Leak-Free Load-Control Valve, Size 16

Qmax = 250 l/min [66 gpm], \( p_{\text{max}} = 420 \text{ bar [6000 psi]} \)

leak-proof, two-stage hydraulic, manifold mounting

Series CINDY 16-B-P...

1 Description

Whenever large loads are to be precisely moved, placed and held, or work access platforms must maintain their position and withstand high forces, then leak-free load-control valves from the CINDY series are the right solution.

Load-control valves in this series prevent hydraulic actuators from running ahead of the available oil supply. In one valve, they combine the functions of load-holding, safety and pipe-rupture protection. Leak-free load-control valves in this series are ideally suited for use in high-pressure applications up to 420 bar (6000 psi). With a variety of optional components, the series can be extended and adapted to the requirements of the system.

2 Symbol

2.1 Manifold-mounting variants

Variant A

Influenced by return-line pressure

(pressure in A is additive to opening pilot pressure).

Variant L

Not influenced by return-line pressure

(drain line is required).

Reference: 300-P-9050100-EN-00
### General characteristics

<table>
<thead>
<tr>
<th>Description, value, unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation</td>
</tr>
<tr>
<td>Design</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Mounting method</td>
</tr>
<tr>
<td>Main ports</td>
</tr>
<tr>
<td>Tank port</td>
</tr>
<tr>
<td>Control / drain ports</td>
</tr>
<tr>
<td>Test ports</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Mounting attitude</td>
</tr>
<tr>
<td>Ambient temperature range</td>
</tr>
<tr>
<td>Surface corrosion protection</td>
</tr>
</tbody>
</table>

### Hydraulic characteristics

<table>
<thead>
<tr>
<th>Description, value, unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating pressure</td>
</tr>
<tr>
<td>Maximum pressure at the flow- or return port A</td>
</tr>
<tr>
<td>Maximum pressure at the actuator- / load port B</td>
</tr>
<tr>
<td>Maximum pressure at the pilot port X</td>
</tr>
<tr>
<td>Maximum flow rate</td>
</tr>
<tr>
<td>Flow direction</td>
</tr>
<tr>
<td>Operator type</td>
</tr>
<tr>
<td>Opening pilot ratio</td>
</tr>
<tr>
<td>Secondary pressure relief valve</td>
</tr>
<tr>
<td>Hydraulic fluid</td>
</tr>
<tr>
<td>Hydraulic fluid temperature range</td>
</tr>
<tr>
<td>Temperature rating of seals</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
4 Construction and function

The functions of the control assembly are subdivided into the following positions:

4.1 Neutral position
The load pressure and the compression spring act on the control spool in the closing direction. The valve is closed with no leakage.

4.2 Lifting (flow direction from A → B)
The pump pressure at port A opens the valve against the "light" compression spring and the load. The pilot spool and control spool move together in the opening direction. Oil flows from A → B and the valve functions as a check valve.

4.3 Lowering (flow direction from B → A)
The pilot pressure at port X acts on the pilot piston and against the control springs. The pilot spool opens. As a result, the load pressure B is discharged to port A via the metering grooves in the pilot spool. The progressive characteristic of the pre-opening phase ensures that lowering begins smoothly and without jerks.
If the pilot pressure at port X is increased, the pilot spool opens further. The change in the pressure conditions at the control spool means that it follows the pilot spool in the opening direction. The oil flows from B → A.
4.4 Types of pilot control

<table>
<thead>
<tr>
<th>Cover types / applications</th>
<th>Type “G”</th>
<th>Type “D”</th>
<th>Type “K”</th>
<th>Type “H”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder application (external pilot signal)</td>
<td>✓✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cylinder application (pilot signal from opposite line)</td>
<td></td>
<td>✓✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Motors / Winches</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Motors for slewing drives</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Explanation of symbols: ✓✓ = normal ✓ = possible × = not possible

4.4.1 Standard damping cover, type “G”

Pilot control type “G” is recommended for external control, or with low-oscillation applications. This control cover can only be damped with an inlet orifice. Stroke-dependent damping is not possible with this cover.

4.4.2 Stroke-dependent damping cover, type “D”

The type “D” cover is recommended for handling pilot signals that come from the opposite actuator line and for applications that are susceptible to oscillations. Thanks to the pilot piston’s stroke-dependent damping system, oscillation-prone applications can be started in a very stable manner. The starting pressure peak is reduced because in the starting zone the valve responds quickly to the pilot signal.

4.4.3 Stroke-dependent damping cover with metering grooves, type “K”

The stroke-dependent damping cover with metering grooves, type “K”, is recommended for applications that are susceptible to oscillations, such as hydraulic motors (e.g. winches).

4.4.4 Hydromechanical stroke-limiting cover, type “H”

With the type “H” pilot control, the stroke is limited in order to achieve a particular flow rate or speed. This reduces the valve resolution.

