 1, 2, 3, 5</li> <li>With SG 1 not for use in conjunction with a pressure-limiting valve</li> </ul>   | <p>G C D E N</p>  |
| <b>W, R, V, Q, Z</b> | <p>4/2 or 3/2 directional spool valve for parallel circuit</p> <p>Coding R, V:</p> <ul style="list-style-type: none"> <li>With SG 1 not for use in conjunction with a pressure-limiting valve</li> </ul> <p>Coding Q:</p> <ul style="list-style-type: none"> <li>Negative overlap (slight floating position between the two switching positions)</li> <li>Only for size 2, 3, 5</li> </ul> <p>Coding Z:</p> <ul style="list-style-type: none"> <li>Only for size 2</li> <li>Not for use in conjunction with a pressure-limiting valve</li> </ul> <p>For coding V and Q the port R must be connected to the tank in order to drain away the leakage oil flow rate.</p> | <p>W R V Q Z</p>  |

| Coding                   | Description   | Circuit symbol |
|--------------------------|---|----------------|
| <b>L, LS, P, H, Y, S</b> | <p>4/3 or 3/3 directional spool valve for series or parallel circuit. Not for use in conjunction with a pressure-limiting valve in a series circuit.</p> <p>Coding L:</p> <ul style="list-style-type: none"> <li>With SG 0 and SG 5 not for use in conjunction with a pressure-limiting valve</li> </ul> <p>Coding LS:</p> <ul style="list-style-type: none"> <li>Special version to avoid decompression surges</li> <li>Only for SG 5, not for use in conjunction with a pressure-limiting valve</li> </ul> <p>Coding P:</p> <ul style="list-style-type: none"> <li>Only for size 0, 1, 2, 3</li> <li>With SG 0 not for use in conjunction with a pressure-limiting valve</li> </ul> <p>Coding H:</p> <ul style="list-style-type: none"> <li>Only for SG 1, SP 1, SG 3</li> </ul> <p>Coding Y:</p> <ul style="list-style-type: none"> <li>Only for SG 3</li> <li>Not for use in conjunction with a pressure-limiting valve</li> </ul> <p>Coding S:</p> <ul style="list-style-type: none"> <li>Only possible for SG 2 in conjunction with a pressure-limiting valve, and for SG 3</li> </ul> <p>Coding L, LS, H, Y have a negative overlap (slight floating position between the switching positions).<br/>Coding P, S have a positive overlap (slight closed position between the switching positions).</p> <p><b>Note on LS:</b><br/>In shipbuilding, spool valves with large ports are often used because very long pipelines generally lead to high flow resistance values, even with lower flow rates. The decompression surges and pressure waves caused by large pipe volumes place additional stresses on hydraulic equipment. For version SG 5 LS the valve spool is designed so that a delayed build-up in pressure during switching is achieved by long control notches, and thus these pressure surges can be largely avoided. In addition the port sizes G 1 permit the use of Ø25 pipelines with correspondingly low flow resistance.</p> |                |

**! DAMAGE**

If several individual spool valves are used within a single system, consideration must be given to the type of circuit (parallel circuit or series circuit). For a series circuit the maximum permissible system pressure is the same as the maximum permissible return pressure. Therefore a series circuit is not always suitable for all versions and types of actuation.

Maximum permissible return pressure see Chapter 2.4, "Actuation"

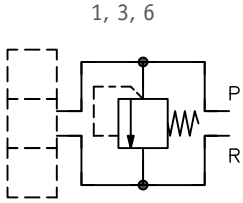
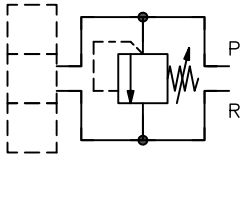


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## 2.3 Pressure-limiting valve (only type SG)

| Coding         | Description  | Circuit symbol  |
|----------------|--|---|
| Without coding | Without pressure-limiting valve  | -   |
| 1<br>2         | Pressure-limiting valve for SG 0, 1<br>Zinc die-cast spring housing,<br>$p_{max}$ at port R = 20 bar<br><ul style="list-style-type: none"> <li>▪ 1: fixed</li> <li>▪ 2: adjustable</li> </ul>                                      |  |
| 3<br>4         | Pressure-limiting valve for SG 2, 3, 5<br>Zinc die-cast spring housing,<br>$p_{max}$ at port R = 20 bar<br><ul style="list-style-type: none"> <li>▪ 3: fixed</li> <li>▪ 4: adjustable</li> </ul>                                   |   |
| 6<br>7         | Pressure-limiting valve for SG 2, 3, 5<br>Steel spring housing<br>$p_{max}$ at port R > 20 bar (proof against pressure surges to 300 bar)<br><ul style="list-style-type: none"> <li>▪ 6: fixed</li> <li>▪ 7: adjustable</li> </ul> |  |
|                | Special version for special installations and marine applications  |   |

**! DAMAGE**

The pressure in R is additional to the pressure setting.

**! DAMAGE**

The version with the pressure-limiting valve is available only for type SG and for parallel circuits.

see Chapter 2.1, "Basic type and size"

see Chapter 2.2, "Circuit symbol"

### Adjustment range for the pressure-limiting valve

| Coding         | Description                     |
|----------------|---------------------------------|
| Without coding | Without pressure-limiting valve |
| B              | 315 ... 400 bar                 |
| C              | 160 ... 315 bar                 |
| E              | 80 ... 160 bar                  |
| F              | 20 ... 80 bar                   |

## 2.4 Actuation

### 2.4.1 Manual actuation

| Coding               | Description   | Pressure $p_{max}$ (bar) |                    | Circuit symbol | View |
|----------------------|---|--------------------------|--------------------|----------------|------|
|                      |   | P, A, B                  | R                  |                |      |
| AK, AKS<br>AK1, AKS1 | Manual operation with spring return <ul style="list-style-type: none"> <li>AK: Standard version</li> <li>AKS: Special version with a corrosion-resistant steel shaft. Especially for maritime applications. For size 2, 3, 5 the lever housing has an additional flat grease nipple.</li> </ul> Actuation supplement 1: without hand lever  | 400                      | SG: 315<br>SP: 100 |                |      |
| CK, CKS<br>CK1, CKS1 | Manual operation with 3-stage detent <ul style="list-style-type: none"> <li>CK: Standard version</li> <li>CKS: Special version with a corrosion-resistant steel shaft. Especially for maritime applications. For size 2, 3, 5 the lever housing has an additional flat grease nipple.</li> </ul> Actuation supplement 1: without hand lever | 400                      | SG: 315<br>SP: 100 |                |      |

#### ! DAMAGE

For 4/2 and 3/2 directional spool valves, the 3rd switching position of the hand lever is blocked internally in the lever housing.

### 2.4.2 Manual actuation with contact switch

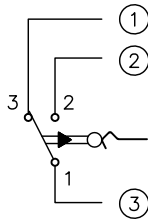
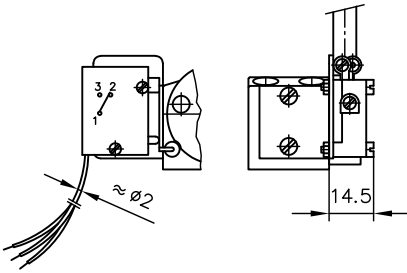
| Coding  | Description   | Pressure $p_{max}$ (bar) |                    | Circuit symbol | View |
|---------|---|--------------------------|--------------------|----------------|------|
|         |   | P, A, B                  | R                  |                |      |
| PK, PK2 | Manual operation with spring return and contact switch, hand lever upwards <ul style="list-style-type: none"> <li>PK2:               <ul style="list-style-type: none"> <li>Without contact switch and switch retainer but with cam</li> <li>Only for size 2, 3, 5</li> </ul> </li> </ul>     | 400                      | SG: 315<br>SP: 100 |                |      |
| UK, UK2 | Manual operation with spring return and contact switch, hand lever to the side <ul style="list-style-type: none"> <li>Only for size 2, 3, 5</li> <li>UK2:               <ul style="list-style-type: none"> <li>Without contact switch and switch retainer but with cam</li> </ul> </li> </ul> | 400                      | SG: 315<br>SP: 100 |                |      |

#### ! DAMAGE

The contact switches are not adjusted by HAWE. They are to be adjusted when they are electrically connected to their switch retainers.

**Size 0, 1**

The switch is not pressed in the spool valve neutral position, for 3/3 directional spool valves it is also pressed in position a.

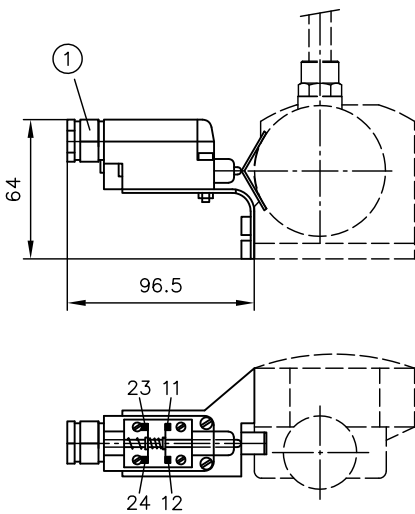


- 1 Normally open contact (blue)
- 2 N/C contact (grey)
- 3 Input (black)

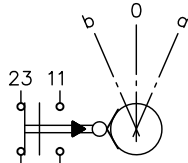
**Size 2, 3, 5**

**4/2, 3/2 and 4/3 directional spool valve**

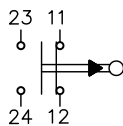
(Contact switch functions in positions a and b) The cam is symmetrical. The switch can be adjusted on the switch retainer in such a way that, in switching positions a or b, the contact bridge 11-12 can be used as a normally open contact or 23-24 can be used as a N/C contact, as required (switch is pressed in position 0).



**Neutral position**



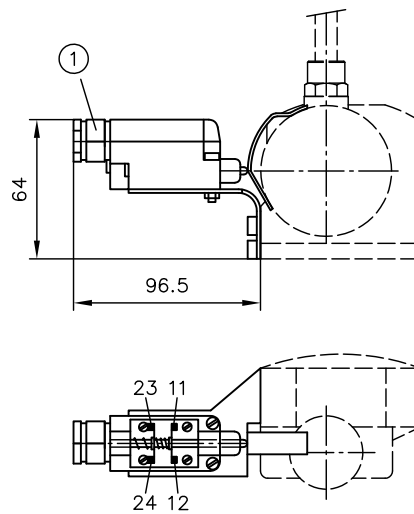
**Switching position a or b**



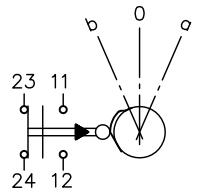
1 Cable fitting

**3/3 directional spool valve**

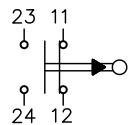
(Contact switch functions in position a) The cam is asymmetrical. The switch can be adjusted on the switch retainer in such a way that, in switching position a, for example, the contact bridge 11-12 can be used as a normally open contact. The switch can also be set so that both bridges are open in neutral position, and the bridge 11-12 is closed in switching position a and 23-24 is closed in switching position b.



