### Counterbalance valves

#### Cartridge Valves Technical Information

**Quick reference**

<table>
<thead>
<tr>
<th>Hydraulic Vent</th>
<th>Model No.</th>
<th>Cavity</th>
<th>Description</th>
<th>Flow*</th>
<th>Pressure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP448-1</td>
<td>CP08-3L</td>
<td></td>
<td>Counterbalance Valve, Hydraulic Vent</td>
<td>20 l/min [5 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.6</td>
</tr>
<tr>
<td>CB10-HV</td>
<td>SDC10-3S</td>
<td></td>
<td>Counterbalance Valve, Hydraulic Vent</td>
<td>60 l/min [16 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.7</td>
</tr>
<tr>
<td>CP441-1</td>
<td>CP12-3S</td>
<td></td>
<td>Counterbalance Valve, Hydraulic Vent</td>
<td>115 l/min [30 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.8</td>
</tr>
<tr>
<td>CP443-1</td>
<td>CP20-3S</td>
<td></td>
<td>Counterbalance Valve, Hydraulic Vent</td>
<td>190 l/min [50 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atmospheric Vent</th>
<th>Model No.</th>
<th>Cavity</th>
<th>Description</th>
<th>Flow*</th>
<th>Pressure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB10-AV</td>
<td>SDC10-3S</td>
<td></td>
<td>Counterbalance Valve, Atmospheric Vent</td>
<td>60 l/min [16 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.10</td>
</tr>
<tr>
<td>VCB 12-CN</td>
<td>NCS12/3</td>
<td></td>
<td>Counterbalance Valve, Atmospheric Vent</td>
<td>140 l/min [37 US gal/min]</td>
<td>350 bar [5000 psi]</td>
<td>09.11</td>
</tr>
</tbody>
</table>

* Flow ratings are based on a pressure drop of 7 bar [100 psi] unless otherwise noted. They are for comparison purposes only.
### Cartridge Valves Technical Information

**Counterbalance valves**

**Quick reference**

#### Dual Counterbalance

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Cavity</th>
<th>Description</th>
<th>Flow*</th>
<th>Pressure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1EEC11-1</td>
<td>None</td>
<td>Dual-Counterbalance Valve, with Makeup Checks, Catalog HIC</td>
<td>57 l/min (15 US gal/min)</td>
<td>345 bar (5000 psi)</td>
<td>09.12</td>
</tr>
<tr>
<td>P102 686</td>
<td></td>
<td>Dual-Counterbalance Valve, with Makeup Checks, Catalog HIC</td>
<td>57 l/min (15 US gal/min)</td>
<td>345 bar (5000 psi)</td>
<td>09.12</td>
</tr>
<tr>
<td>P102 379E</td>
<td>None</td>
<td>Counterbalance Valve, Hydraulic Vent, Catalog HIC</td>
<td>20 l/min (5 US gal/min)</td>
<td>350 bar (5000 psi)</td>
<td>09.13</td>
</tr>
<tr>
<td>DCB10-HV</td>
<td>None</td>
<td>Counterbalance Valve, Hydraulic Vent, Catalog HIC</td>
<td>60 l/min (16 US gal/min)</td>
<td>350 bar (50075 psi)</td>
<td>09.14</td>
</tr>
<tr>
<td>CP441-2</td>
<td>None</td>
<td>Counterbalance Valve, Hydraulic Vent, Catalog HIC</td>
<td>115 l/min (30 US gal/min)</td>
<td>350 bar (5000 psi)</td>
<td>09.15</td>
</tr>
</tbody>
</table>

* * Flow ratings are based on a pressure drop of 7 bar [100 psi] unless otherwise noted. They are for comparison purposes only.

520L0588 • Rev DA • June 2010
Counterbalance valves

A counterbalance valve provides several functions:

• Free flow in one direction.
• Leak-free load holding.
• Protection against hydraulic line failure.
• Protection against pressure shocks caused by external forces or overrunning loads.
• Cavitation-free motion control to match speed to pump flow when a load could cause loss of control of an actuator (cylinder or motor).
• Smooth, modulated motion control when the directional valve is suddenly closed.

Motion control valves, also referred to as load holding valves, are used to control the motion of a load in the following ways:

• Prevent a load from dropping in case of hose or tube failure.
• Prevent a load from drifting caused by directional control valve spool leakage.
• Provide smooth, modulated motion when the load is in a lowering or run-away mode.
• Provide smooth, modulated motion when the directional control valve is suddenly closed.