General:

The series-connection of the orifices allows the opening time, the closing time, the start of opening, and the full extent of opening to be matched to the requirements of the application.
4.5 Secondary pressure relief valve (SV)

To protect the actuator from overload, a version that includes a secondary pressure relief valve is available. A direct-acting pressure relief valve, type SVT or SVA, for the whole rated flow.

**IMPORTANT!:** With open-centre directional valves, make sure that the valve has an adequate flow rating. If the security seals or other security elements are removed, all Bucher Hydraulics' liabilities become null and void.

4.5.1 Direct-acting secondary pressure relief valve

Variant: SVA (B → A)

The SVA direct-acting secondary pressure relief valve is connected directly to the load port B. When the pressure setting is reached, the relief spool opens a flow path to port A, the return line connection.

The relief setting is locked and sealed with a special lock nut.

**ATTENTION!:** With body variant A, the return-line pressure is additive 1:1 to the pressure setting (see Fig. at left)! With body variant L, the spring chamber in the pressure relief valve is drained to tank, so the return-line pressure does not affect the pressure setting.

Circuit example for SVA (B → A)

for directional valves with open-centre spool

4.5.2 Direct-acting secondary pressure relief valve

Variant: SVT (B → T)

The SVT direct-acting secondary pressure relief valve is connected to the load port B. When the pressure setting is reached, the relief spool opens and creates a connection to the tank port T.

The relief setting is locked and sealed with a special lock nut.

This model is used when the open-centre spool cannot handle the full flow rate, or when the application causes the load to move.

**ATTENTION!:** In the case of a tank-line preload, the pressure is additive 1:1 to the pressure setting!

Circuit example for SVT (B → T)

for directional valves with closed-centre spool
### 4.5.3 Overview table for secondary pressure relief valves

**IMPORTANT!** Please refer to the technical design sheets 300-D-9050101 for cylinder applications and 300-D-9050102 for motor applications.

<table>
<thead>
<tr>
<th>SV variants / spool variants</th>
<th>SV variants</th>
<th>SVA ** Back-pressure dependent (CINDY 16-B-P__-S___-A)</th>
<th>SVA Back-pressure independent (CINDY 16-B-P__-S___-L)</th>
<th>SVT Back-pressure dependent (CINDY 16-B-P__-S___-A)</th>
<th>SVT *** Back-pressure independent (CINDY 16-B-P__-S___-L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder applications</td>
<td>SVA</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Directional valve spool with open centre</td>
<td></td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Directional valve spool with closed centre</td>
<td></td>
<td>×</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Motor applications *</td>
<td>SVA</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Directional valve spool with open centre</td>
<td></td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Directional valve spool with closed centre</td>
<td></td>
<td>×</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Explanation of symbols: ✓✓ = normal ✓ = possible × = not possible

**Supplements / Notes:**
- * In motor applications, to prevent cavitation at the hydraulic motor it is essential to ensure that sufficient oil is always available at the supply side under all operating conditions!
- ** Return-line pressure from line A is additive to the secondary pressure relief valve's pressure setting!
- *** Leakage/drain gallery (L) is internally connected within the body to the tank gallery (T)!
5 Performance graphs

measured with oil viscosity 33 mm²/s (cSt)

\( \Delta p = f (Q) \) Pressure drop - Flow rate characteristic

Lifting A → B

\[ \Delta p \text{ [bar (psi)]} \]

\begin{align*}
0 & \quad 10 & \quad 20 & \quad 30 & \quad 40 & \quad 50 & \quad 60 \\
5 & \quad 14 & \quad 24 & \quad 34 & \quad 44 & \quad 54 & \quad 64 \\
Q \text{ [l/min (gpm)]} & \quad (13.2) & \quad (26.4) & \quad (39.6) & \quad (52.8) & \quad (66) & \quad (79.2) \\
\end{align*}

Lowering B → A

\[ \Delta p \text{ [bar (psi)]} \]

\begin{align*}
0 & \quad 10 & \quad 20 & \quad 30 & \quad 40 & \quad 50 & \quad 60 \\
5 & \quad 14 & \quad 24 & \quad 34 & \quad 44 & \quad 54 & \quad 64 \\
Q \text{ [l/min (gpm)]} & \quad (13.2) & \quad (26.4) & \quad (39.6) & \quad (52.8) & \quad (66) & \quad (79.2) \\
\end{align*}

\( p = f (Q) \) Pressure - Flow rate characteristic

Secondary pressure relief valve SVA / SVT

\[ p_B \text{ [bar (psi)]} \]

\begin{align*}
0 & \quad 100 & \quad 200 & \quad 300 & \quad 400 & \quad 500 & \quad 600 \\
50 & \quad 140 & \quad 290 & \quad 430 & \quad 570 & \quad 720 & \quad 860 \\
Q \text{ [l/min (gpm)]} & \quad (13.2) & \quad (26.4) & \quad (39.6) & \quad (52.8) & \quad (66) & \quad (79.2) \\
\end{align*}

