HYDRAULIC BRAKE SYSTEM

- **Tank**
- **Pump**
- **Auxiliaries**
- **Accumulators** store energy for power off braking.
- **Emergency / Parking brake valve** controls the SAHR brake to provide emergency and parking brake functions.
- **Accumulator charging valve** ensures the pressure is available in the accumulator(s) to operate the brake(s).
- **HASR (Hydraulic Applied Spring Release)**
- **Service braking valve** provides HASR brake control to provide dynamic brake functions.
# CONTENTS

<table>
<thead>
<tr>
<th>Emergency / Parking brake valves</th>
<th>VB3-002</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service brake valves</td>
<td>VB-00E</td>
<td>11</td>
</tr>
<tr>
<td>Service brake valves + inching</td>
<td>VB-00M</td>
<td>17</td>
</tr>
<tr>
<td>Steering assist brake valves</td>
<td>VB3-010</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>VB3-020</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>VB3-012</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>VB3-022</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>VB-0B0</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>VB-0D0</td>
<td>47</td>
</tr>
<tr>
<td>Accumulator charging valves</td>
<td>VB-100</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>VB-200</td>
<td>55</td>
</tr>
<tr>
<td>Full power brake valves</td>
<td>VB-110</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>VB-220</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>VB-22E</td>
<td>71</td>
</tr>
<tr>
<td>Relay valve</td>
<td>VS</td>
<td>75</td>
</tr>
</tbody>
</table>

**OPTIONS** ...................................................................................................................................................................... 79

**INSTALLATION** ..................................................................................................................................................................... 83
Methodology:
This document is intended for manufacturers of machines that incorporate Poclain Hydraulics products. It describes the technical characteristics of Poclain Hydraulics products and specifies installation conditions that will ensure optimum operation.

This document includes important comments concerning safety. They are indicated in the following way:

- Safety comment.

This document also includes essential operating instructions for the product and general information. These are indicated in the following way:

- Essential instructions.
- General information.
- Information on the model number.
- Weight of component without oil.
- Volume of oil.
- Units.
- Tightening torque.
- Screws.
- Information intended for Poclain-Hydraulics personnel.

The views in this document are created using metric standards. The dimensional data is given in mm and in inches (inches are given in brackets in italic)
Applications
VB3-002 reverse modulator is a mechanically-controlled, three-way, graduated release pressure reducing valve.

VB3-002 valve is used for precision dosing of the output pressure (at F) proportionally to the control stroke. It is controlled via lever or pedal. Lever is usually used for controlling the parking brake (spring applied hydraulic release brake). Pedal is usually used for inching control.

Operation
When the control is idle, the output pressure (at F) is limited to the preset pressure of the valve, irrespectively of the supply pressure. When the lever or pedal is activated, the output pressure (at F) falls in proportion to the angular position of the control.

- **Lever control:**
  When the lever is in its maximum position (locked), the output pressure (at F) is zero. The control lever can be unlocked using the pushbutton (horizontal lever) or the collar (vertical lever).

- **Pedal control:**
  When the pedal is fully depressed, the output pressure (at F) is zero.
Overall dimensions of VB3-002 brake valve

### Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>See parking brake pressure (page 9)</td>
<td>M10x1 1/4</td>
<td>Output</td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M12x1.5 G1/4</td>
<td>Tank</td>
</tr>
<tr>
<td>MF *</td>
<td></td>
<td>M10x1 M12x1.5 G1/4</td>
<td>Parking brake pressure switch</td>
</tr>
</tbody>
</table>

* Option
Mechanical controls with standard valve orientation

**Horizontal auto-lock lever**

**Vertical auto-lock lever**
Hydraulic diagram and characteristic curve

Estimated maximum actuator forces

- Max. traction on T-rod for valve only
- Floor mount pedal
- Lockable pedal
- Horizontal lever
- Vertical lever

\[ F_a = 1030 \text{ N} \approx 299 \text{ lbf} \]

\[ F_b = \frac{F_a}{5} \]

\[ F_b = \frac{F_a}{8} \]

\[ F_b = \frac{F_a}{7} \]

