Check valve, pilot operated

Type SV and SL

Features

▶ For subplate mounting
▶ Porting pattern according to ISO 5781-06-07-0-00 (NG10), ISO 5781-08-10-0-00 (NG20), ISO 5781-10-13-0-00 (NG32)
▶ For threaded connection
▶ For the leakage-free blocking of one actuator port
▶ Attachment possibility for directional spool valve or directional seat valve, optional
▶ With internal or external pilot oil return, optional
▶ Version with pre-opening for dampened release, optional
▶ Various cracking pressures, optional
▶ Check valve cartridge separately available
▶ Corrosion-resistant housing design, optional

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RE 21468
Edition: 2017-03
Replaces: 2017-01

Size 10, 20, and 32
Component series 4X
Maximum operating pressure 315 bar
Maximum flow 550 l/min
## Ordering code

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- **01 Check valve**
- **02 Internal pilot oil return**
  - External pilot oil return
- **03**
  - Size 10
  - Size 20
  - Size 32

### Type of connection

<table>
<thead>
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<tr>
<td>Subplate mounting</td>
<td>With pre-opening</td>
</tr>
<tr>
<td>Threaded connection</td>
<td>Without pre-opening</td>
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</table>

- **04**
  - Size 10
  - Size 20
  - Size 32

### Cracking pressure

- **06**
  - See characteristic curves (A → B), page 8 and 9

- **07** Component series 40 ... 49 (40 ... 49: unchanged installation and mounting dimensions)

- **08**
  - Without attachment possibility for directional spool or seat valve
  - With attachment possibility for directional spool or seat valve (NG6)

### Spool position monitoring

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<td>Without position switch</td>
<td>Orifice Ø0.8 mm in channel A (standard)</td>
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</tbody>
</table>
| With position switch | Orifice Ø** in channel A **

- **09**
  - No code
  - QMG24

### Orifice fitting channel A (version "6U" only)

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<tr>
<td>Orifice Ø0.8 mm in channel A (standard)</td>
<td>Channel B closed (standard)</td>
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| Orifice Ø** in channel A ** | Orifice Ø** in channel B **

### Orifice fitting channel B (version "6U" only)

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<tr>
<td>Without orifice (standard)</td>
<td>Without orifice (standard)</td>
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| Orifice Ø** in channel T ** | Orifice Ø** in channel P **

### Orifice fitting channel T (version "6U" only)

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<tr>
<td>Channel X closed (standard)</td>
<td>Channel Y closed (standard, version &quot;SV&quot; only)</td>
</tr>
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</table>
| Orifice Ø** in channel X ** | Orifice Ø** in channel XY **

### Orifice fitting channel Y

- **15**
  - Channel Y open (standard, versions "SL" and "SL...6U" only)
  - Orifice Ø** in channel XY **

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Bosch Rexroth AG, RE 21468, edition: 2017-03
Ordering code

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Seal material

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<td>FKM seals</td>
<td>V</td>
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Observe compatibility of seals with hydraulic fluid used. (Other seals upon request)

Corrosion resistance

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<td>Improved corrosion protection (240 h salt spray test according to EN ISO 9227)</td>
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<td>Pilot pressure $p_{\text{pilot}}$ from channel X</td>
<td>SO168</td>
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<td></td>
<td>Control open spool with shaft sealing (between channel X–Y and Y–A)</td>
<td>SO286</td>
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Connection thread (versions with threaded connection "G" only)

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<td>Pipe thread &quot;UNF/UN&quot; according to ANSI/ASME B 1.1</td>
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| 20 | Further details in the plain text | * |

1) Version "SL" and sizes 20 and 32 only.

