KCB*
LOAD HOLDING VALVES, CARTRIDGE

KCB08    max 350 bar    30 l/min
KCB10    max 350 bar    60 l/min
KBC1S    max 350 bar    60 l/min
KBC4S    max 350 bar    150 l/min
INTRODUCTION

They control the movement of a hydraulic actuator (cylinder or motor), specifically:

- Safe locking of actuator with directional valve in idle position (or with pump stopped).
- Controlled movements of the actuator when the load is descending. Due to the presence of the pilot line, the velocity of the actuator is always due to the flow rate from the pump, even in the case of dragging load, cavitation phenomena that can cause serious accidents due to loss of control are avoided.
- They limit the maximum pressure in the service due to any shocks, overloads or abrupt maneuvers.
- They allow free rise of the load thanks to a built-in one-way valve.

FLUIDS

Mineral oil based hydraulic fluids HL (DIN 51524 part 1) or HLP (DIN 51524 part 2). The performance curves are obtained using mineral based fluid ISO VG 46 with an oil temperature of 30-40 °C.

RANGE
TEMPERATURES:
ambient
-30 to +100 °C
- 22 to +212 °F

FLUID VISCOSITY
range 10 - 500 cSt SUS
recommended 25 cSt 120 SUS

NOTE: here shown the version with variable adjustment

KCB OPERATING PARAMETERS

<table>
<thead>
<tr>
<th>MAXIMUM OPERATING PRESSURE</th>
<th>350 bar</th>
<th>5000 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOAD PRESSURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S 60 l/min</td>
<td>gpm</td>
<td></td>
</tr>
<tr>
<td>R 30 l/min</td>
<td>10.6 gpm</td>
<td></td>
</tr>
<tr>
<td>F 15 l/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U 4 l/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAVITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KCB08</td>
<td>SAE08</td>
<td></td>
</tr>
<tr>
<td>KCB10</td>
<td>SAE10</td>
<td></td>
</tr>
<tr>
<td>KCB1S</td>
<td>T11A</td>
<td></td>
</tr>
<tr>
<td>KCB4S</td>
<td>T2A</td>
<td></td>
</tr>
<tr>
<td>TEMPERATURES:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluid -30 to +100 °C</td>
<td>-22 to +212 °F</td>
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<tr>
<td>FLUID VISCOSITY</td>
<td></td>
<td></td>
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<tr>
<td>range 10 - 500 cSt SUS</td>
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<td></td>
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<tr>
<td>recommended 25 cSt 120 SUS</td>
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<td>FLUID CONTAMINATION</td>
<td></td>
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<tr>
<td>ISO 4406:1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>class 19/17/14</td>
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<td></td>
</tr>
</tbody>
</table>

Figure 1

Typical use of a counterbalance valve to control the descent of a load.

HYDRAULIC SYMBOLS

normal

vented

NOTE: here shown the version with variable adjustment
### PILOT RATIO

The quotient of the active area on the pilot line and the active area of the valve acting as a pressure limiter defines the pilot ratio $R$ of the counterbalance valve:

$$R = \frac{\text{pilot area}}{\text{relief area}}$$

With reference to Figure 1, during descent, the pressure acting on the rod side of the cylinder also acts on the pilot line (3) of the valve, aiding its opening. Load-induced pressure also pushes the cylinder downward. We call the pressure on the port (3) $P_C$, the load-induced pressure $P_r$, the setting pressure of the valve $P_{TAR}$, and the pilot ratio $R$. Neglecting back pressure, for a scheme as in Figure 1, we have that the minimum pressure required to operate the valve descent $P_r$ is:

$$P_r = \frac{P_{TAR} - P_c}{R}$$

Example:

valve set to $P_{TAR} = 350$ bar, load-induced pressure $P_c = 250$ bar, pilot ratio 4:1 ($R = 4$).

$$P_r = \frac{350 - 250}{4} = 25 \text{ bar}$$

### PRESSURE SETTING

For the pressure relief function, the valve must remain closed even when the utility is subjected to the maximum load allowed by the application ($P_{\text{max}}$).

For this purpose, it is generally required that the set pressure is at least 30% more than the pressure induced by the maximum permissible load, thus: $P_r \geq 1.3 \cdot P_{\text{max}}$

### VALVES IN NORMAL AND VENTED DESIGN

Due to the construction geometry, a normal counterbalance valve is strongly affected by back pressure at the port (2). If this pressure is not zero, then the pilot pressure in the previous example should be fixed with:

$$P_r' = P_r + P_2 \cdot \frac{R+1}{R}$$

In addition, the pressure will be relieved to an upper value that can be calculated by:

$$P_x = P_{TAR} + P_2 \cdot (R + 1)$$

If in the example above we had a back pressure of $P_2 = 20$ bar, then:

$$P_r' = 25 + 20 \cdot \frac{4 + 1}{4} = 50 \text{ bar}$$

While the valve set at 350 bar would relieve the pressure to:

$$P_x = 350 + 20 \cdot (4 + 1) = 450 \text{ bar}$$

If this is not acceptable, there is the vented version that makes the counterbalance valve completely insensitive to back pressure because the spring is vented in air. Such valves are commonly used in directional control valves with services locked in the idle position, with antishock auxiliary valves on the ports; typical use cases are:

1. Counterbalance valves operating with limited pilot pressures, or in the presence of back pressure (example: regenerative circuits or with actuators connected in series).
2. Progressive and stable opening is required in the presence of oscillating back pressure.
3. Counterbalance valves with openings piloted directly by hydraulic joystick pressure.