**Neutral position and switching position b**



**Switching position a**



1 Cable fitting



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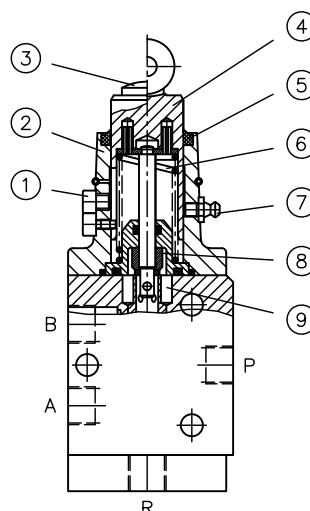
## 2.4.3 Mechanical actuation

| Coding | Description   | Pressure $p_{max}$ (bar) |     | Circuit symbol | View |
|--------|---|--------------------------|-----|----------------|------|
|        |   | P, A, B                  | R   |                |      |
| RE     | Roller head actuation <ul style="list-style-type: none"> <li>▪ RE: Single-stroke</li> <li>– Only for parallel circuit</li> <li>– Only for 4/2 or 3/2 directional spool valve</li> </ul>                                   | 400                      | 100 | RE<br>         |      |
| BE     | Ball head actuation <ul style="list-style-type: none"> <li>▪ BE: Single-stroke</li> <li>– Only for size 2, 3 and 5</li> <li>– Only for parallel circuit</li> <li>– Only for 4/2 or 3/2 directional spool valve</li> </ul> | 400                      | 100 | BE<br>         |      |

### Assembly

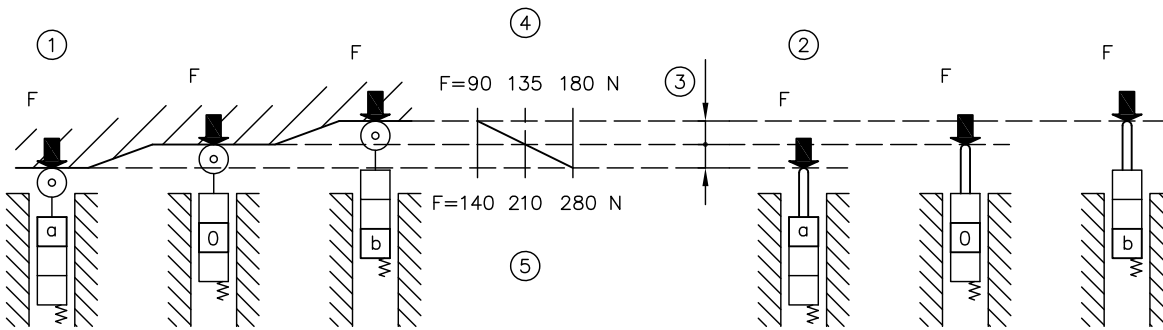
- Roller head actuation: For lateral actuation by a cam or a control rod, a hardened plunger must have a roller bearing roller at its outer end. The plunger is installed in a flange housing with anti-twist protection, and is fitted with a strong return spring.
- Ball head actuation: For the axial direction of actuation the outer end is designed convex (without a roller).

The connection to the valve spool is made by a connecting rod sealed against the spring cavity of the plunger. This means that this type of actuation is not fully pressure compensated. Any pressure in the reflux of the directional spool valve adds a certain percentage to the force of the return spring. Allowance must be made for this when designing the external actuating elements.



- 1 Anti-twist protection
- 2 Housing
- 3 Ball head
- 4 Roller head with roller bearing roller
- 5 Dirt scraper
- 6 Return spring
- 7 Grease nipple
- 8 for RE, BE
- 9 Reflux chamber of the directional spool valve

### Actuation diagram



- 1 Roller head
- 2 Ball head
- 3 Switching travel
- 4 Spring force for spool valve size 0, 1
- 5 Spring force for spool valve size 2, 3, 5

#### Overall actuation force (N)

- ▶ for spool valve size 0, 1:  $F_{ges} = F + 2.8 p_R$
- ▶ for spool valve size 2, 3, 5 (4):  $F_{ges} = F + 5 p_R$

$F$  (N) = see actuation diagram

$p_R$  (bar) = pressure at port R (reflux)

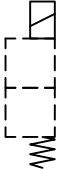
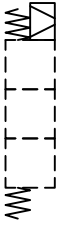
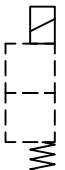
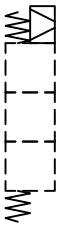

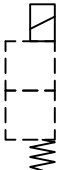
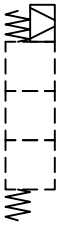
Roller head actuation is preferred when actuation is by a cam or a control rod. The actuation curve should be configured and adjusted at assembly against the spool valve so that the spool stroke of the roller head is not pushed beyond the actuation path (3) from the 0 position into the a-position.

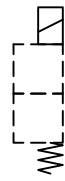

For a double stroke valve (RD, BD) the return spring always pushes the spool valve including the actuating part into the switching position b. In the installed condition the cam, control rod or other linkage elements should therefore be arranged so that in the home position or initial position the system adopts the 0 position.

## 2.4.4 Hydraulic or pneumatic actuation

| Coding                          | Description   | Pressure $p_{max}$ (bar) |    | Circuit symbol | View |
|---------------------------------|---|--------------------------|----|----------------|------|
|                                 |   | P, A, B                  | R  |                |      |
| NE, ND, NDH<br>Size 0, 1        | Hydraulic or pneumatic actuation <ul style="list-style-type: none"> <li>NE: Single-stroke</li> <li>ND: Double-stroke</li> <li>NDH: with manual override</li> </ul> Only for parallel circuit                | 400                      | 40 |                |      |
| NE, ND, NU, NUH<br>Size 2, 3, 5 | Pneumatic actuation <ul style="list-style-type: none"> <li>NE: Single-stroke</li> <li>ND: Double-stroke</li> <li>NU: Reverse stroke</li> <li>NUH: with manual override</li> </ul> Only for parallel circuit | 400                      | 30 |                |      |
| NM<br>Size 2, 3, 5              | Hydraulic actuation<br>Single-stroke or double-stroke<br>Only for parallel circuit  | 400                      | 30 |                |      |
| KD, KM<br>Size 2, 3, 5          | <ul style="list-style-type: none"> <li>KD: Combined pneumatic and manual actuation</li> <li>KM: Combined hydraulic and manual actuation</li> </ul> Double-stroke<br>Only for parallel circuit               | 400                      | 12 |                |      |

## 2.4.5 Electrical actuation

| Coding                              | Rated voltage                  | Description   | Pressure $p_{max}$ (bar) |     | Circuit symbol  |
|-------------------------------------|--------------------------------|---|--------------------------|-----|---|
|                                     |                                |   | P, A, B                  | R   |   |
| <b>Size 0, 1</b>                    |                                |   |                          |     |   |
| ME 1<br>ME 2<br>ME 8                | 12 V DC<br>24 V DC<br>230 V AC | Single-stroke actuation for 4/2 or 3/2 directional spool valves<br>– 45 W power<br>– 100% duty cycle  | 200                      | 200 |    |
| MD 1<br>MD 2<br>MD 8                | 12 V DC<br>24 V DC<br>230 V AC | Double-stroke actuation for 4/3 or 3/3 directional spool valves<br>– 45 W power<br>– 100% duty cycle  | 200                      | 200 |    |
| <b>Size 2, 3</b>                    |                                |   |                          |     |   |
| ME 2/12<br>ME 2/24<br>ME 2/230 W    | 12 V DC<br>24 V DC<br>230 V AC | Single-stroke actuation for 4/2 or 3/2 directional spool valves<br>– 60 W power<br>– 100% duty cycle  | 200                      | 200 |   |
| MD 2/12<br>MD 2/24<br>MD 2/230 W    | 12 V DC<br>24 V DC<br>230 V AC | Double-stroke actuation for 4/3 or 3/3 directional spool valves<br>– 60 W power<br>– 100% duty cycle  | 200                      | 200 |  |
| MU 2/24                             | 24 V DC                        | Reversal stroke actuation (detent) for 4/2 or 3/2 directional spool valves<br>– 60 W power<br>– 100% duty cycle<br><br>The switching position can be changed with a current pulse of approx. 0.2 to 0.5 s | 200                      | 200 |  |
| ME 23/12<br>ME 23/24<br>ME 23/230 W | 12 V DC<br>24 V DC<br>230 V AC | Single-stroke actuation for 4/2 or 3/2 directional spool valves<br>– 150 W power<br>– S3 35% duty cycle 5 min   | 315                      | 200 |  |
| MD 23/12<br>MD 23/24<br>MD 23/230 W | 12 V DC<br>24 V DC<br>230 V AC | Double-stroke actuation for 4/3 or 3/3 directional spool valves<br>– 150 W power<br>– S3 35% duty cycle 5 min   | 315                      | 200 |  |

| Coding  | Rated voltage                  | Description  | Pressure p <sub>max</sub> (bar) |     | Circuit symbol  |
|---|--------------------------------|--|---------------------------------|-----|---|
|   |                                |  | P, A, B                         | R   |   |
| <b>Size 2, 3, 5</b>                                   |                                |  |                                 |     |   |
| <b>ME 3/12</b><br><b>ME 3/24</b><br><b>ME 3/230 W</b> | 12 V DC<br>24 V DC<br>230 V AC | Single-stroke actuation for 4/2 or 3/2 directional spool valves<br>– 65 W power<br>– 100% duty cycle | Size 2, 3: 315<br>Size 5: 200   | 200 |  |
| <b>MD 3/12</b><br><b>MD 3/24</b><br><b>MD 3/230 W</b> | 12 V DC<br>24 V DC<br>230 V AC | Double-stroke actuation for 4/3 or 3/3 directional spool valves<br>– 65 W power<br>– 100% duty cycle | Size 2, 3: 315<br>Size 5: 200   | 200 |  |

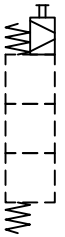


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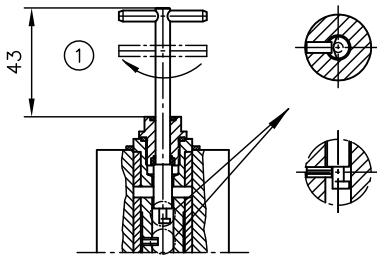
**Actuation supplement**

| Coding         | Description                              | Circuit symbol  |
|----------------|--|---|
| Without coding | Standard version without manual override | --  |
| N              | Special version with manual override     |  |

**! DAMAGE**  
Permitted pressure at R during use is only approx. 40 bar! For size 5, to protect switching reliability, the flow rate  $Q_{A,B \rightarrow R}$  must not exceed 160 lpm.

**Manual override**

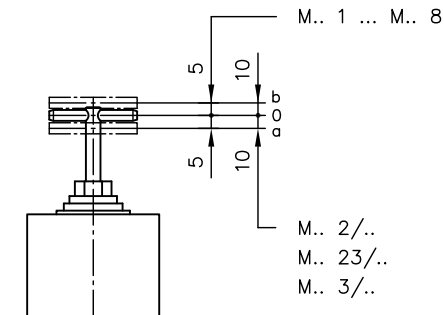
1. To use, insert until you can feel the locking pin, then turn until the pin has engaged completely in the groove.



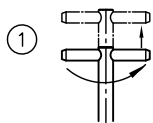
Rest position

1 pulled up

2. Locate switching position



3. After use, disengage and pull up to the stop (tommy bar in rest position again).



1 Disengage and pull up

**! DAMAGE**  
The disengage and pull up steps are crucial to prevent malfunctions, especially faulty switching, when pressure is exerted at the return connection (series connection) of several spool valves.