There are two basic types of motion control valves:

• Pilot-operated, or pilot-to-open check valves will satisfy the first two of the above requirements.
• Counterbalance valves will satisfy all four of the above requirements.
Counterbalance valves will positively hold a pressurized load and will control the motion of the load based on application of a pressure signal to the pilot port. Counterbalance valves are available as individual cartridges or standard cartridge-in-body (CIB) packages.

A typical circuit application for a counterbalance valve contains a pump, directional control valve, and an actuator. Without a counterbalance valve the load will drift down due to spool leakage if the directional control valve is centered with the load raised. Additionally there is no protection against the load dropping in the event of hydraulic line failure.

Adding a counterbalance valve controls motion and provides protection against hose or tube failure. In this circuit, moving the directional control valve to the left causes the cylinder to extend, raising the load with free flow going through the check valve portion of the counterbalance valve. When the directional control valve is centered, the counterbalance valve will prevent leakage and lock the load in position. Moving the directional control valve to the right sends flow/pressure to the rod end of the cylinder. This pressure also acts to pilot open the counterbalance valve and allows the load to be lowered. Should the load cause the cylinder to run away from the pump, pilot pressure to the counterbalance valve will decrease and the counterbalance valve will modulate to match the cylinder speed to the pump flow.
The pressure required to pilot open the counterbalance valve can be calculated as follows:

\[ P = \frac{(P_s \cdot A_b) - W}{(A_b \cdot R) + A_r} \] (load retracts cylinder)

\[ P = \frac{(P_s \cdot A_r) - W}{(A_r \cdot R) + A_b} \] (load extends cylinder)

\( W = \) Load
\( P_s = \) Counterbalance valve relief setting; see below for more information
\( A_b = \) Cylinder bore area
\( A_r = \) Cylinder rod area
\( R = \) Counterbalance valve pilot ratio; see below for more information

Note that these equations are idealized and do not consider any backpressure in the circuit, which is additive to the pressure required to pilot open the check valve.

Some additional guidelines for counterbalance valve applications:

- Specify the counterbalance valve relief setting high enough to stop any motion (flow) at the maximum expected actuator pressure. Generally it is recommended to use a setting of 1.3 multiplied by the maximum load pressure.

- Use low pilot ratios (3:1 and 4.5:1) for applications where loads may vary widely. Low pilot ratios require higher pilot pressure and are less efficient but provide stable, precise control for varying loads.

- Use high pilot ratios (8:1 and 10:1) for applications where loads are relatively constant. High pilot ratio valves require lower pilot pressure, have faster response, and are more efficient, but lack stability and precision in response to varying loads.

- Do not oversize counterbalance valves. There is no pressure drop operating limit for counterbalance valves and in fact some pressure drop is required to maintain valve operation.

- Locate counterbalance valves at or near the actuator to provide maximum load holding protection in the event of hydraulic line failure.

- Do not use counterbalance valves with closed-center directional control valves. Pressure trapped between the directional control valve and the actuator can pilot the counterbalance valve open and result in undesired load motion.

- Do not use counterbalance valves with tandem-center directional control valves. Backpressure in the system can prevent the counterbalance valve from opening.
This is a pilot-operated counterbalance valve.

### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated pressure</td>
<td>350 bar [5000 psi]</td>
</tr>
<tr>
<td>Rated flow at 22 bar</td>
<td>20 l/min [5 US gal/min]</td>
</tr>
<tr>
<td>Leakage</td>
<td>10 drops/min @ 70% of crack pressure</td>
</tr>
<tr>
<td>Weight</td>
<td>0.16 kg [0.36 lb]</td>
</tr>
<tr>
<td>Pilot ratio</td>
<td>3.0, 4.5:1, 8:1</td>
</tr>
<tr>
<td>Cavity</td>
<td>CP08-3L</td>
</tr>
</tbody>
</table>

### Dimensions

- **0.875 in [22 mm]**
- **34-41 Nm [25-30 lbf ft]**
- **3/16 UNF**
- **max 52.1 [2.05]**
- **45.7 [1.80]**

### Ordering Information

- **Seals**
  - B = Buna-N
  - V = Viton
- **Housing and ports**
  - 0 = No Housing
  - 2 = AL, 1/4 BSP
  - 3 = AL, 3/8 BSP
  - 4 = AL, #4 SAE
  - 6 = AL, #6 SAE
- **Adjustment option**
  - E = External
- **CP448 - 1 - B - 65 - E - B - 150 - 45 - 040**