### AVAILABLE SETTING

Valves are supplied in various sizes, in SAE or SUN cavities. Each size currently available (SAE 08, SAE 10, SUN T11A, SUN T2A) consists of several versions (normal or vented design), with different pilot ratios, fixed or variable pressure settings, and with different $Q - \Delta P$ characteristics (from the most restrictive for particularly fine movements to the largest openings the size can allow). In the next page will follow most standards products. All the various combinations available will be included in the catalog.

For special needs, we recommend contacting HYDRECO.
KCB08 (SAE 08 cavity)

Fixed setting

Variable pressure setting

Q-ΔP characteristic

Q-ΔP chart
KCB10 (SAE 10 cavity)

Fixed setting

Variable pressure setting

Q-ΔP characteristic

Q-ΔP chart

- P 1 → 2 (full piloted flow)
- P 2 → 1 (free flow)
KCB1S (SUN T11A cavity)

Fixed setting

Variable pressure setting

Q-ΔP characteristic

Q-ΔP chart

- Q 1 → 2 (full piloted flow)
- Q 2 → 1 (free flow)
KCB4S (SUN T2A cavity)

### Fixed setting

![Fixed setting diagram]

### Variable pressure setting

![Variable pressure setting diagram]

### Q-ΔP characteristic

![Q-ΔP chart]

Q-ΔP chart

- \( P \rightarrow 2 \) (full piloted flow)
- \( P \rightarrow 1 \) (free flow)
## CARTRIDGES FOR SAE CAVITY

### KCB Model

<table>
<thead>
<tr>
<th>CAVITY</th>
<th>ADJUSTMENT</th>
<th>PILOT RATIO</th>
<th>SEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>V variable</td>
<td>3:1 (*)</td>
<td>N NBR (standard)</td>
</tr>
<tr>
<td>10</td>
<td>F fixed</td>
<td>4:1 (**)</td>
<td>V Viton</td>
</tr>
</tbody>
</table>

- **ADJUSTMENT**
  - V variable
  - F fixed

- **PILOT RATIO**
  - 3:1 (*)
  - 4:1 (**) (only for 10)
  - 8:1 (*)

- **SEAL**
  - N NBR (standard)
  - V Viton

### Pressure Setting

- Only for ratio 4:1
  - 030 to 350 bar (*)

- Only for ratio 8:1
  - 140 to 350 bar (*)
  - 030 to 350 bar (**) (only for 10)
  - 070 to 350 bar (**) (only for 08)

- **Scheme**
  - N normal

### Code Examples:

- KCB08-V070N4-F-N-1
- KCB08-V210N8-S-N-1
- KCB10-V030N3-S-N-1

## CARTRIDGES FOR SPECIAL CAVITIES

### KCB4S-Model

<table>
<thead>
<tr>
<th>CAVITY</th>
<th>ADJUSTMENT</th>
<th>PILOT RATIO</th>
<th>MAX FLOW</th>
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</thead>
<tbody>
<tr>
<td>4S</td>
<td>V variable</td>
<td>4:1</td>
<td>S max flow 120 l/min</td>
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<tr>
<td></td>
<td>F fixed</td>
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<td>X max flow 150 l/min</td>
</tr>
</tbody>
</table>

- **ADJUSTMENT**
  - V variable
  - F fixed

- **PILOT RATIO**
  - 4:1

- **MAX FLOW**
  - S max flow 120 l/min
  - X max flow 150 l/min

- **Scheme**
  - N normal

### Code Examples:

- KCB10-V030N3-N-1
- KCB10-V210N8-N-1

### Pressure Setting

- 070 to 350 bar
CARTRIDGES FOR SPECIAL CAVITIES

KCB1S- [ ] [ ] [ ] [ ] [ ] design mark

ADJUSTMENT
V variable
F fixed

CAVITY
1S SUN T11A

Pilot Ratio
3 3:1
4 4:1
8 8:1
10 10:1

MAX FLOW
H high flow 75 l/min
S max flow 60 l/min (std)
R max flow 30 l/min
F max flow 15 l/min
U max flow 4 l/min

SEAL
N NBR (standard)
V Viton

PRESSURE SETTING
— only for ratio 3 and 4
040 to 350 bar
— only for ratio 8:1
070 to 350 bar
— only for ratio 10:1
070 to 350 bar

AVAILABILITY TABLE

<table>
<thead>
<tr>
<th>scheme</th>
<th>adjustment</th>
<th>pressure range [bar]</th>
<th>max flow [l/min] (code)</th>
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<tr>
<td></td>
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<td>4 (U) 15 (F) 30 (R) 60 (S)</td>
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<tr>
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<tr>
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<tr>
<td></td>
<td>105...210</td>
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<tr>
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<td>70...210</td>
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</table>

CODE EXAMPLES:
KCB1S-V040N3-S-N-1
KCB1S-F210N8-S-N-1

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