2) Order example:
   ** = dimension in mm x 10 – e.g. orifice Ø1.2 mm in channel T = "T12"

Notice: Preferred types and standard units are contained in the EPS (standard price list).
Symbols

**Version “SV”** (internal pilot oil return)

**Version “SL”** (external pilot oil return)

**Version “SO168”**

**Version “SL ...6U”**

- With directional spool valve type 4WE 6 D...
- With directional spool valve type 4WE 6 Y...
- With directional seat valve type M-3SEW 6 C...
- With directional seat valve type M-3SEW 6 U...
Function, section

The isolator valve type SV/SL is a pilot operated check valve for subplate mounting or threaded connection. It is used for the leakage-free blocking of one actuator port, also in case of longer standstill times.

The valve basically consists of a housing (1), a seat poppet (2), a compression spring (3), a control spool (4) as well as of an optional pre-opening as ball seat valve (5). The seat valve can be flown through from A to B without external pilot pressure. In the opposite direction, the seat valve closes hydraulically tight.

Condition: \( p_A > p_B + \) cracking pressure (compression spring).

A sufficiently high pilot pressure at port X moves the control spool (4) in the direction of the ball seat valve (5) (version "A") and pushes the seat poppet (2) out of its seat. This allows for a free flow in both directions (active keeping open).

In order to ensure that the seat valve actively opens, the pressure ratios on both sides of the control spool (4) are just as important as the area ratios at the control spool (4) or seat poppet (2).

This results in the following available options for the types

- SV (large annulus area \( A_3 \) (8) connected with \( p_A \))
- SL (small annulus area \( A_4 \) (9))

as well as for the versions with pre-opening "A" and without pre-opening "B".

**Version "A"** (with pre-opening)

This valve is provided with an additional pre-opening. By pressurization at the X port, the control spool (4) is moved to the right. As a result, the ball (5) is pushed off the seat first and the seat poppet (2) afterwards.

**Notices:**

- **Version "A":**
  - The two-stage set-up with an increased control open ratio means even low pilot pressure can be unloaded securely.
  - Avoidance of switching shocks due to dampened decompression of the pressure volume on the actuator side.

- **Version "B":**
  - In case of valves without pre-opening, the included pressure volume may be unloaded suddenly. Resulting switching shocks may lead to premature wear on installed components, as well as noise formation.

The modification of type SV to type SL is possible by exchange of plugs (10) and (11). One of the both plugs must always be installed.

<table>
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<tr>
<th>NG</th>
<th>Plug (10)</th>
<th>Plug (11)</th>
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<tbody>
<tr>
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<td>M6</td>
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<tr>
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<td>M4</td>
<td>M6</td>
</tr>
<tr>
<td>32</td>
<td>M4</td>
<td>M6</td>
</tr>
</tbody>
</table>

6  Area \( A_1 \) (seat poppet)
7  Area \( A_2 \) (ball)
8  Area \( A_3 \) (control spool)
9  Area \( A_4 \) (control spool)
**Function, section:** Version "6U" (with built-on directional valve)

At direct operated, pilot operated check valves type SL with built-on directional valve, the control spool (4) may be controlled directly via the directional valve to open the seat poppet (2) against the system pressure, i.e. the blocking direction.

**Notice:**
When ordering the directional valve, please observe the different position of port A at versions "P" and "G" (porting pattern rotated by 180° at version "G", see pages 13 and 14).

![Diagram of check valve](attachment:image.png)

**Type SL..PB.-4X/6U...** (with pilot oil return, without pre-opening)
Technical data
(For applications outside these parameters, please consult us!)