To calculate the actuator forces for your mechanical control: please contact your Poclain Hydraulics application engineer.
### POCLAIN HYDRAULICS VB3-002

#### Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>VB3</td>
<td>002</td>
<td>00</td>
<td>00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### P3 - Parking brake pressure

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 bar</td>
<td>Without</td>
</tr>
<tr>
<td>10 bar [145 PSI]</td>
<td>2</td>
</tr>
<tr>
<td>30 bar [435 PSI]</td>
<td>A</td>
</tr>
<tr>
<td>60 bar [870 PSI]</td>
<td>5</td>
</tr>
<tr>
<td>80 bar [1 160 PSI]</td>
<td>6</td>
</tr>
<tr>
<td>100 bar [1 450 PSI]</td>
<td>7</td>
</tr>
<tr>
<td>120 bar [1 740 PSI]</td>
<td>8</td>
</tr>
<tr>
<td>125 bar [1 812 PSI]</td>
<td>T</td>
</tr>
<tr>
<td>130 bar [1 885 PSI]</td>
<td>U</td>
</tr>
<tr>
<td>135 bar [1 957 PSI]</td>
<td>V</td>
</tr>
<tr>
<td>140 bar [2 030 PSI]</td>
<td>9</td>
</tr>
<tr>
<td>145 bar [2 106 PSI]</td>
<td>W</td>
</tr>
<tr>
<td>150 bar [2 175 PSI]</td>
<td>B</td>
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### P4 - Pressure curve shape

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
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<tbody>
<tr>
<td>Linear</td>
<td>1</td>
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<tr>
<td>Bi-linear</td>
<td>2</td>
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</table>

### C1 - Control

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without pedal</td>
<td>0</td>
</tr>
<tr>
<td>Floor mount pedal</td>
<td>Plain A</td>
</tr>
<tr>
<td>Floor mount pedal</td>
<td>Metal anti-skid B</td>
</tr>
<tr>
<td>Floor mount pedal</td>
<td>Rubber anti-skid C</td>
</tr>
<tr>
<td>Floor mount pedal</td>
<td>Rubber anti-skid (lockable) F</td>
</tr>
<tr>
<td>8” Wall mount pedal</td>
<td>Aluminium anti-skid (casted) I</td>
</tr>
<tr>
<td>4” Wall mount pedal</td>
<td>Aluminium anti-skid (casted) R</td>
</tr>
<tr>
<td>Locking lever</td>
<td>Horizontal (auto-lock) M</td>
</tr>
<tr>
<td>Locking lever</td>
<td>Vertical (auto-lock) N</td>
</tr>
<tr>
<td>Locking lever</td>
<td>Vertical (manual lock) P</td>
</tr>
</tbody>
</table>

* For other operating pressures, please consult your Poclain Hydraulics application engineer.

### C2 - Pressure switch **

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
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<tbody>
<tr>
<td>Without</td>
<td>0</td>
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<tr>
<td>MF 1x parking control</td>
<td>4</td>
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### R1 - Electrical connection

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
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<tbody>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>Bare wire</td>
<td>1</td>
</tr>
<tr>
<td>Deutsch</td>
<td>3</td>
</tr>
<tr>
<td>AMP (6.3 x 0.8)</td>
<td>5</td>
</tr>
<tr>
<td>AMP Superseal</td>
<td>6</td>
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</table>

### R2 - Voltage

<table>
<thead>
<tr>
<th>Options</th>
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<tr>
<td>Without 12V DC</td>
<td>1</td>
</tr>
<tr>
<td>24V DC</td>
<td>2</td>
</tr>
</tbody>
</table>

### R3 - Hydraulic connection

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without ISO 1179-1 (BSPP + spot face » ports) G1/4</td>
<td>3</td>
</tr>
<tr>
<td>ISO 9974-1 (metric + spot face » ports) M14x1.5</td>
<td>4</td>
</tr>
<tr>
<td>ISO 6149 (metric + cone » ports) M14x1.5</td>
<td>8</td>
</tr>
<tr>
<td>ISO 11926-1 (SAE J514 fittings with O-ring) 9/16-18 UNF-2B</td>
<td>A</td>
</tr>
</tbody>
</table>