### Free Flow Check

- **Code x 10 = psi**
- Example: 150 = 1500 psi
- XXX = Std. setting w/no stamping

### Pressure Range

- **Pilot ratio 3.0**
  - Std. setting 69 [1000-3000]
  - Std. setting 103 [1500]
- **Pilot ratio 4.5**
  - Std. setting 103 [1500-5000]
  - Std. setting 172 [2500]
- **Pilot ratio 8.0**
  - Std. setting 172 [2500]
Cartridge Valves Technical Information
Counterbalance valves
Hydraulic Vent
CB10-HV

OPERATION

This is a pilot-operated counterbalance valve.

SPECIFICATIONS

Theoretical performance

Rated pressure 350 bar [5000 psi]
Rated flow at 22 bar [319 psi] 60 l/min [16 US gal/min]
Leakage 10 drops/min @ 70% of crack pressure
Weight 0.22 kg [0.47 lb]
Pilot ratio 1.5:1, 3:1, 4.5:1, 10:1
Cavity SDC10-3S

DIMENSIONS

mm [in]

ORDERING INFORMATION

CB10-HV-1-A-1-E-70-B-XXXX

Spring Range
For Pilot Ratio Z [1.5:1]
1 = 20-70 bar [290-1015 psi]
2 = 30-90 bar [435-1305 psi]
3 = 50-140 bar [725-2030 psi]
For Pilot Ratio A [3:1]
1 = 35-110 bar [507-1595 psi]
2 = 60-150 bar [870-2175 psi]
3 = 80-230 bar [1160-3335 psi]
For Pilot Ratio B [4.5:1]
1 = 55-180 bar [797-2610 psi]
2 = 75-240 bar [1087-3480 psi]
3 = 90-350 bar [1305-5075 psi]
For Pilot Ratio C [10:1]
1 = 90-350 bar [1305-5075 psi]

Pilot Ratio
Z = 1.5 to 1
A = 3 to 1
B = 4.5 to 1
C = 10 to 1

Adjustment type
E = external adjustment
F = tamper resistant

Body and ports
65 = Aluminium, #6 SAE
85 = Aluminium, #8 SAE
SE3B = Aluminium, 3/8” BSPP
SE4B = Aluminium, 1/2” BSPP

Body Nomenclature
No Body
SDC10-3S-65
SDC10-3S-85
SDC10-3S-SE3B
SDC10-3S-SE4B

Seals
B = Buna-N
V = Viton

Seal kit
P103 324E

This is a pilot-operated counterbalance valve.

Rated pressure 350 bar [5000 psi]
Rated flow at 22 bar [319 psi] 60 l/min [16 US gal/min]
Leakage 10 drops/min @ 70% of crack pressure
Weight 0.22 kg [0.47 lb]
Pilot ratio 1.5:1, 3:1, 4.5:1, 10:1
Cavity SDC10-3S

Cross-sectional view

Body and ports
65 = Aluminium, #6 SAE
85 = Aluminium, #8 SAE
SE3B = Aluminium, 3/8” BSPP
SE4B = Aluminium, 1/2” BSPP

Body Nomenclature
No Body
SDC10-3S-65
SDC10-3S-85
SDC10-3S-SE3B
SDC10-3S-SE4B

Seals
B = Buna-N
V = Viton

Seal kit
P103 324E
Cartridge Valves Technical Information
Counterbalance valves
Hydraulic Vent
CP441-1

OPERATION
This is a pilot-operated counterbalance valve.

SPECIFICATIONS

Theoretical performance

<table>
<thead>
<tr>
<th>psi</th>
<th>bar</th>
<th>154 SUS (33 cSt) hyd. oil @ 100° F (38°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>435</td>
<td>30</td>
<td>pilai alpen</td>
</tr>
<tr>
<td>365</td>
<td>25</td>
<td>free flow</td>
</tr>
<tr>
<td>300</td>
<td>20</td>
<td>free flow</td>
</tr>
<tr>
<td>250</td>
<td>15</td>
<td>free flow</td>
</tr>
<tr>
<td>200</td>
<td>10</td>
<td>free flow</td>
</tr>
</tbody>
</table>