| general |
|-------------------|-------|-------|-------|
| Sizes              | NG    | 10    | 20    | 32    |
| Weight Subplate mounting kg | 1.8   | 4.7   | 7.8   |
| Weight Threaded connection kg | 2.1   | 5.4   | 10    |
| Installation position | Any   |
| Ambient temperature range °C | ~30 ... +80 (NBR seals) | ~20 ... +80 (FKM seals) |
| MTTFd values according to EN ISO 13849 Years | 150 (for further details, see data sheet 08012) |
| Maximum storage time Months | 12 (if the storage conditions are observed; refer to the operating instructions 07600-B) |

| hydraulic |
|-------------------|-------|-------|-------|
| Maximum operating pressure bar | 315   |
| Maximum flow l/min | See characteristic curves on page 8 and 9 |
| Pilot pressure bar | 5 ... 315 |
| Hydraulic fluid | see table below |
| Hydraulic fluid temperature range °C | ~30 ... +80 (NBR seals) | ~20 ... +80 (FKM seals) |
| Viscosity range mm²/s | 2.8 ... 500 |
| Maximum admissible degree of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c) | Class 20/18/15 1) |
| Direction of flow | Free from A → B, from B → A by opening |
| Pilot volume ▶ Port X cm³ | 2.5 | 10.8 | 19.27 |
| ▶ Port Y (version “L” only) cm³ | 2.0 | 9.6 | 17.5 |
| Control areas ▶ Area A₁ cm² | 1.33 | 3.46 | 5.72 |
| ▶ Area A₂ cm² | 0.33 | 0.7 | 1.33 |
| ▶ Area A₃ cm² | 3.8 | 10.17 | 16.61 |
| ▶ Area A₄ cm² | 0.79 | 1.13 | 1.54 |

<table>
<thead>
<tr>
<th>Hydraulic fluid</th>
<th>Classification</th>
<th>Suitable sealing materials</th>
<th>Standards</th>
<th>Data sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oils</td>
<td>HL, HLP, HLDP, HVLP, HVLPD</td>
<td>NBR, FKM</td>
<td>DIN 51524</td>
<td>90220</td>
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<tr>
<td>Bio-degradable</td>
<td>Insoluble in water</td>
<td>HETG, HEES</td>
<td>FKM</td>
<td>ISO 15380</td>
</tr>
<tr>
<td></td>
<td>Soluble in water</td>
<td>HEPG</td>
<td>FKM</td>
<td>ISO 15380</td>
</tr>
<tr>
<td>Flame-resistant</td>
<td>Water-free</td>
<td>HDFU (glycol base)</td>
<td>FKM</td>
<td>ISO 12922</td>
</tr>
<tr>
<td></td>
<td>containing water</td>
<td>HDFU (ester base)</td>
<td>FKM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>containing water</td>
<td>HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)</td>
<td>NBR</td>
<td>ISO 12922</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flame-resistant – containing water:</th>
</tr>
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<tbody>
<tr>
<td>▶ Maximum pressure differential 210 bar, otherwise, increased cavitation erosion</td>
</tr>
<tr>
<td>▶ Life cycle as compared to operation with mineral oil HL, HLP 30 ... 100%</td>
</tr>
<tr>
<td>▶ Maximum hydraulic fluid temperature 60 °C</td>
</tr>
</tbody>
</table>

Important information on hydraulic fluids:
▶ For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
▶ The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.

1) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components. For the selection of filters, see www.boschrexroth.com/filter.
**Characteristic curves:** Subplate mounting (measured with HLP46, $\theta_{oil} = 40 \pm 5 ^\circ C$)

**$\Delta p-q_V$ characteristic curves**

### NG10

![Graph of characteristic curves for NG10](image)

### NG20

![Graph of characteristic curves for NG20](image)

### NG32

![Graph of characteristic curves for NG32](image)

**Cracking pressure** in bar

<table>
<thead>
<tr>
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<th>NG10</th>
<th>NG20</th>
<th>NG32</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
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</tr>
<tr>
<td>4</td>
<td>10</td>
<td>10</td>
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</table>

**Pilot pressure/load pressure characteristic curves**

**without** pre-opening

![Graph of pilot pressure/load pressure characteristic curves without pre-opening](image)

**with** pre-opening

![Graph of pilot pressure/load pressure characteristic curves with pre-opening](image)

5 Scatter range  
6 Limit value  
7 Valve poppet  
8 Pre-opening
Characteristic curves: Threaded connection (measured with HLP46, $\theta_{\text{oil}} = 40 \pm 5 ^\circ\text{C}$)

- **NG10**
  - Graph showing pressure differential in bar vs. flow in l/min.
  - Lines indicate different settings.