## 2.5 Pressure setting

| Coding         | Description  |
|----------------|--|
| Without coding | Without pressure-limiting valve  |
| -..            | with pressure-limiting valve<br>Adjustment range see Chapter 2.3, "Pressure-limiting valve (only type SG)" |

### Pressure adjustment for the pressure-limiting valve

| Coding | $\Delta p$ (bar)/revolution |            |
|--------|-----------------------------|------------|
|        | SG 0, 1                     | SG 2, 3, 5 |
| B      | 100                         | 80         |
| C      | 55                          | 35         |
| E      | 19                          | 17.5       |



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## 3 Parameters

### 3.1 General data

|                              |  |
|------------------------------|--|
| <b>Designation</b>           | Directional spool valve  |
| <b>Design</b>                | Spool valve  |
| <b>Model</b>                 | Single valve for pipe connection or manifold mounting  |
| <b>Material</b>              | Steel, internal functional parts hardened and ground, SG valves: spool blocks zinc coated  |
| <b>Attachment</b>            | Mounting thread or tapped holes, <a href="#">see Chapter 4, "Dimensions"</a>   |
| <b>Installation position</b> | any  |
| <b>Ports/connections</b>     | <ul style="list-style-type: none"> <li>▪ P = Pump</li> <li>▪ R = Reflux</li> <li>▪ A, B = Consumers</li> <li>▪ 1, 2 = pilot pressure for pneumatic or hydraulic actuation</li> </ul> <p>Connecting thread:<br/> P, R, A, B: <a href="#">see Chapter 2.1, "Basic type and size"</a><br/> 1, 2: G 1/8 for size 0, 1 or G 1/4 for size 2, 3, 5 (ISO 228/1)</p>  |
| <b>Hydraulic fluid</b>       | Hydraulic fluid, according to DIN 51 524 Parts 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448<br>Viscosity range: 4 - 1500 mm <sup>2</sup> /s<br>Optimal operating range: approx. 10 - 500 mm <sup>2</sup> /s<br>Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C.<br>Not suitable for HETG such as rapeseed oil and water-glycol solutions, e.g. HFA and HFC.   |
| <b>Cleanliness level</b>     | <b>ISO 4406</b><br><hr style="width: 20%; margin-left: 0;"/> 20/17/14  |
| <b>Temperatures</b>          | Environment: approx. -40 to +80 °C, hydraulic fluid: -25 to +80 °C, pay attention to the viscosity range.<br>Start temperature: down to -40 °C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation.<br>Start temperature: down to -20 °C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation.<br>Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C. |

### 3.2 Pressure and volumetric flow

|                           |   |
|---------------------------|---|
| <b>Operating pressure</b> | $p_{max} = 400$ bar (ports P, A, B)<br>Return pressure at port R:<br><a href="#">see Chapter 2.3, "Pressure-limiting valve (only type SG)"</a><br><a href="#">see Chapter 2.4.1, "Manual actuation"</a> |
| <b>Flow rate</b>          | $Q_{max}$ : <a href="#">see Chapter 2.1, "Basic type and size"</a>  |



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### 3.3 Weight

All dimensions in kg.

| Single valve without pressure-limiting valve | Type | Manual actuation         | Mechanical actuation | Hydraulic or pneumatic actuation |        | Electrical actuation |     |             |                   |      |
|--|------|--------------------------|----------------------|----------------------------------|--------|----------------------|-----|-------------|-------------------|------|
|  |      | AK, AKS, CK, CKS, PK, UK | RE, BE               | NE, ND, NU, NM                   | KD, KM | ME                   | MD  | ME 2, ME 23 | MD 2, MD 23, MU 2 | ME 3 |
| SG 0, 1<br>SP 1                              | 1.0  | 1.1                      | 0.9                  | -                                | 1.4    | 1.7                  | -   | -           | -                 | -    |
| SG 2, 3<br>SP 3                              | 3.5  | 2.7                      | 2.5                  | 2.9                              | -      | -                    | 3.9 | 5.0         | 4.5               | 4.8  |
| SG 5   | 3.9  | 3.1                      | 2.9                  | 3.3                              | -      | -                    | 4.3 | 5.4         | 4.9               | 5.1  |
| SP 5   | 4.8  | 4.0                      | 3.8                  | 4.2                              | -      | -                    | 5.2 | 6.3         | 5.8               | 6.6  |

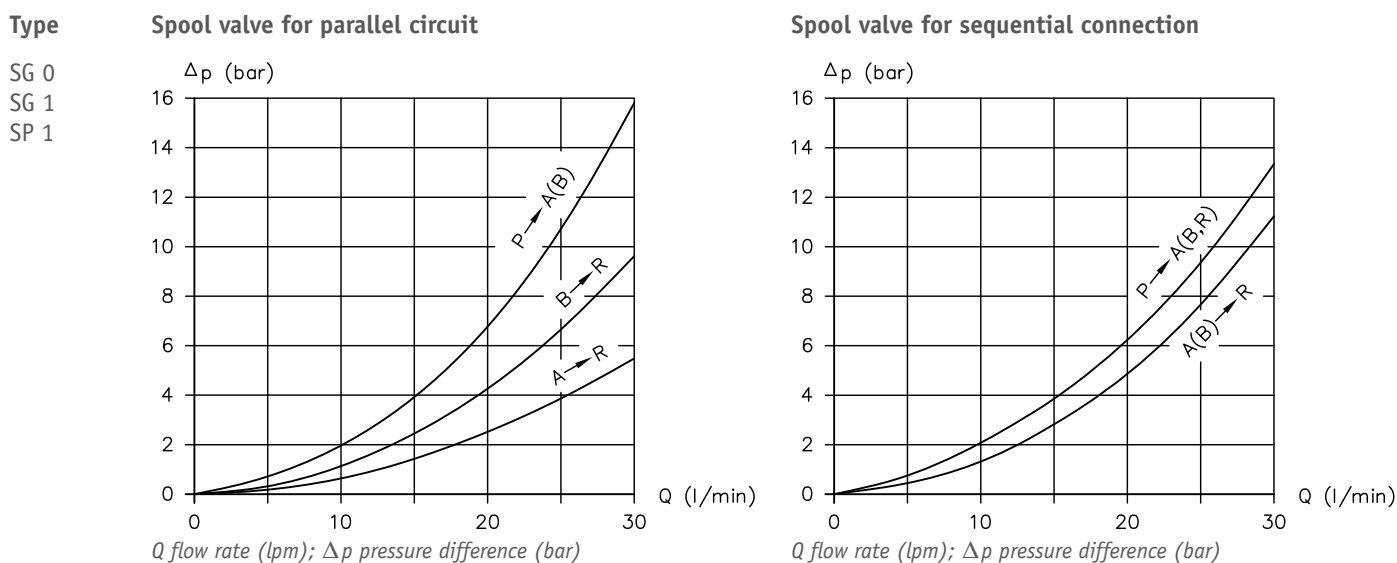
| Single valve with pressure-limiting valve | Type | Manual actuation         | Mechanical actuation | Hydraulic or pneumatic actuation |        | Electrical actuation |     |             |                   |      |
|---|------|--------------------------|----------------------|----------------------------------|--------|----------------------|-----|-------------|-------------------|------|
|   |      | AK, AKS, CK, CKS, PK, UK | RE, BE               | NE, ND, NU, NM                   | KD, KM | ME                   | MD  | ME 2, ME 23 | MD 2, MD 23, MU 2 | ME 3 |
| SG 0, 1                                   | 1.2  | 1.3                      | 1.1                  | -                                | 1.6    | 1.9                  | -   | -           | -                 | -    |
| SG 2, 3                                   | 3.8  | 3.0                      | 2.8                  | 3.2                              | -      | -                    | 4.2 | 5.3         | 4.8               | 5.0  |
| SG 5                                      | 5.2  | 4.4                      | 4.2                  | 4.6                              | -      | -                    | 5.6 | 6.7         | 6.2               | 7.0  |

### 3.4 Characteristic lines

Viscosity of the hydraulic fluid approx. 60 mm<sup>2</sup>/s

Pressure difference P → A/B and A/B → R

All values without fittings (type SG) or connection block (type SP)



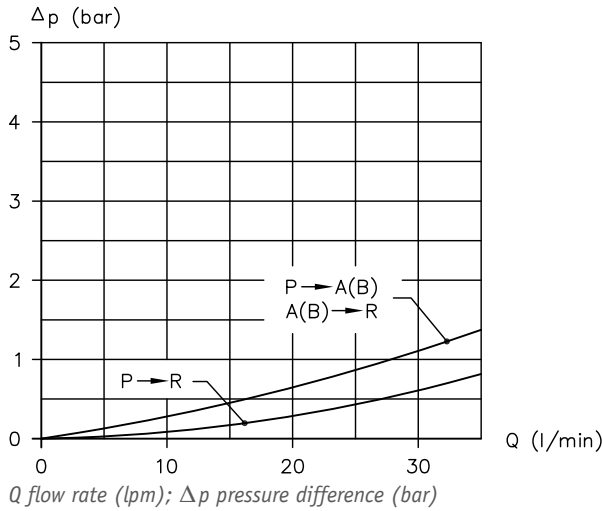
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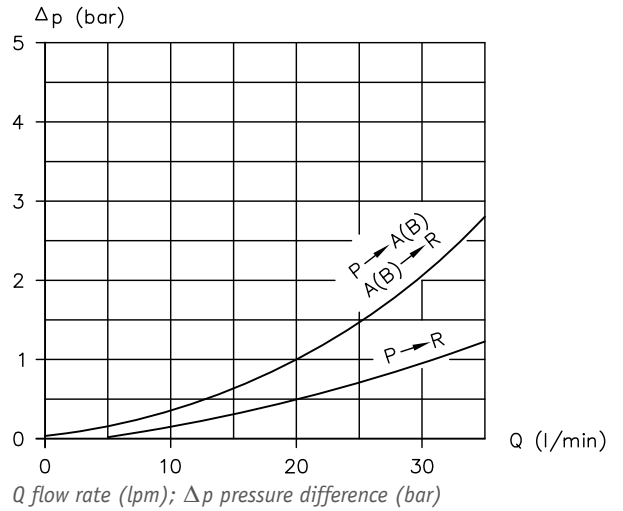
[sales@oilsolutions.com.au](mailto:sales@oilsolutions.com.au)

Type **Spool valve for parallel circuit**

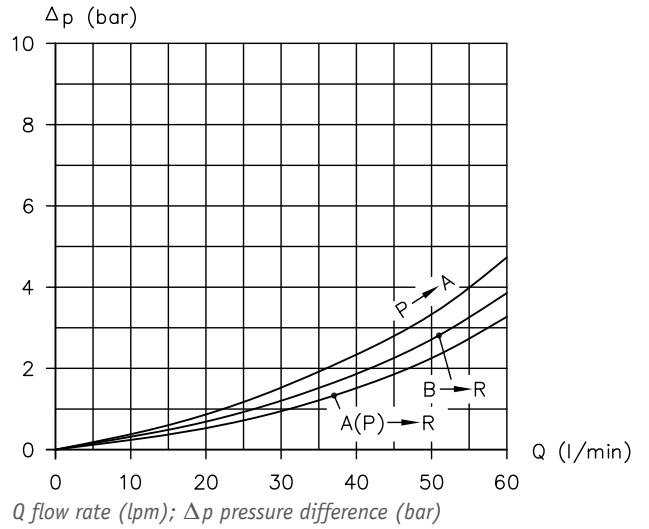
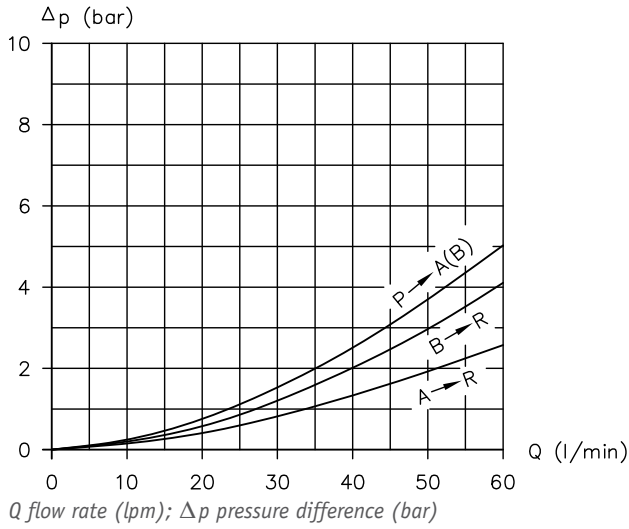
SG 2