DIMENSIONS

Cross-sectional view

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/16-12 UN</td>
<td>1.25 in</td>
</tr>
<tr>
<td>68-75 Nm [50-55 lbf-ft]</td>
<td></td>
</tr>
</tbody>
</table>

ORDERING INFORMATION

Seals
B = Buna-N
V = Viton

Housing and ports
0 = No Housing
4B = AL 1/2 BSP
6B = AL 3/4 BSP
10S = AL, #10 SAE
12S = AL, #12 SAE

Adjustment option
E = External adjustment

Seal kit
120335
120336

Housing P/N
CP12-35-4B/2B
CP12-35-6B/2B
CP12-35-10S/4S
CP12-35-12S/4S

Other housings available

Pilot ratio
3.0:1
4.5:1
10:1

Free flow check
Code x 10 = psi
Example: 250 = 2500 psi
XXX=Std. setting w/no stamping

Pressure range

<table>
<thead>
<tr>
<th>Pilot ratio 3.0</th>
<th>[psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = 34-103</td>
<td>[500-1500]</td>
</tr>
<tr>
<td>B = 103-207</td>
<td>[1500-3000]</td>
</tr>
<tr>
<td>Std. setting</td>
<td>69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pilot ratio 4.5</th>
<th>[psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = 34-138</td>
<td>[500-2000]</td>
</tr>
<tr>
<td>B = 103-345</td>
<td>[1500-5000]</td>
</tr>
<tr>
<td>Std. setting</td>
<td>103</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pilot ratio 10.0</th>
<th>[psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = 69-345</td>
<td>[1000-5000]</td>
</tr>
<tr>
<td>B = 172</td>
<td>[2500]</td>
</tr>
<tr>
<td>Std. setting</td>
<td>172</td>
</tr>
</tbody>
</table>

Pilot ratio

Rating pressure
350 bar [5000 psi]

Rated flow at 22 bar [319 psi]
115 l/min [30 US gal/min]

Leakage
10 drops/min @ 70% of crack pressure

Weight
0.22 kg [0.48 lb]

Pilot ratio
3.1, 4.5:1, 10:1

Cavity
CP12-3S

Free flow check

Crack pressure
Code x 10 = psi
Example: 250 = 2500 psi
XXX=Std. setting w/no stamping
Cartridge Valves Technical Information
Counterbalance valves
Hydraulic Vent
CP443-1

OPERATION
This is a pilot-operated counterbalance valve.

SPECIFICATIONS

Theoretical performance

<table>
<thead>
<tr>
<th>Pressure drop bar</th>
<th>Flow L/min</th>
<th>US gal/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>100</td>
<td>26.4</td>
</tr>
<tr>
<td>1</td>
<td>150</td>
<td>39.6</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>52.8</td>
</tr>
<tr>
<td>2</td>
<td>250</td>
<td>66.0</td>
</tr>
</tbody>
</table>

Specifications

- Rated pressure: 350 bar [5000 psi]
- Rated flow at 7 bar [100 psi]: 190 L/min [50 US gal/min]
- Leakage: 10 drops/min @ 70% of crack pressure
- Weight: 1.22 kg [2.69 lb]
- Pilot ratio: 3:1, 4.5:1, 10:1
- Cavity: CP20-3S

DIMENSIONS

Cross-sectional view

ORDERING INFORMATION

Seals
B = Buna-N
V = Viton

Housing and ports
0 = No Housing
8B = AL, 1 BSP
10B = AL, 1-1/4 BSP
16S = AL, #16 SAE
20S = AL, #20 SAE

Housing P/N
No Housing
CP20-3S-88/28
CP20-3S-108/28
CP20-3S-165/45
CP20-3S-205/45

Other housings available

Adjustment option
E = External

Pilot ratio

- Pilot ratio 3.0
  A = 34-138 [500-2000]
  B = 103-345 [1500-5000]
- Pilot ratio 4.5
  A = 34-138 [500-2000]
  B = 103-345 [1500-5000]
- Pilot ratio 10.0
  A = 69-345 [1000-5000]

Free flow check

- Cracking pressure code x 10 = psi
  Example: 100 = 1000 psi
- XXX = Std. setting w/no stamping

Pressure range

- Pilot ratio 3.0
  A = 34-138 [500-2000]
  B = 103-345 [1500-5000]
- Pilot ratio 4.5
  A = 34-138 [500-2000]
  B = 103-345 [1500-5000]
- Pilot ratio 10.0
  A = 69-345 [1000-5000]
Cartridge Valves Technical Information

Counterbalance valves

Atmospheric Vent

CB10-AV

OPERATION

This is a pilot-operated counterbalance valve with an atmospheric vent.