- **NG20**
  - Graph showing pressure differential in bar vs. flow in l/min.
  - Lines indicate different settings.

- **NG32**
  - Graph showing pressure differential in bar vs. flow in l/min.
  - Lines indicate different settings.

**Cracking pressure** in bar

<table>
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<tr>
<td>4</td>
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</table>

**Pilot pressure/load pressure characteristic curves**

- **without** pre-opening
  - Graph showing load pressure in bar vs. pilot pressure in bar.
  - Lines indicate different settings.

- **with** pre-opening
  - Graph showing load pressure in bar vs. pilot pressure in bar.
  - Lines indicate different settings.
Calculation of the pilot pressure $p_{\text{pilot}}$ depending on $p_A$ and $p_B$

**Version “A”** (with pre-opening)

Balance of forces:
- Detailed formula
  $$p_A \cdot A_1 + p_{\text{pilot}} \cdot A_3 - p_B \cdot A_2 - p_F \cdot A_1 - p_A - A_4 \cdot (A_2 - A_4) = 0$$
  $$\Rightarrow p_{\text{pilot}} = \frac{p_B \cdot A_2}{A_3} + \frac{p_F \cdot A_1}{A_3} + \frac{p_A - A_4}{A_3} \cdot p_A.$$
- Simplified formula (Assumption $p_A = 0$)
  $$p_{\text{pilot}} = \frac{1}{3} \cdot p_B + p_F.$$

$p_A^*$ Depending on the type (for type SL: $p_A^* = 0$)

$p_{\text{pilot}}$ Pilot pressure

$p_A$ Working pressure in A

$p_B$ Working pressure in B

$p_F$ Cracking pressure (spring)

$A_1 - A_4$ For areas, see sectional drawing on page 5.
Control area ratios, see page 7.

**Version “B”** (without pre-opening)

Balance of forces:
- Detailed formula
  $$p_A \cdot A_1 + p_{\text{pilot}} \cdot A_3 - p_B \cdot A_1 - p_F \cdot A_1 - p_A - A_4 \cdot (A_2 - A_4) = 0$$
  $$\Rightarrow p_{\text{pilot}} = \frac{p_B \cdot A_1}{A_3} + \frac{p_F \cdot A_1}{A_3} + \frac{p_A - A_4}{A_3} \cdot p_A.$$
- Simplified formula (Assumption $p_A = 0$)
  $$p_{\text{pilot}} = \frac{1}{3} \cdot p_B + \frac{1}{3} \cdot p_F.$$
## Dimensions: Subplate mounting
(dimensions in mm)

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For item explanations, valve mounting screws and subplates see page 15.
**Dimensions:** Threaded connection
(dimensions in mm)

Connections

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For item explanations, valve mounting screws and connection adapters see page 15.
**Dimensions:** Version "6U", subplate mounting (dimensions in mm)

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For **item explanations, valve mounting screws and subplates** see page 15.
**Dimensions:** Version "6U", threaded connection (dimensions in mm)

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</tr>
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</table>

For **item explanations, valve mounting screws and connection adapters** see page 15.
Dimensions