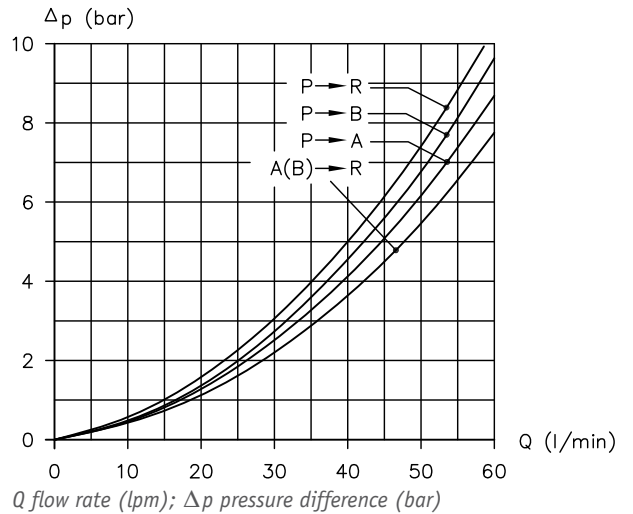
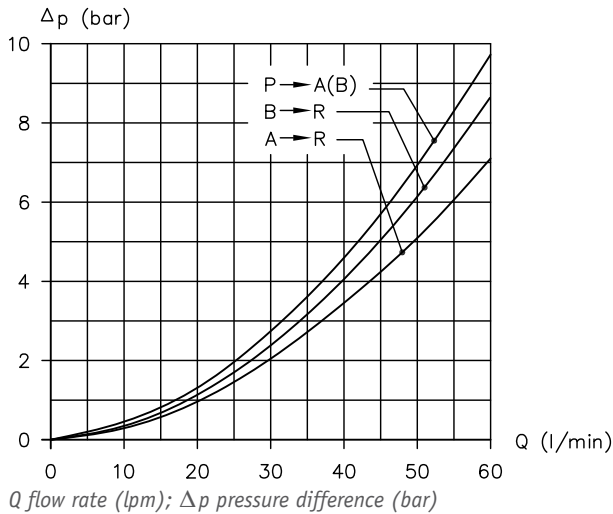
Type **Spool valve for sequential connection**



SG 3



SP 3



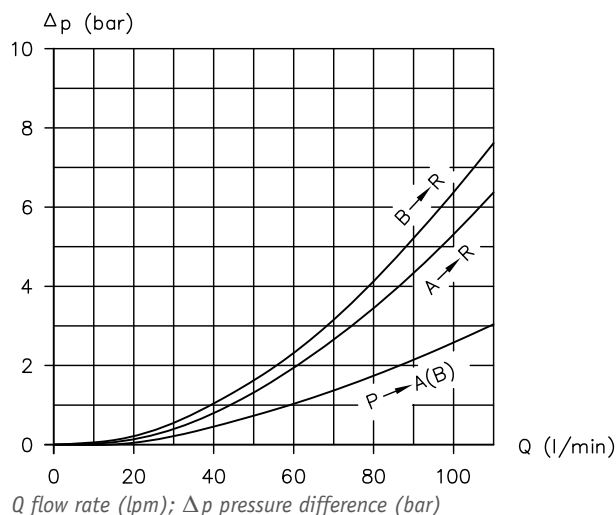
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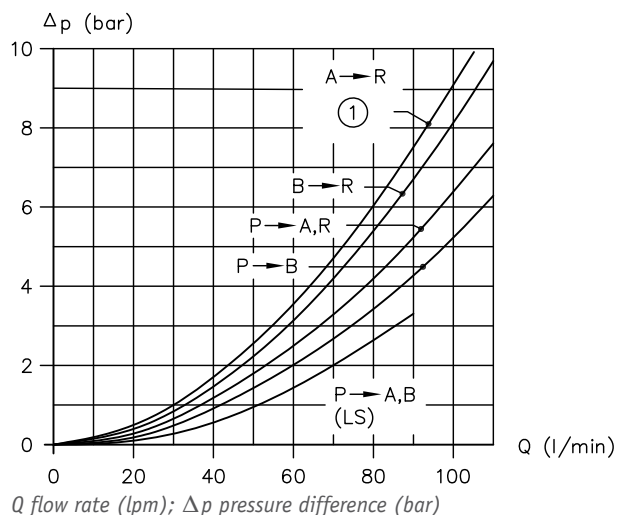
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**Type** Spool valve for parallel circuit

SG 5  
SP 5



**Type** Spool valve for sequential connection



1 A, B  $\rightarrow$  R for LS

### 3.5 Electrical data

#### 3.5.1 Electrical actuation

Black-white solenoids, pressure-sealed in hydraulic fluid.

| Nominal power                                  |          | 45 W                   | 60 W           | 150 W          | 65 W           |
|--|----------|------------------------|----------------|----------------|----------------|
| Nominal voltage                                | 12 V DC  | 1                      | 2/12           | 23/12          | 3/12           |
|  | 24 V DC  | 2                      | 2/24           | 23/24          | 3/24           |
|  | 230 V AC | 8                      | 2/230 W        | 23/230 W       | 3/230 W        |
| Insulation class                               |          | H                      | F              | H              | F              |
| Max. winding temperature                       |          | 180 °C                 | 155 °C         | 180 °C         | 155 °C         |
| Contact temperature at 20° ambient temperature |          | approx. 108 °C         | approx. 105 °C | approx. 110 °C | approx. 90 °C  |
| Response time                                  |          | approx. 80 ms          | approx. 100 ms | approx. 100 ms | approx. 100 ms |
| Drop-off time                                  |          | approx. 100 ms         | approx. 50 ms  | approx. 50 ms  | approx. 50 ms  |
| Switching frequency per hour                   |          | approx. 3,600 switches |                |                |                |



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| Nominal power  | 45 W                  | 60 W                  | 150 W                     | 65 W                  |
|--|-----------------------|-----------------------|---------------------------|-----------------------|
| Relative duty cycle at $t_s = 5$ min   | S 1 (100% duty cycle) | S 1 (100% duty cycle) | S 3-35 % (35% duty cycle) | S 1 (100% duty cycle) |
| <p>The graph plots %ED (0-100) against ambient temperature <math>\vartheta</math> (20-70 °C). It shows performance curves for DC (1) and AC (2) operation across three model ranges: ME 1, 2, 8 / MD 1, 2, 8; ME 2/.. / MD 2/.. / MU 2/..; and ME 23/.. / MD 23/.. (S 3-35 % 5 min).</p> |                       |                       |                           |                       |
| <p>1 Direct current operation DC<br/>2 Alternating current operation AC</p>  |                       |                       |                           |                       |

**Cut-off energy W** ≤ 0.5 Ws

**Dwell time under pressure**

**! DAMAGE**

The reference values below should not be exceeded for the dwell time under pressure in switching position a or b with ME or MD solenoids (spring return), if possible, to prevent seizing due to microfne dirt particles in the oil (edge filter effect).

- 150 bar ≤ 10 min
- 200 bar ≤ 5 min
- 250 bar ≤ 30-40 s
- 300 bar ≤ 15-20 s

Longer dwell times may be possible in the event of fine filtration of the hydraulic oil.

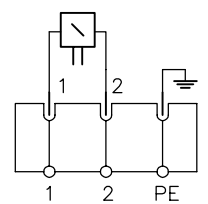
**Electrical connection**

**Single-action solenoid**

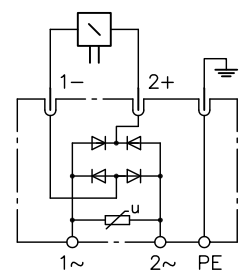
EN 175 301-803 A  
IP 67 (IEC 60529)



**ME 1, ME 2,  
ME 2/12, ME 2/24,  
ME 23/12, ME 23/24,  
ME 3/12, ME 3/24**



**ME 8,  
ME 2/230 W,  
ME 23/230 W,  
ME 3/230 W**



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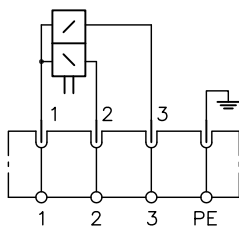
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### Double and reverse solenoid

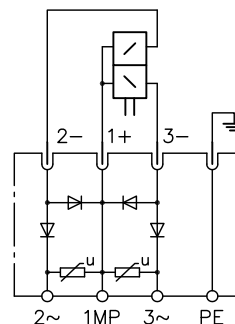
EN 175 301-803 A  
IP 65 (IEC 60529)



MD 1, MD 2,  
MD 2/12, MD 2/24, MU 2/24,  
MD 23/12, MD 23/24,  
MD 3/12, MD 3/24



MD 8,  
MD 2/230 W,  
MD 23/230 W,  
MD 3/230 W



### 3.5.2 Contact switch

Reference values for electrical switch load (approx.  $1 \times 10^6$  switching operations):

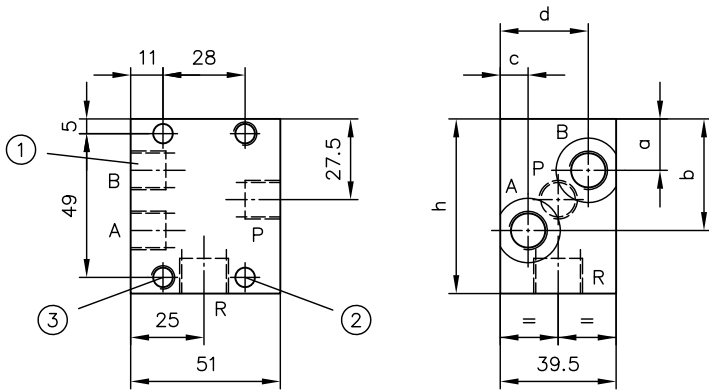
|  | PK<br>(Size 0, 1) | PK, UK<br>(Size 2, 3, 5) | Reference                |                       |
|--|-------------------|--------------------------|--------------------------|-----------------------|
| Switching capacity<br>$\approx 10^5$ switching<br>cycles | 15 V DC           | 10 A                     | --                       | $L/R \approx 3$ ms    |
|  | 24 V DC           | --                       | 5 A                      | $\tau \approx 40$ ms  |
|  | 30 V DC           | 7.5 A                    | --                       | $L/R \approx 3$ ms    |
|  | 110 V DC          | 0.07 A                   | --                       | $L/R \approx 3$ ms    |
|  |                   | --                       | 0.02 A                   | $\tau \approx 40$ ms  |
|  | 230 V DC          | 0.03 A                   | --                       | $L/R \approx 3$ ms    |
|  | 230 V AC          | 5 A                      | --                       | $\cos. \varphi = 0.6$ |
| --   |                   | 6 A                      | $\cos. \varphi \geq 0.4$ |                       |
| Switch type  | SAJA-BURGESS V3S  | ELAN SEK103/S/PG11K      | --                       |                       |
| Protection class   | IP 67             | IP 65                    | --                       |                       |

## 4 Dimensions

All dimensions in mm, subject to change.