SPECIFICATIONS

Theoretical performance

Rated pressure 350 bar [5000 psi]
Rated flow at 22 bar [319 psi] 60 l/min [16 US gal/min]
Leakage 10 drops/min @ 70% of crack pressure
Weight 0.27 kg [0.60 lb]
Pilot ratio 1.5:1, 3:1, 4.5:1, 10:1
Cavity SDC10-3S

DIMENSIONS

Cross-sectional view

春 l/min

Specifications

Rated pressure 350 bar [5000 psi]
Rated flow at 22 bar [319 psi] 60 l/min [16 US gal/min]
Leakage 10 drops/min @ 70% of crack pressure
Weight 0.27 kg [0.60 lb]
Pilot ratio 1.5:1, 3:1, 4.5:1, 10:1
Cavity SDC10-3S

ORDERING INFORMATION

CB10-AV-1-A-1-E-70-B-XXXX

Spring Range
For Pilot Ratio Z (1.5:1)
1 = 20-70 bar [290-1015 psi]
2 = 30-90 bar [435-1305 psi]
3 = 50-140 bar [725-2030 psi]
For Pilot Ratio A (3:1)
1 = 35-110 bar [507-1595 psi]
2 = 60-150 bar [870-2175 psi]
3 = 80-230 bar [1160-3335 psi]
For Pilot Ratio B (4.5:1)
1 = 55-180 bar [797-2610 psi]
2 = 75-240 bar [1087-3480 psi]
3 = 90-350 bar [1305-5075 psi]
For Pilot Ratio C (10:1)
1 = 90-350 bar [1305-5075 psi]

Pilot Ratio
Z = 1.5 to 1
A = 3 to 1
B = 4.5 to 1
C = 10 to 1

Adjustment type
E = external adjustment
F = tamper resistant

Body and ports
60 = Cartridge only
65 = Aluminium, #6 SAE
85 = Aluminium, #8 SAE
SE3B = Aluminium, 3/8” BSPP
SE4B = Aluminium, 1/2” BSPP

Seals
B = Buna-N
V = Viton

Seal kit
P103 327E

Body Nomenclature
SDC10-3S-65
SDC10-3S-85
SDC10-3S-SE3B
SDC10-3S-SE4B

P103 326E
Cartridge Valves Technical Information

Counterbalance valves

Atmospheric Vent

VCB 12-CN

OPERATION

This is a pilot-operated counterbalance valve with an atmospheric vent.

SPECIFICATIONS

Theoretical performance

Pressure drop

26 cSt [125 SUS] hyd.oil @ 20°C [68°F]

<table>
<thead>
<tr>
<th>PSI</th>
<th>BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>15</td>
<td>105</td>
</tr>
<tr>
<td>20</td>
<td>140</td>
</tr>
</tbody>
</table>

Rated pressure: 350 bar [5000 psi]

Rated flow at 22 bar: 140 l/min [37 US gal/min]

Weight: 0.93 kg [2.05 lb]

Pilot ratio: 4.7:1, 5.9:1, 6.9:1

Cavity: NCS12/3

DIMENSIONS

mm [in]

Cross-sectional view

ORDERING INFORMATION

VCB 12-CN-2-A-SE3/8-V

Spring range

Pilot ratio A & C

1 = 25 to 140 bar [363 to 2011 psi]

2 = 70 to 250 bar [1015 to 3626 psi]

3 = 105 to 350 bar [1523 to 5076 psi]

Pilot ratio B

1 = 25 to 120 bar [363 to 1740 psi]

2 = 60 to 200 bar [870 to 2901 psi]

3 = 90 to 280 bar [1303 to 4061 psi]

Seals

Omit = Buna N

V = Viton

Seal kit

230000130

Housing P/N

No Housing

NCS12/3-5E-1/2

NCS12/3-5E-3/4

NCS12/3-5E-5/8

NCS12/3-5E-12S

To order this valve with a specific factory setting, contact your Sauer-Danfoss representative.

P103 859
Cartridge Valves Technical Information

Counterbalance valves

1EEC11

OPERATION

This valve is a dual counterbalance valve with make up checks.