### S1 - S4 Options (See page 79)

<table>
<thead>
<tr>
<th>Options</th>
<th>( T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>Special calibration</td>
<td>1</td>
</tr>
<tr>
<td>Specific port *</td>
<td>2</td>
</tr>
<tr>
<td>Customized component *</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical control adaptation *</td>
<td>4</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>8</td>
</tr>
<tr>
<td>Pedal back abutment</td>
<td>9</td>
</tr>
<tr>
<td>Circuit pressurization *</td>
<td>B</td>
</tr>
<tr>
<td>Additional check valve</td>
<td>C</td>
</tr>
<tr>
<td>Special painting</td>
<td>D</td>
</tr>
<tr>
<td>Pedal position sensor</td>
<td>F</td>
</tr>
<tr>
<td>Lever with rubber protection</td>
<td>H</td>
</tr>
<tr>
<td>Customized name plate</td>
<td>P</td>
</tr>
<tr>
<td>Horizontal valve/pedal position (line back of the valve » top of pedal)</td>
<td>L</td>
</tr>
<tr>
<td>Horizontal valve/pedal position (with line back of the valve » top of pedal)</td>
<td>M</td>
</tr>
</tbody>
</table>

* For other operating pressures, please consult your Poclain Hydraulics application engineer.

### ** Limitations

- Pressure rise: \(< 1 \text{ bar [14.5 PSI] / ms}\)
- Current: min. 100 mA to assure contact; max. 4 A for Resistor load; max. 2.5 A for Inductive load
- Voltage: max. 42 V

15/10/2019
Applications
The VB-00E is a reverse modulating electrically or electrically/manually operated brake valve for Spring Applied Hydraulically Released (SAHR) brake. The VB-00E brake valve is a 3-way / 2-position electro-valve and includes a pressure reducing valve as well as selector.

Operation
When valve is not operated, output pressure (X) is limited to the preset max. pressure of the valve independently from the input pressure.

VB-00E has two principles of operation:

1. Electric actuation
   VB-00E has fixed output pressure preset by the pressure reducing valve. When the VB-00E is not actuated (when electric control =0) the output (X) is directly connected to the tank (T) and provide a pressure equal to zero. SAHR brake is applied. When VB-00E is electrically actuated (electric control =1) the output (X) is connected to the output of the pressure reducing valve: VB-00E provides the preset fixed pressure. SAHR brake is released.

2. Electric with mechanical actuation
   In this configuration, the pressure reducing valve provides an output pressure proportional to the mechanical command position.
   When VB-00E is not actuated (when electric control=0) the output (X) is directly connected to the tank (T) and provide a pressure equal to 0; SAHR brake is applied.
   When is electrically actuated (when electric control=1) the output (X) is connected to the output of the pressure reducing valve. Therefore, VB-00E supplies a precise output pressure inversely proportional to the mechanical command stroke; the output pressure (X) decreases from the max. preset pressure (control released, brake released) to 0 (control actuated, brake applied).
Overall dimensions of VB-00E brake valve

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3 046]</td>
<td>M14x1.5</td>
<td>Input</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>See parking brake pressure (page 15)</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M12x1.5</td>
<td>Tank</td>
<td>3 [6.61]</td>
</tr>
<tr>
<td>MX *</td>
<td></td>
<td>Parking brake pressure switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Option
Mechanical controls with standard valve orientation

**Horizontal lever**

![Horizontal lever diagram]

**Vertical lever**

![Vertical lever diagram]
Wall mount pedal
Hydraulic diagram and characteristic curve

Estimated maximum actuator forces

- Max. traction on T-rod for valve only
- Standard pedal
- Lockable pedal
- Horizontal lever
- Vertical lever

To calculate the actuator forces for your mechanical control: please contact your Poclain Hydraulics application engineer.