### 4.1 Single valve for pipe connection type SG

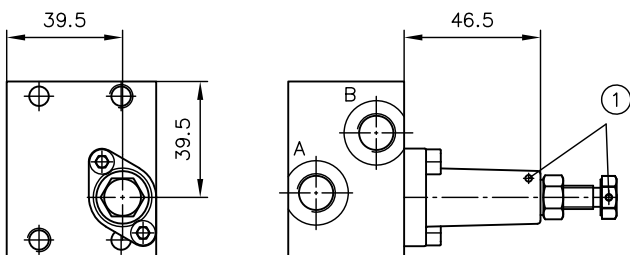
SG 0, SG 1



- 1 Circuit symbol coding N, S, R: Port B not present
- 2 M 8, 10 deep (rear side), core hole  $\varnothing 6.5$  through
- 3 M 8, 10 deep, core hole  $\varnothing 6.5$  through

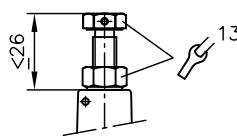
| Type | Circuit symbol Coding | a    | b    | c   | d    | h    | Ports to ISO 228-1 |       |
|------|-----------------------|------|------|-----|------|------|--------------------|-------|
|      |                       |      |      |     |      |      | P, A, B            | R     |
| SG 0 | D, E, G, W, R         | 17.5 | 38   | 9.5 | 30   | 59.5 | G 1/4              | G 3/8 |
|      | L, P, V               | 21.5 | 33,5 |     |      |      |                    |       |
| SG 1 | All circuit symbols   | 18.5 | 40   | 11  | 28,5 | 59.5 | G 3/8              | G 3/8 |

Version with pressure-limiting valve SG 0, SG 1

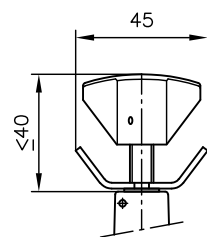


- 1 Sealing option

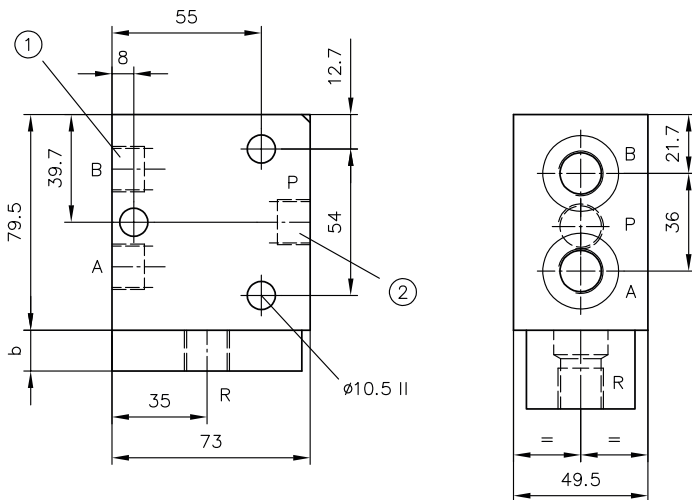
Fixed



Adjustable



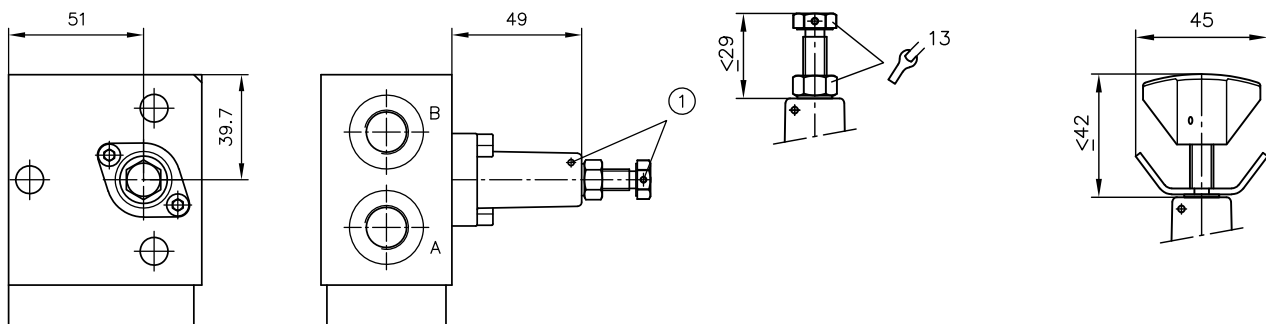
**SG 2, SG 3**



- 1 Circuit symbol coding N, S, R, U: Port B not present
- 2 Circuit symbol coding Y: Ports P and A are interchanged

| Type | Circuit symbol Coding | b  | Ports to ISO 228-1 |
|------|-----------------------|----|--------------------|
|      |                       |    | P, A, B, R         |
| SG 2 | All circuit symbols   | 15 | G 3/8              |
| SG 3 | Y                     | 29 | G 1/2              |
|      | Other circuit symbols | 15 |                    |

**Version with pressure-limiting valve SG 2, SG 3**



- 1 Sealing option

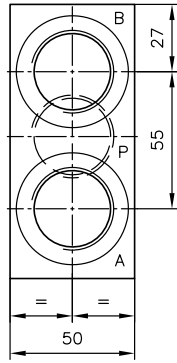
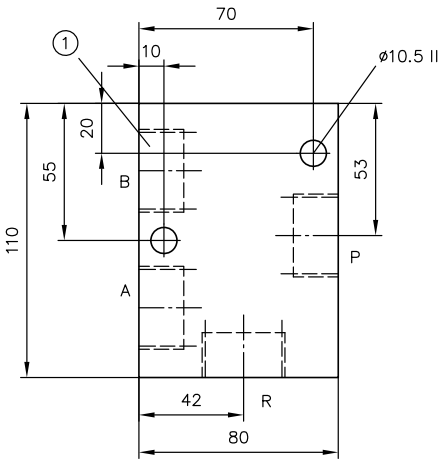


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**SG 5**



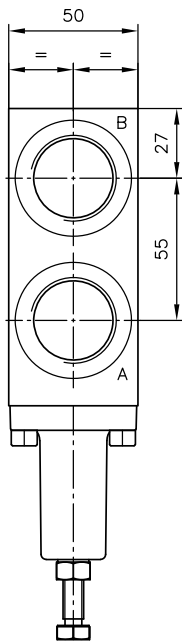
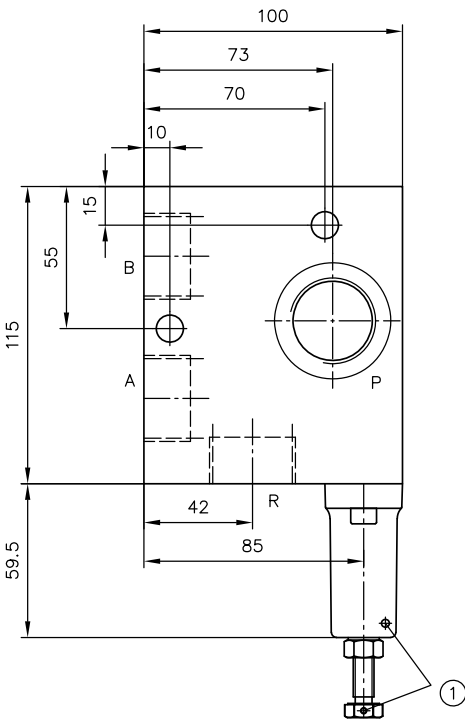
1 Circuit symbol coding N, R: Port B not present

Ports to ISO 228-1

P, A, B, R

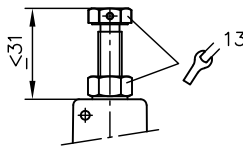
G 1

**Version with pressure-limiting valve SG 5**

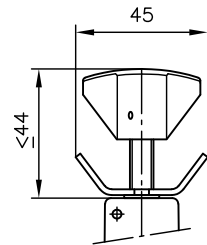


1 Sealing option

**Fixed**

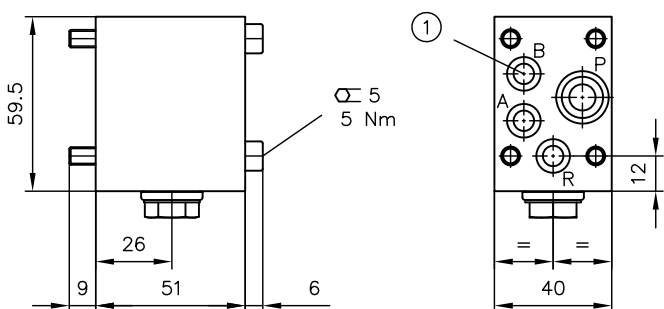


**Adjustable**

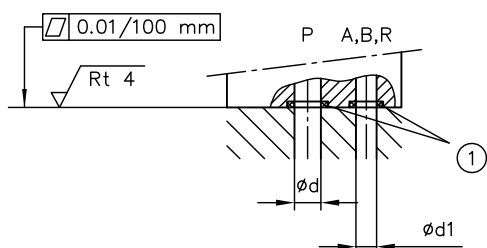


## 4.2 Single valve for manifold mounting, type SP

### SP 1

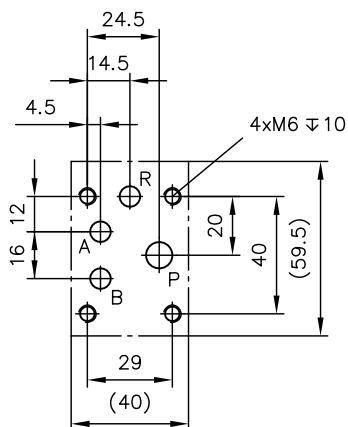


1 For circuit symbol coding N, R without port B



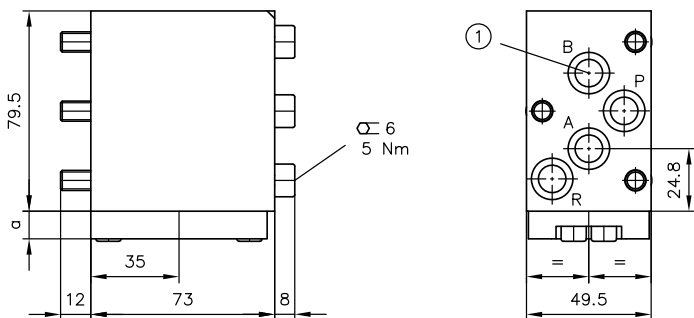
1 O-ring NBR 90 Sh

### Hole pattern of the base plate

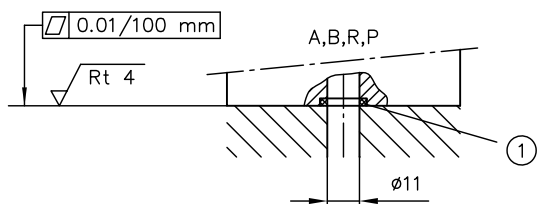


| Ports   | $\phi d$ | $\phi d1$ | O-ring |
|---------|----------|-----------|--------|
| A, B, R | --       | 7         | 8x2    |
| P       | 7 to 9   | --        | 14x2   |