SPECIFICATIONS

Theoretical performance

<table>
<thead>
<tr>
<th>psi</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>174</td>
<td>12</td>
</tr>
<tr>
<td>140</td>
<td>9</td>
</tr>
<tr>
<td>116</td>
<td>7.9</td>
</tr>
<tr>
<td>92</td>
<td>5.9</td>
</tr>
<tr>
<td>68</td>
<td>4.7</td>
</tr>
<tr>
<td>54</td>
<td>3.7</td>
</tr>
<tr>
<td>40</td>
<td>2.8</td>
</tr>
<tr>
<td>26</td>
<td>1.8</td>
</tr>
<tr>
<td>12</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Rated pressure

345 bar [5000 psi]

Rated flow at 7 bar [100 psi]

57 l/min [15 US gal/min]

Weight

2.04 kg [4.50 lb]

Pilot ratio

3:1, 4.5:1, or 10:1

Cavity

none

DIMENSIONS

mm [in]

Cross-sectional view

Free flow check cracking pressure

005 = 0.34 bar [5 psi]

015 = 1.03 bar [15 psi]

ORDERING INFORMATION

1EEC11-01-B-85-E-A- 100 - 3.0 - 005

Seals

B = Buna-N

V = Viton

Body and ports

6S = #6 SAE (T, C and V ports)

8S = #8 SAE (T, C and V ports)

Relief adjustment option

E = External adjustment

K = Knob adjustment

Pressure range

Pilot ratio 3.0

A = 34-103 bar [500-1500 psi]

Standard setting 69 bar [1000 psi]

B = 69-172 bar [1000-2500 psi]

Standard setting 103 bar [1500 psi]

C = 103-241 bar [1500-3500 psi]

Standard setting 172 bar [2500 psi]

Pilot ratio 4.5

A = 34-172 bar [500-2500 psi]

Standard setting 103 bar [1500 psi]

B = 69-241 bar [1000-3500 psi]

Standard setting 103 bar [1500 psi]

C = 103-345 bar [1500-5000 psi]

Standard setting 172 bar [2500 psi]

Pilot ratio 10.0

A = 103-345 bar [1500-5000 psi]

Standard setting 172 bar [2500 psi]

B = 103-345 bar [1500-5000 psi]

Standard setting 172 bar [2500 psi]

Free flow check cracking pressure

005 = 0.34 bar [5 psi]

015 = 1.03 bar [15 psi]
Cartridge Valves Technical Information

Counterbalance valves

Dual Counterbalance

CP448-2

OPERATION

This valve is a dual counterbalance valve. It uses two CP448-1 cartridges.

SPECIFICATIONS

Theoretical performance

<table>
<thead>
<tr>
<th>psi</th>
<th>bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>10</td>
<td>69</td>
</tr>
<tr>
<td>15</td>
<td>103</td>
</tr>
<tr>
<td>20</td>
<td>137</td>
</tr>
<tr>
<td>25</td>
<td>172</td>
</tr>
<tr>
<td>30</td>
<td>207</td>
</tr>
<tr>
<td>35</td>
<td>241</td>
</tr>
</tbody>
</table>

Rated pressure: 350 bar [5000 psi]
Rated flow at 22 bar [319 psi]: 20 l/min [5 US gal/min]
Weight: 0.78 kg [1.72 lb]
Pilot ratio: 3:1, 4.5:1, 8:1
Cavity: none

DIMENSIONS

mm [in]

Cross-sectional view

ORDERING INFORMATION

CP448-2-4S-B-0-E-8-150-4.5-040

Check crack pressure

040 = 2.8 bar [40 psi]

Crack pressure

Code x 10 = psi
Example: 050 = 500 psi

Pilot ratio

A

B

C

14-55 bar [200-300 psi]
34-117 bar [500-1700 psi]
55-207 bar [800-3000 psi]

Pressure range

41-124 bar [600-1800 psi]
69-241 bar [1000-3500 psi]
124-345 bar [1800-5000 psi]

Adjustment option

E = External

Seals

B = Buna N
V = Viton

Seal kits

120238
120239

Housing and ports

4S = AL, #4 SAE
6S = AL, #6 SAE
other housings available, consult factory

Specifications

Rated pressure 350 bar [5000 psi]
Rated flow at 22 bar [319 psi]: 20 l/min [5 US gal/min]
Weight 0.78 kg [1.72 lb]
Pilot ratio 3:1, 4.5:1, 8:1
Cavity none

Pilot ratio

B 34-117 bar 69-241 bar 103-345 bar
A 14-55 bar 41-124 bar 55-186 bar

Pressure range

[500-1700 psi] [1000-3500 psi] [1500-5000 psi]
[600-1800 psi] [1000-3500 psi] [1500-5000 psi]
[800-3000 psi] [1800-5000 psi] [1500-5000 psi]
Cartridge Valves Technical Information
Counterbalance valves
Dual Counterbalance
DCB10-HV

OPERATION
This is a dual counterbalance valve with hydraulic vent. This assembly uses the CB10-HV valve.