Model code

<table>
<thead>
<tr>
<th>P3 - Parking brake pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 bar [145 PSI]</td>
</tr>
<tr>
<td>20 bar [290 PSI]</td>
</tr>
<tr>
<td>30 bar [435 PSI]</td>
</tr>
<tr>
<td>40 bar [580 PSI]</td>
</tr>
<tr>
<td>60 bar [870 PSI]</td>
</tr>
<tr>
<td>100 bar [1450 PSI]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C1 - Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without lever</td>
</tr>
<tr>
<td>Actuation not possible; fixed calibration</td>
</tr>
<tr>
<td>Locking lever</td>
</tr>
<tr>
<td>Vertical (up to 30 bar [435 PSI])</td>
</tr>
<tr>
<td>Pedal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C2 - Pressure switch**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
</tr>
<tr>
<td>On MX (parking brake pressure)</td>
</tr>
</tbody>
</table>

For other operating pressures, please consult your Poclain Hydraulics application engineer.

**Limitations

Pressure rise < 1 bar [14.5 PSI] / ms
Current min. 100 mA to assure contact max. 4 A for Resistor load max. 2.5 A for Inductive load
Voltage max. 42 V

ISO 11926-1 (metric + spot face » ports) M14x1.5
ISO 9974-1 (metric + spot face » ports) M14x1.5
(SAE J514 fittings with O-ring) 9/16-18 UNF-2B

R1 - Electrical connection
Bare wire 1
Packard 2
Deutsch 3
Hirschmann 4
AMP 5

R2 - Supply voltage
12 V DC (max. amp. 1.5 A) 1
24 V DC (max. amp. 0.8 A) 2

R3 - Hydraulic connection
ISO 9974-1 (metric + spot face » ports) M14x1.5
(SAE J514 fittings with O-ring) 9/16-18 UNF-2B

S1 - S4 Options (See page 79)
Special calibration * 1
Specific port * 2
Customized component * 3
Mechanical control adaptation * 4
Improved watertightness A
Ports oriented to the right (east) E
Ports oriented to the left (west) W

* Please consult your Poclain Hydraulics application engineer.
The VB-00M is a fail-safe park brake management valve, designed to comply with the EU regulation 2015/68 for self-propelled AG machine equipped with spring applied hydraulically released (SAHR) park brake. It is an electrical ON/OFF valve with manual hand pump to release the park brake and tow the machine in case of breakdown.

Operation
The VB-00M has two principles of operation:

1. Electric actuation (normal operation)
   The VB-00M is operated by two solenoids with a spool detent assembly. It allows the change of spool position applying a short-time pulse. A pulse on “a” solenoid will release the park brake and a pulse on “b” solenoid will apply the brake.
   The valve is also available with single solenoid.

2. Manual actuation (vehicle breakdown event)
   Release of the brakes is achieved manually by pumping. Lock nut of the tap should be loosen and then fully closed. This allows towing a machine to the desired place for service. Tap needs to be kept opened to apply the brake and lock nut tightened. After the service the machine can be used normally again.

Do not remove rubber film placed over lever of the manual pump in normal operation. Remove it only in case of vehicle breakdown event.

Dedicated software
The VB-00M is meant to be used with an ECU to achieve the right level of safety and be compliant with the 2015/68 regulation. The valve management “software component” is available with the Poclain Hydraulics range of ECU.

See technical catalogue N° A51874K for further information.
Overall dimensions of VB-00M brake valve

* Working stroke to pressurize (max. 10cc per stroke).