### SP 3

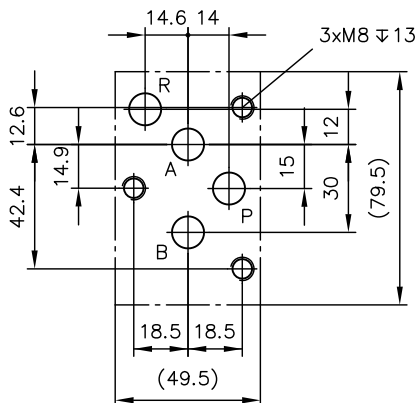


1 Circuit symbol coding N, R: Port B not present



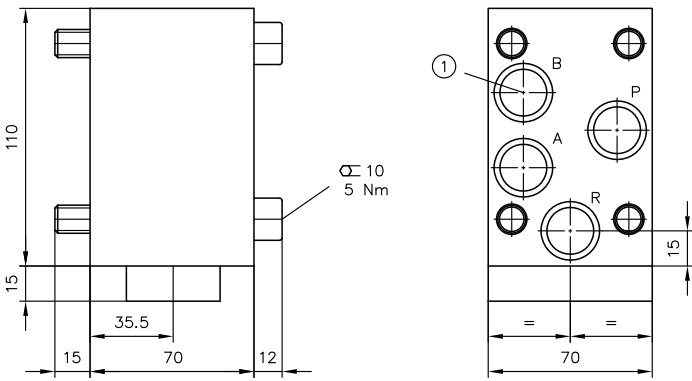
1 O-ring 12x2.5 NBR 90 Sh

### Hole pattern of the base plate



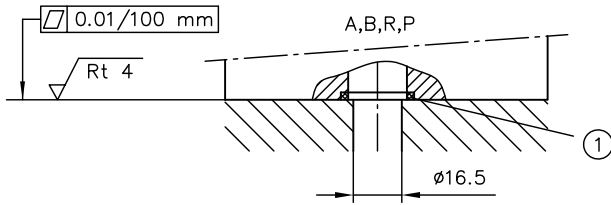
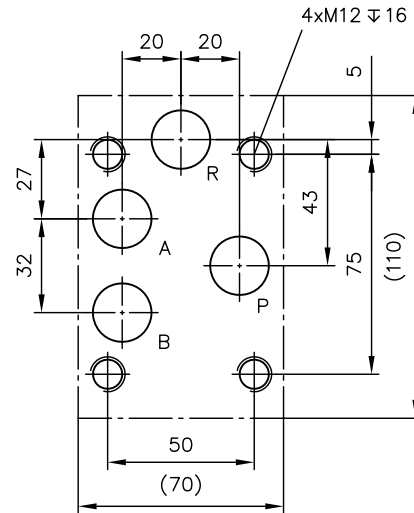
| Circuit symbol coding | a  |
|-----------------------|----|
| D, E, G, N, R, V, W   | 11 |
| L, P                  | 15 |

SP 5



1 Circuit symbol coding N, R: Port B not present

Hole pattern of the base plate



1 O-ring 20x2.5 NBR 90 Sh

## 4.3 Actuators

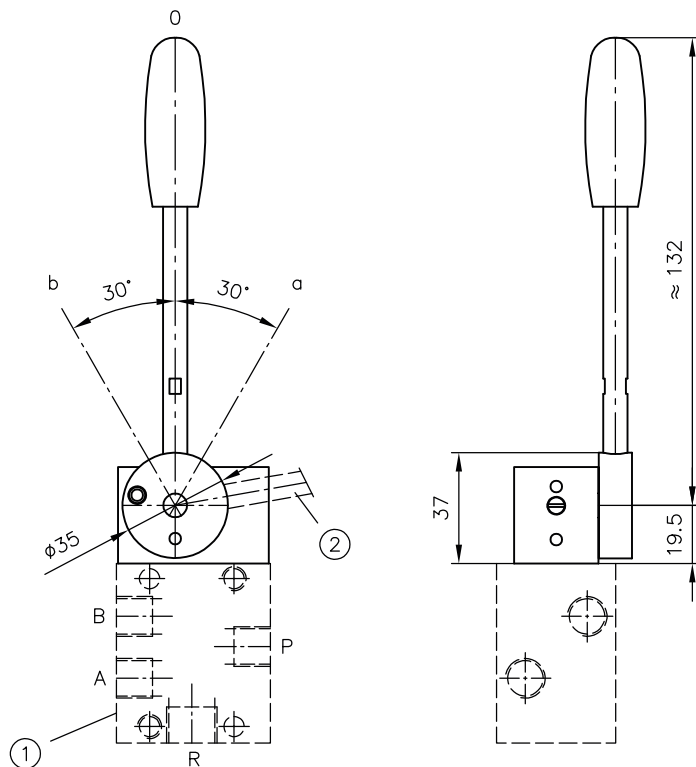
### 4.3.1 Manual actuators

**! DAMAGE**

Actuation housing can be mounted turned through 180°.

Actuation AK, AKS, CK, CKS

Size 0, 1



- 1 Flange face for directional spool valve type SP 1
- 2 Hand lever can be attached here

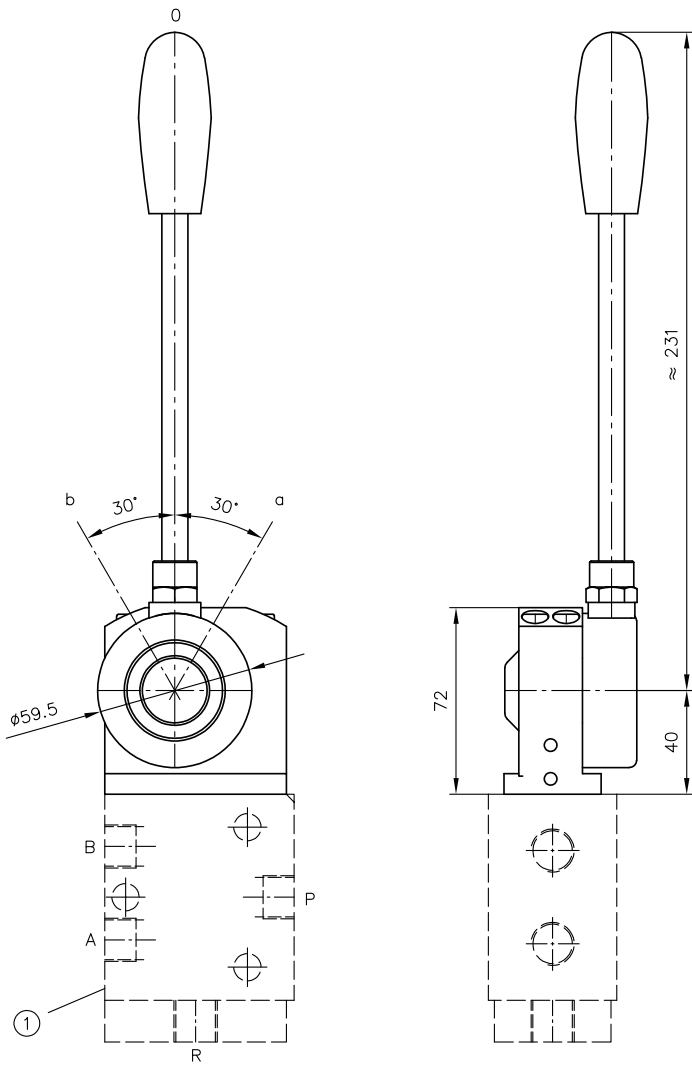


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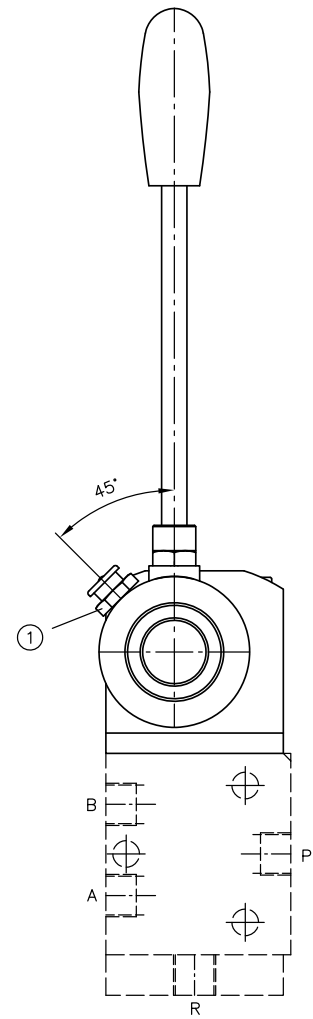
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Actuation **AK, CK**  
Size 2, 3, 5



1 Flange face for directional spool valve type SP 3, 5

Actuation **AKS, CKS**  
Size 2, 3, 5

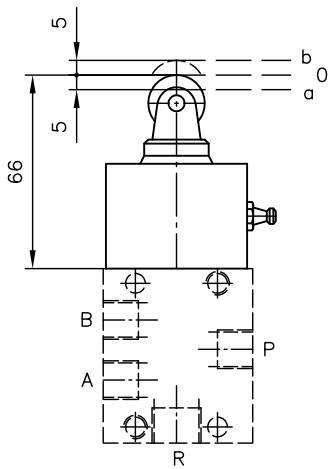


1 Flat grease nipple M10 DIN 3404 for type AKS, CKS and YKS

### 4.3.2 Mechanical actuations

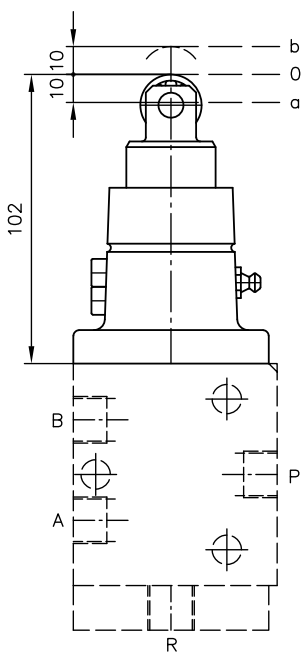
#### Actuation RE

Size 0, 1



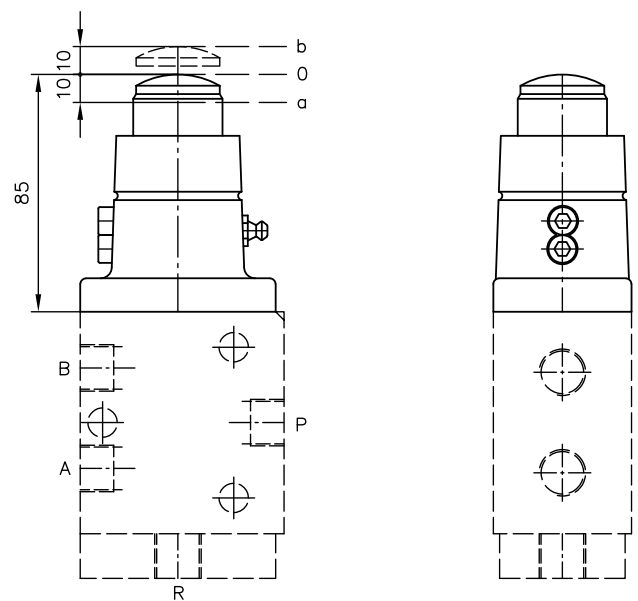
#### Actuation RE

Size 2, 3, 5



#### Actuation BE

Size 2, 3, 5



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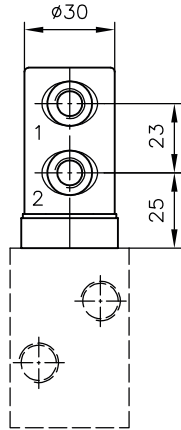
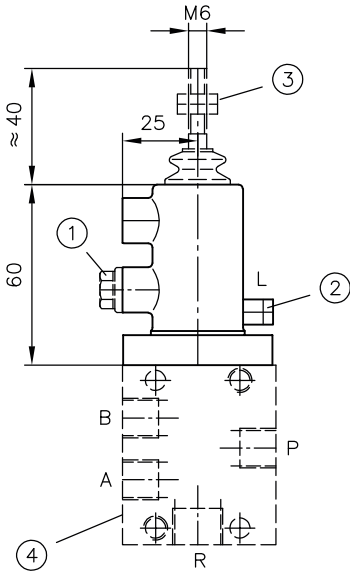
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### 4.3.3 Hydraulic and pneumatic actuations