6 Available modules
7 Dimensions & sectional view

Example for the dimensional units:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] mm</td>
<td>mm</td>
<td>0.79</td>
</tr>
<tr>
<td>[ ] mm</td>
<td>mm</td>
<td>0.79</td>
</tr>
<tr>
<td>[ ] °</td>
<td>°</td>
<td>0.031</td>
</tr>
</tbody>
</table>

Standard damping cover type “G”
Standard damping cover type “G”
"G" 型标准减震功能盖

Hub-dependent damping cover type “D”
Hub-dependent damping cover with metering grooves type “K”
"D" 型行程相关阻尼功能盖
"K" 型行程次级阻尼功能盖，带沟槽

Hydromechanical stroke-limiting cover type “H”
Hydromechanical stroke-limiting cover type “H”
"H" 型液压行程限制功能盖

Example for the dimensional units:

<table>
<thead>
<tr>
<th>Symbol</th>
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<td>[ ] mm</td>
<td>mm</td>
<td>0.031</td>
</tr>
</tbody>
</table>

Ohne Sekundärdruckbegrenzungsventil (SVA / SVT)
Without secondary pressure relief valve (SVA / SVT)

Mit Sekundärdruckbegrenzungsventil (SVA / SVT)
With secondary pressure relief valve (SVA / SVT)

7.1 Body and control versions

Anschluss T und L sind abhängig von der Variantenauswahl
Connections T and L are depend on the variant selection

7.2 Interface drawing for mating face

Anschlussgrößen, O-Ring auf der Valve
Dimensions, O-Ring on the valve

Erforderliche Oberflächen des Gegenstücks:
Required surface of the counterpart:

Toleranzen nach:
Tolerances according to:
DIN ISO 2768-mK
8 Safety instructions

**IMPORTANT!** Designing load-control valves requires specialist technical knowledge and product knowledge. Safety applications must be verified by adequate tests to ensure safety in actual use.

8.1 Assembly / disassembly

**IMPORTANT!**

The valve may only be used for its intended purpose within its nominal rating. If you plan to use it outside the nominal rating, you must contact the valve manufacturer. The ultimate responsibility for safety in the installation and use rests with the end-machine manufacturer of the mobile application.

**IMPORTANT!**

Seal kit with the external seals is available on application.

**IMPORTANT!**

The port threads conform to DIN 3852 T1. Use screws to DIN 912, grade 12.9, to mount the valve. Tightening torques as per the manufacturer's instructions.

**IMPORTANT!**

Protect seals and flange faces from damage. The mating flange face must be of the quality specified in the data sheet! Pay attention to the port designations.

9 Application examples

9.1 Cylinder application

CINDY 16-B-P with the control version type "G"

9.2 Motor application

CINDY 16-B-P with the control version type "K"
10 Ordering code

CINDY = series
16 = size 16
B = model / version
P = manifold mounting
N = NBR (Nitrile) seals (standard)
V = FKM (Viton) seals
T = MIL (low temperature) seals
O = without mounting screws (standard)
D = incl. mtg. screws Geomet (ZL) 12.9 DIN 912
S050 = standard spool, B → A 50 l/min [13.20 gpm] *
S100 = standard spool, B → A 100 l/min [26.41 gpm] *
S150 = standard spool, B → A 150 l/min [39.61 gpm] *
S200 = standard spool, B → A 200 l/min [52.82 gpm] *
S240 = standard spool, B → A 240 l/min [63.40 gpm] *
A = influenced by return-line pressure in A
L = not influenced by return-line pressure
G… = standard damping cover
D… = stroke-dependent damping cover
K… = stroke-dependent damping cover with metering grooves
H… = hydromechanical stroke-limiting cover
... = orifice combination (is factory-defined)
(Blank) = without secondary pressure relief
SVA = secondary pressure relief valve B → A
SVT = secondary pressure relief valve B → T
... = setting of the secondary pressure relief valve
SVA 120…420 bar [1700…6000 psi]
SVT 120…420 bar [1700…6000 psi]

*) measured at 33 bar [478 psi] Δp from B → A.

11 Related data sheets

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-D-9050101</td>
<td>Technical design sheet for CINDY load-control valves in motor applications</td>
</tr>
<tr>
<td>300-D-9050102</td>
<td>Technical design sheet for CINDY load-control valves in cylinder applications</td>
</tr>
</tbody>
</table>

**IMPORTANT!:**
Additional documentation and 3D models (.stp or .igs format) can be downloaded from www.bucherhydraulics.com (LOGintern area; registration is necessary)

We also offer customised solutions. Please talk to our sales team.

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