SPECIFICATIONS

Theoretical performance

Pilot open

Free flow

Cross-sectional view

DIMENSIONS

mm [in]

ORDERING INFORMATION

DCB10-HV-1-B-1-E-100-B-8S

Spring range
For pilot ratio Z (1.5:1)
1 = 20-70 bar [290-1015 psi]
2 = 30-90 bar [435-1305 psi]
3 = 50-140 bar [725-2030 psi]
For pilot ratio A (3:1)
1 = 35-110 bar [507-1595 psi]
2 = 60-210 bar [870-3045 psi]
3 = 80-230 bar [1160-3335 psi]
For pilot ratio B (4.5:1)
1 = 55-180 bar [797-2610 psi]
2 = 75-240 bar [1087-3480 psi]
3 = 90-350 bar [1305-5075 psi]
For pilot ratio C (10:1)
1 = 90-350 bar [1305-5075 psi]

Pilot ratio
Z = 1.5 to 1
A = 3 to 1
B = 4.5 to 1
C = 10 to 1

Check crack pressure
1 = 1 bar (14.5 psi)

Adjust type
E = External adjustment
F = Tamper resistant

Body and ports
65 = Aluminium, #6 SAE
85 = Aluminium, #8 SAE
SE3B = Aluminium, 3/8’’ BSPP
SE4B = Aluminium, 1/2’’ BSPP
S65 = Steel, #6 SAE
S65 = Steel, #8 SAE

Seals
B = Buna-N
V = Viton

Std. setting
45 = 45 bar [650 psi] Set in Spring 1 For Pilot Ratio Z
60 = 60 bar [870 psi] Set in Spring 2 For Pilot Ratio Z
70 = 70 bar [1015 psi] Set in Spring 1 For Pilot Ratio A
100 = 100 bar [1450 psi] Set in Spring 3 For Pilot Ratio Z
100 = 100 bar [1450 psi] Set in Spring 2 For Pilot Ratio A,B
175 = 175 bar [2537 psi] Set in Spring 3 For Pilot Ratio A,B
175 = 175 bar [2537 psi] Set in Spring 1 For Pilot Ratio C

Body P/N
11002669
11001779
11008008
11008009
11009171
11009170

Seal kit
11002672
11002673

Rated pressure
350 bar [5075 psi]

Rated flow at 22 bar [319 psi]
60 l/min [16 US gal/min]

Leakage
10 drops/min @ at 70% of crack pressure

Weight
0.90 kg [1.98 lb]

Pilot ratio
1.5:1, 3:0:1, 4:5:1, 10:0:1

Cavity
None

This is a dual counterbalance valve with hydraulic vent. This assembly uses the CB10-HV valve.
## Cartridge Valves Technical Information

### Counterbalance valves

### Dual Counterbalance

#### CP411-2

### OPERATION

This valve is a dual counterbalance valve. It uses two CP441-1 cartridges.

### SPECIFICATIONS

#### Theoretical performance

<table>
<thead>
<tr>
<th>psi</th>
<th>bar</th>
<th>Flow</th>
<th>US gal/min</th>
<th>154 SUS ((33 \text{ cSt})) hyd. oil @ 100°F (38°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>pilot open</td>
</tr>
<tr>
<td>5</td>
<td>34</td>
<td>435</td>
<td>10.6</td>
<td>21.1</td>
</tr>
<tr>
<td>10</td>
<td>68</td>
<td>230</td>
<td>20.7</td>
<td>31.7</td>
</tr>
<tr>
<td>15</td>
<td>102</td>
<td>185</td>
<td>29.8</td>
<td>40.2</td>
</tr>
<tr>
<td>20</td>
<td>136</td>
<td>140</td>
<td>37.9</td>
<td>51.3</td>
</tr>
<tr>
<td>25</td>
<td>170</td>
<td>95</td>
<td>46.0</td>
<td>70.3</td>
</tr>
<tr>
<td>30</td>
<td>204</td>
<td>50</td>
<td>54.1</td>
<td>89.3</td>
</tr>
<tr>
<td>35</td>
<td>238</td>
<td>0</td>
<td>62.2</td>
<td>108.3</td>
</tr>
</tbody>
</table>