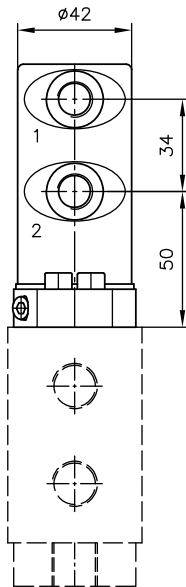
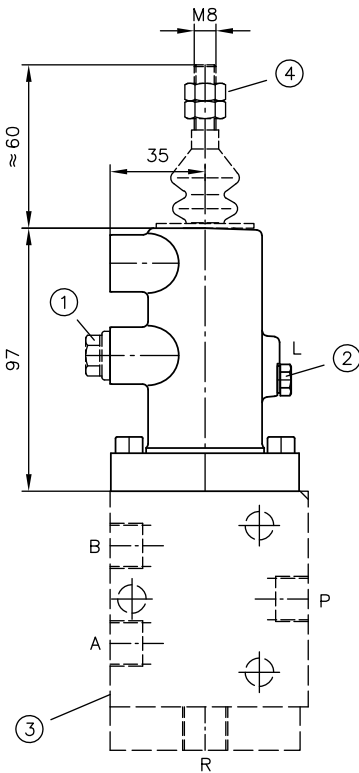
**! DAMAGE**

Actuation housing can be mounted turned through 180°.



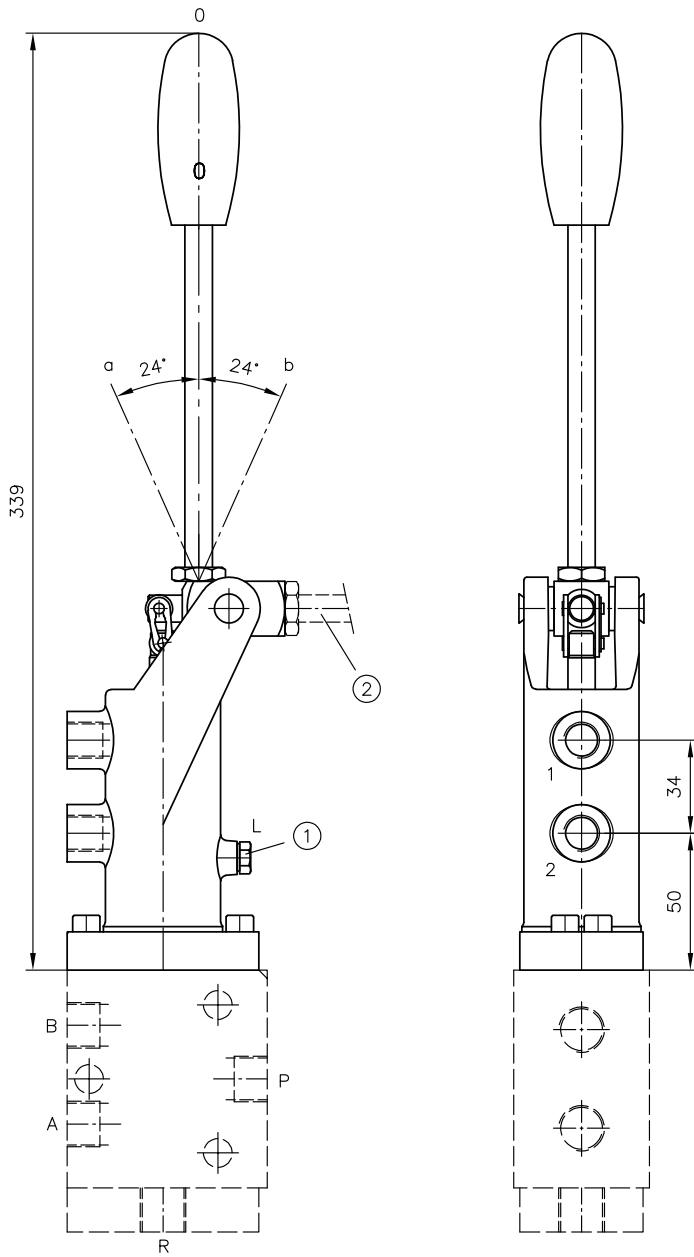
Ports to ISO 228-1

1, 2 G 1/8



Ports to ISO 228-1

1, 2 G 1/4



Ports to ISO 228-1

1, 2 G 1/4



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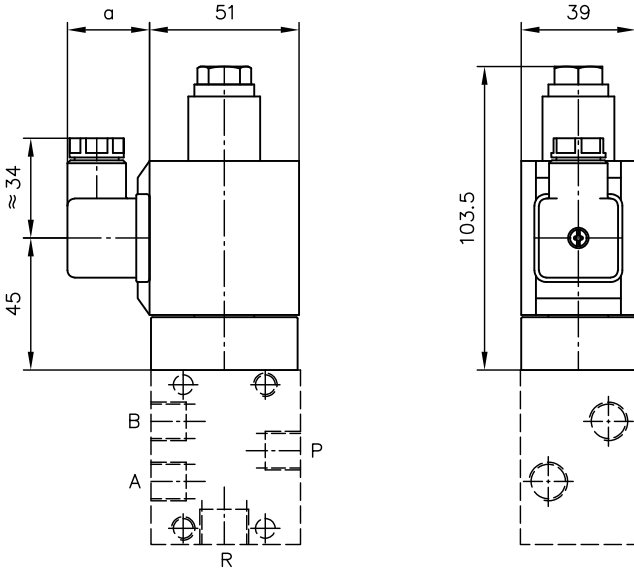
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### 4.3.4 Electrical actuations

Actuation **ME 1, 2, 8**

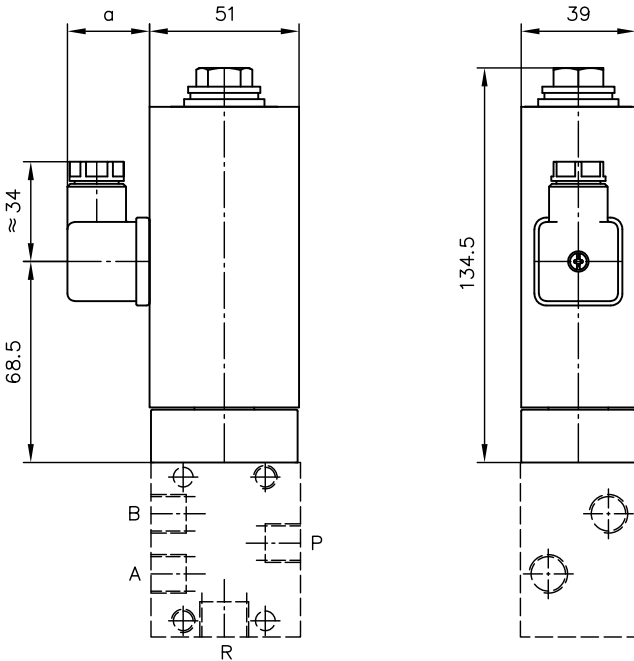
Size 0, 1



| Coding     | a  |
|------------|----|
| ME 1, ME 2 | 28 |
| ME 8       | 35 |

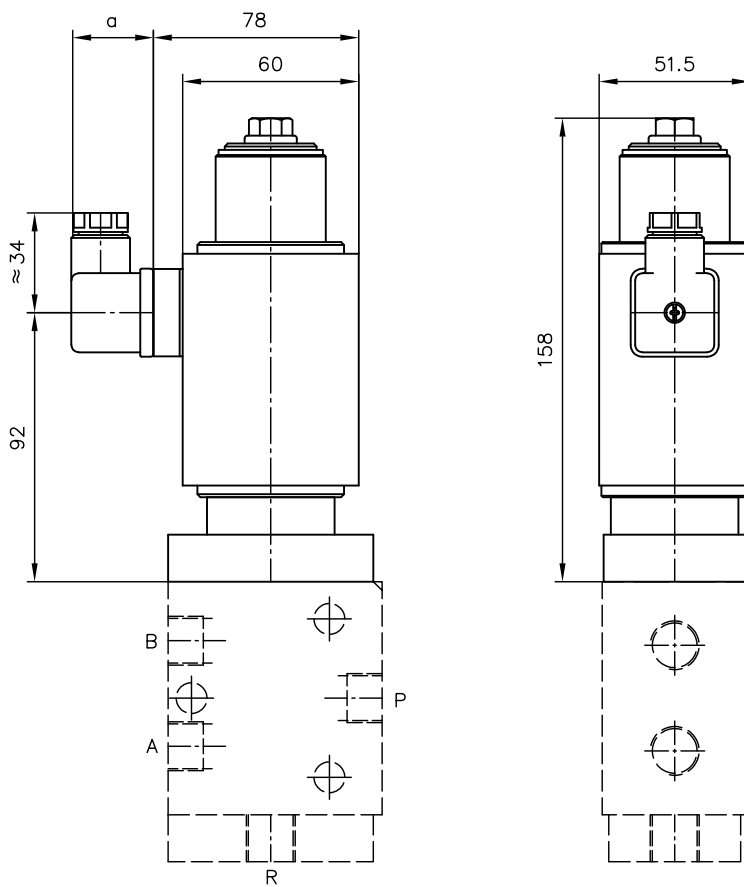
Actuation **MD 1, 2, 8**

Size 0, 1



| Coding     | a  |
|------------|----|
| MD 1, MD 2 | 28 |
| MD 8       | 35 |

Actuation ME 2/.., ME 23/..  
Size 2, 3



| Coding                                  | a  |
|---|----|
| ME 2/12, ME 2/24, ME 23/12,<br>ME 23/24 | 28 |
| ME 2/230 W, ME 23/230 W                 | 35 |