1 Port Y at version "SL" (closed at version "SV")
2 Name plate
3 Locking pin
4 Identical seal rings for ports
   ▶ A and B
   ▶ X and Y
5 Valve with cracking pressure version "1" and "2" (dimension L2)
6 Valve with cracking pressure version "3" and "4" (dimension L3)
7.1 6 valve mounting bores at NG32
7.2 2 valve mounting bores
8 Porting pattern according to ISO 5781
9 Version without position switch
   Tightening torque \( M_A = 40 \, \text{Nm} \) (NG10), screwed in
   - medium-strength thread locker;
   Tightening torque \( M_A = 70 \, \text{Nm} \) (NG20 and 30), screwed in
   - medium-strength thread locker;
10 Version with position switch "QMG24"
   (circuitry see page 16)
11 Directional seat valve type M-3SEW 6 ...
   (data sheet 22058)
12 Directional spool valve type 4WE 6 ...
   (data sheet 23178)
13 Porting pattern according to ISO 4401–03–02–0–05

Subplates (separate order) with porting pattern according to
ISO 5781-06-07-0-00 (NG10), ISO 5781-08-10-0-00 (NG20),
ISO 5781-10-13-0-00 (NG32) see data sheet 45100.

Valve mounting screws (separate order)

- NG10
  4 x ISO 4762 - M10 x 50 - 10.9
- NG20
  4 x ISO 4762 - M10 x 70 - 10.9
- NG32
  6 x ISO 4762 - M10 x 85 - 10.9
(at friction coefficient \( \mu_{\text{total}} = 0.14 \));
tightening torque \( M_A = 75 \, \text{Nm} \pm 10\% 
(please adjust for different surface)

Connection adapter / reducing pieces

<table>
<thead>
<tr>
<th>Material number</th>
<th>Male thread</th>
<th>Internal thread</th>
<th>Seal (separate order)</th>
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<td>R900012509</td>
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Function: "Load locking"; inlet side unloading

Function: Unlocking with external pilot pressure
(version "SO168")

Circuit examples
**Inductive position switch type QM: Electrical connection**

The electric connection is realized via a 4-pole mating connector (separate order, see page 17) with connection thread M12 x 1.

<table>
<thead>
<tr>
<th>Connection voltage:</th>
<th>24 V +30%/-15%, direct voltage</th>
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<tbody>
<tr>
<td>Admissible residual ripple:</td>
<td>≤ 10%</td>
</tr>
<tr>
<td>Load capacity:</td>
<td>Maximum 400 mA</td>
</tr>
<tr>
<td>Switching outputs:</td>
<td>PNP transistor outputs, load between switching outputs and GND</td>
</tr>
</tbody>
</table>

**Pinout:**

1  +24 V  
2  Switching output: 400 mA  
3  0 V, GND  
4  Switching output: 400 mA  

**Inductive position switch type QM: Switching logics**
Mating connectors
(dimensions in mm)

Mating connector suitable for K24 4-pole, M12 x 1
with screw connection, cable gland Pg 9.

Material no. R900031155

Mating connector suitable for K24 4-pole, M12 x 1
with screw connection, cable gland Pg 9, angled.
Housing rotatable by 4 x 90° in relation to the contact insert.

Material no. R900082899

Mating connector suitable for K24-3m 4-pole, M12 x 1
with potted-in PVC cable, 3 m long.
Line cross-section: 4 x 0.34 mm²
Core marking: 1 brown 2 white 3 blue 4 black

Material no. R900064381

For further information refer to data sheet 08006.
Further information

- Check valves, pilot operated (NG6)
- Check valves, pilot operated (NG52)
- Directional spool valve
- Directional seat valve
- Subplates
- Hydraulic fluids on mineral oil basis
- Environmentally compatible hydraulic fluids
- Flame-resistant, water-free hydraulic fluids
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)
- Reliability characteristics according to EN ISO 13849
- Hexagon socket head cap screw, metric/UNC
- Hydraulic valves for industrial applications
- Selection of filters
- Information on available spare parts

Data sheet 21460
Data sheet 21482
Data sheet 23178
Data sheet 22058
Data sheet 45062
Data sheet 90220
Data sheet 90221
Data sheet 90222
Data sheet 90223
Data sheet 08012
Data sheet 08936
Operating instructions 07600-B
www.boschrexroth.com/filter
www.boschrexroth.com/spc