#### Cross-sectional view

- Turn ccw to increase pressure setting
- Turn cw to reduce pressure setting

### DIMENSIONS

**mm \([\text{in}]\)**

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Housing and ports</th>
<th>Housing P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>10S = AL #10 SAE</td>
<td>220752</td>
</tr>
<tr>
<td>12S = AL #12 SAE</td>
<td>220753</td>
</tr>
<tr>
<td>6B = AL 3/4 BSP</td>
<td></td>
</tr>
<tr>
<td>4B = AL 1/2 BSP</td>
<td></td>
</tr>
<tr>
<td>other housings available, consult factory</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seals</th>
<th>Seal kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Buna-N</td>
</tr>
<tr>
<td>V</td>
<td>Viton</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjustment option</th>
<th>E = External adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot ratio 3.0</td>
<td>A = 34-103 ([500-1500])</td>
</tr>
<tr>
<td>Std. setting 69</td>
<td>A = 34-138 ([500-2000])</td>
</tr>
<tr>
<td>B = 103-207</td>
<td>A = 69-345 ([1000-5000])</td>
</tr>
</tbody>
</table>

| Pilot ratio 4.5   | A = 34-138 \([500-2000]\) |
| Std. setting 103  | B = 103-345 \([1500-5000]\) |
|                   | Std. setting 103 \([1500]\) |

| Pilot ratio 10.0  | A = 69-345 \([1000-5000]\) |
| Std. setting 172  | B = N/a \(2500\) |
|                   | Std. setting 172 \([2500]\) |

### Specifications

| Rated pressure | 350 bar \([5000 \text{ psi}]\) |
| Rated flow at 7 bar \([100 \text{ psi}]\) | 115 l/min \([30 \text{ US gal/min}]\) |
| Weight | 1.26 kg \([2.77 \text{ lb}]\) |
| Pilot ratio | 3:1, 4.5:1, 10:1 |
| Cavity | none |

### Free flow check

- Code x 10 = psi
- Example: 250 = 2500 psi

### Crack pressure

- Code x 10 = psi
- Example: 250 = 2500 psi

### Pilot ratio

#### Pressure range

| Pilot ratio 3.0 | A = 34-103 \([500-1500]\) |
| Std. setting 69 | A = 34-138 \([500-2000]\) |
| B = 103-207 | A = 69-345 \([1000-5000]\) |

| Pilot ratio 4.5 | A = 34-138 \([500-2000]\) |
| Std. setting 103 | B = 103-345 \([1500-5000]\) |

| Pilot ratio 10.0 | A = 69-345 \([1000-5000]\) |
| Std. setting 172 | B = N/a \(2500\) |

### CP441-2

- Cracking pressure: 00S = .34 \([5]\) 015 = 1.03 \([15]\)
- Std. setting: 69 \(1000\) A = 103 \(1500\) B = N/a \(2500\)
Counterbalance valves

Dual Counterbalance
DCB10-AV

OPERATION

This is a dual counterbalance valve with atmospheric vent. This assembly uses the CB10-AV valve.

SPECIFICATIONS

Theoretical performance

Rated pressure
350 bar [5075 psi]

Rated flow at 22 bar
60 l/min [16 US gal/min]

Leakage
10 drops/min @ at 70% of crack pressure

Weight
0.90 kg [1.98 lb]

Pilot ratio
1.5:1, 3.0:1, 4.5:1, 10.0:1

Cavity
None

DIMENSIONS

mm [in]

Cross-sectional view

ORDERING INFORMATION

DCB10-AV-1-B-1-E-100-B-8S

Body and ports

65 = Aluminium, #6 SAE
85 = Aluminium, #8 SAE
SE3B = Aluminium, 1/8" BSPP
SE4B = Aluminium, 1/2" BSPP
56S = Steel, #6 SAE
565 = Steel, #8 SAE

Seals

B = Buna-N
V = Viton

Standard setting

Body P/N

11002669
11002670
11001779
11008008
11008009
11009171
11009170

520L0588 • Rev DA • June 2010

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