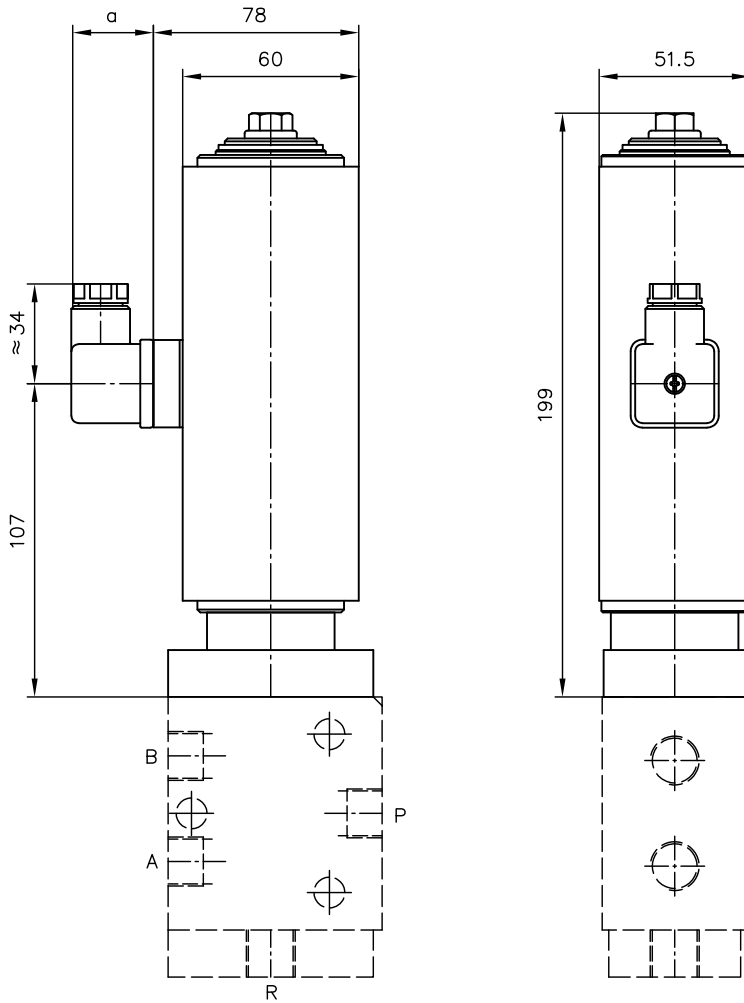


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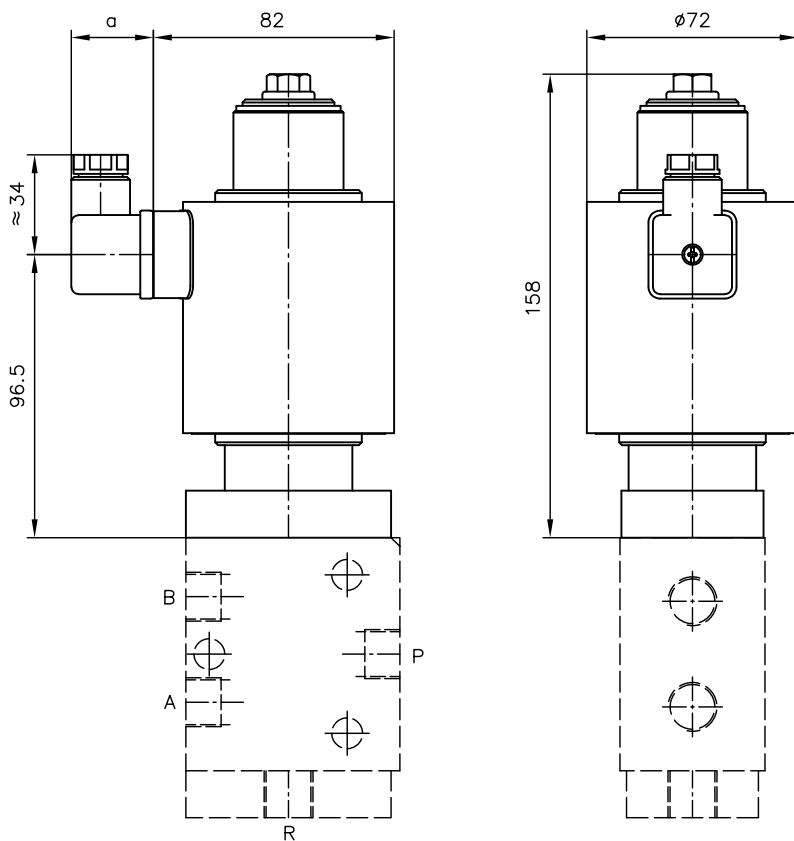
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Actuation MD 2/.., MU 2/.., MD 23/...  
Size 2, 3



| Coding   | a  |
|--|----|
| MD 2/12, MD 2/24, MD 23/12,<br>MD 23/24, MU 2/24 | 28 |
| MD 2/230 W, MD 23/230 W                          | 35 |

Actuation ME 3/..  
Size 2, 3, 5



| Coding           | a  |
|------------------|----|
| ME 3/12, ME 3/24 | 28 |
| ME 3/230 W       | 35 |

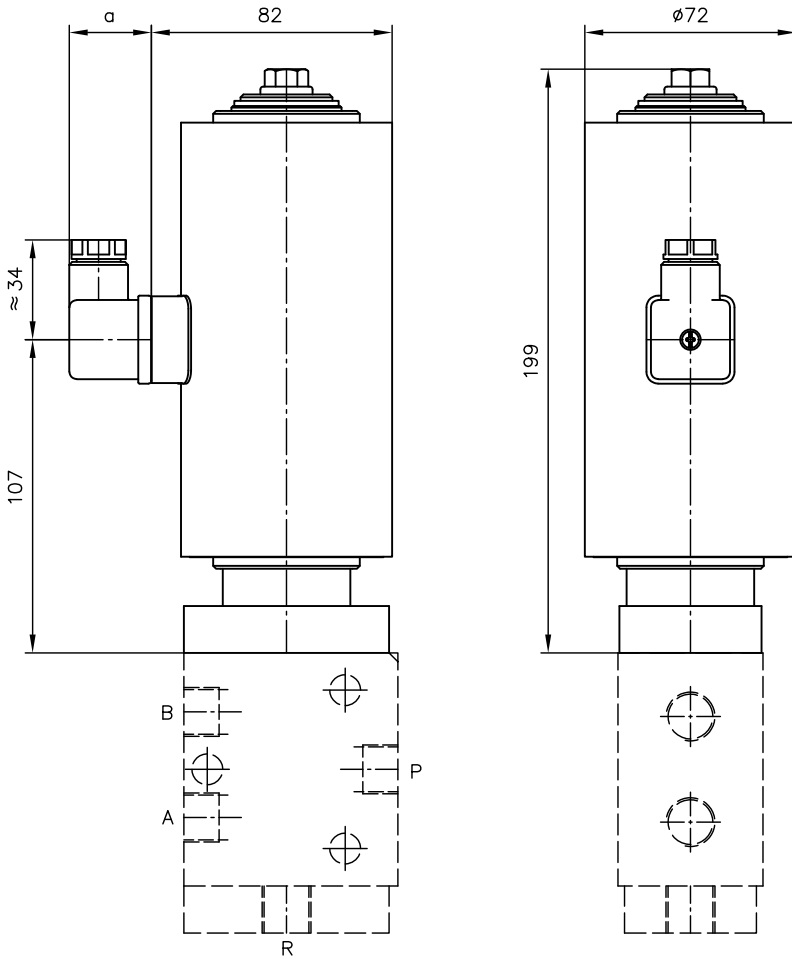


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Actuation MD 3/..  
Size 2, 3, 5



| Coding           | a  |
|------------------|----|
| MD 3/12, MD 3/24 | 28 |
| MD 3/230 W       | 35 |

**5****Installation, operation and maintenance information**

Observe the document B 5488 "General operating instructions for assembly, commissioning, and maintenance."

**5.1 Intended use**

This product is intended exclusively for hydraulic applications (fluid technology).

The user must observe the safety measures and warnings in this document.

**Essential requirements for the product to function correctly and safely:**

- ▶ All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
- ▶ The product must only be assembled and put into operation by specialist personnel.
- ▶ The product must only be operated within the specified technical parameters described in detail in this document.
- ▶ All components must be suitable for the operating conditions when using an assembly.
- ▶ The operating instructions for the components, assemblies and the specific complete system must also always be observed.

**If the product can no longer be operated safely:**

1. Remove the product from operation and mark it accordingly.
  - ✓ It is then not permitted to continue using or operating the product.

**5.2 Assembly information**

The product must only be installed in the complete system with standard and compliant connection components (screw fittings, hoses, pipes, fixtures etc.).

The product must be shut down correctly prior to disassembly (in particular in combination with hydraulic accumulators).

**DANGER****Sudden movement of the hydraulic drives when disassembled incorrectly**

Risk of serious injury or death

- ▶ Depressurise the hydraulic system.
- ▶ Perform safety measures in preparation for maintenance.



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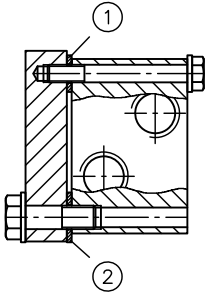
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### 5.2.1 Attachment

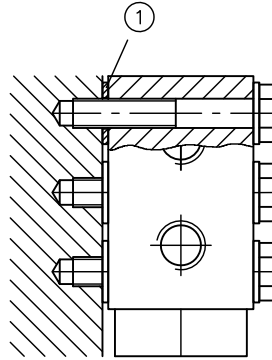
- ▶ Mount the valve on the frame or base of the machine in such a way that no stress is induced. The insertion of shim washers as packing is recommended.

#### SG 0, SG 1



- 1 Washer  
ISO 7089/7090-6,4-140 HV-A2K
- 2 Washer  
ISO 7089/7090-8,4-140 - HV-A2K

#### SG 3, SG 5



- 1 Washer  
ISO 7089/7090-10,4-140 - HV-A2K

### 5.2.2 Pipework

- ▶ All fittings used must utilise deformable seals. The recommended tightening torque values must not be exceeded.

### 5.3 Operating instructions

Observe product configuration and pressure/flow rate.

The statements and technical parameters in this documentation must be strictly observed.  
The instructions for the complete technical system must also always be followed.

#### ! DAMAGE

- Read the documentation carefully before use.
- The documentation must be accessible to the operating and maintenance staff at all times.
- Keep documentation up to date after every addition or update.

#### ⚠ CAUTION

##### Overloading components due to incorrect pressure settings.

Risk of minor injury.

- Pay attention to the maximum operating pressure of the pump and the valves.
- Always monitor the pressure gauge when setting and changing the pressure.

### Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the hydraulic component. Contamination can cause irreparable damage.

#### Examples of fine contamination include:

- Swarf
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

**! DAMAGE**

**New hydraulic fluid from the manufacturer may not have the required purity.**

Damage to the product is possible.

- ▶ Filter new hydraulic fluid to a high quality when filling.
- ▶ Do not mix hydraulic fluids. Always use hydraulic fluid that is from the same manufacturer, of the same type, and with the same viscosity properties.

Adhere to the cleanliness level of the hydraulic fluid in order to maintain faultless operation.

(Also see cleanliness level in [Chapter 3, "Parameters"](#))

Additionally applicable document: [Oil recommendations: D 5488/1](#)

## 5.4 Maintenance information

Conduct a visual inspection at regular intervals, but at least once per year, to check if the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the device surface of dust deposits and dirt at regular intervals, but at least once per year.



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## References

### Additional versions

- Directional spool valve type SAL: D 6449
- 4/2-way and 4/3-way directional control valve type SAM, SBM, SCM (size 6): D 6420
- 4/2-way and 4/3-way directional control valve type SAM, SBM, SCM (size 10): D 6421
- 4/2-way and 4/3-way directional control valve type SAM, SBM, SCM (size 12): D 6422
- Directional spool valve type SWPN: D 7451 AT
- Directional spool valve type NSWP 2: D 7451 N
- Directional spool valve type HSL: D 7493 L
- Directional spool valve type HSF: D 7493 E



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