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection ISO 1179-1</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>250 [3 625]</td>
<td>G 3/8</td>
<td>Pressure supply</td>
</tr>
<tr>
<td>A</td>
<td>207 [3 000]</td>
<td></td>
<td>Accumulator (optional)</td>
</tr>
<tr>
<td>X1</td>
<td>250 [3 625]</td>
<td></td>
<td>Park brake circuit 1</td>
</tr>
<tr>
<td>X2</td>
<td>250 [3 625]</td>
<td></td>
<td>Park brake circuit 2</td>
</tr>
<tr>
<td>Z1</td>
<td>207 [3 000]</td>
<td>G 3/8</td>
<td>Park brake circuit 1 via an external shuttle valve</td>
</tr>
<tr>
<td>Z2</td>
<td>207 [3 000]</td>
<td></td>
<td>Park brake circuit 2 via an external shuttle valve</td>
</tr>
<tr>
<td>MP</td>
<td>250 [3 625]</td>
<td></td>
<td>Pressure supply measurement port or Accumulator (optional)</td>
</tr>
<tr>
<td>T</td>
<td>3 [43.5]</td>
<td></td>
<td>Drain line</td>
</tr>
<tr>
<td>MA</td>
<td>207 [3 000]</td>
<td>G 1/4</td>
<td>Auxiliary release pressure measurement point</td>
</tr>
<tr>
<td>F</td>
<td>250 [3 625]</td>
<td></td>
<td>Flushing</td>
</tr>
<tr>
<td>MX</td>
<td>250 [3 625]</td>
<td></td>
<td>Pressure switch 100 bar [1 450 PSI], normally open</td>
</tr>
</tbody>
</table>

3.8 [8.38] (single solenoid) or 4.3 [9.48] (dual solenoid)
Hydraulic schemes

**Standard piloting, max. 30 bar [435 PSI] SAHR brake**

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
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<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>M</td>
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<td></td>
<td></td>
<td>C</td>
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<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Port P is connected to the charge pump.

Ports X1/X2 are connected to the park brake.

* Integrated shuttle valve

**2015/68 compliant, max. 30 bar [435 PSI] SAHR brake**

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
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</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>M</td>
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<td>0</td>
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<td></td>
<td></td>
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<td>S</td>
<td>U</td>
<td>4</td>
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</tbody>
</table>

Port P is connected to the charge pump.

Ports Z1/Z2 are connected to the park brake via a shuttle valve installed next to it.

Ports X1/X2 are connected to the park brake.

12V pulse on “a” solenoid to release, pulse on “b” solenoid to apply the park brake.

* Integrated shuttle valve

**Standard piloting, max. 120 bar [1740 PSI] SAHR brake**

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>M</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td></td>
<td>T</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>6</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Port P is connected to the auxiliary pump.

Ports X1/X2 feeds a PR3 pressure reducing valve that feeds the park brake.

* Integrated shuttle valve

**2015/68 compliant, max. 120 bar [1740 PSI] SAHR brake**

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>0</td>
<td>0</td>
<td>M</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>U</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Port P is connected to the pump.

Ports Z1/Z2 are connected to the park brake via a shuttle valve installed next to it.

Ports X1/X2 feeds a VB3-002 pressure modulating valve that feeds the park brake.

Port MP is connected to an accumulator.

12V pulse on “a” solenoid to release, pulse on “b” solenoid to apply the park brake.
Model code

<table>
<thead>
<tr>
<th>Model Code</th>
<th>( V )</th>
<th>( B )</th>
<th>( 00 )</th>
<th>( M )</th>
<th>( 0 )</th>
<th>( 1 )</th>
<th>( 2 )</th>
<th>( 3 )</th>
<th>( 0 )</th>
<th>( 1 )</th>
<th>( 2 )</th>
<th>( 3 )</th>
<th>( 4 )</th>
</tr>
</thead>
</table>

- **F3 - Parking brake control**
  - Electric + manual hand pump
  - M

- **P1 - Back pressure**
  - Without
  - 4 bar [58 PSI]
  - D

- **P3 - Max. operating pressure**
  - 30 bar [435 PSI]
  - A
  - 120 bar [1740 PSI]
  - 8

- **Q1 - Max. flow (P to F)**
  - 20 l/min [5.28 GPM]
  - 3

- **Q2 - Restrictor on port P**
  - Without
  - 0.5 mm [0.02 in]
  - S

- **C1 - Control**
  - Single solenoid + spring
  - T
  - Dual solenoid + mechanical lock
  - U

- **C2 - Pressure switch**
  - Without
  - 0
  - On MX
  - 4

- **R1 - Electrical connection**
  - Without
  - 0
  - Deutsch + AMP superseal
  - 6

- **R2 - Supply voltage**
  - 12 V DC
  - 1
  - 24 V DC
  - 2

- **R3 - Hydraulic connection**
  - ISO 1179-1
  - (BSPP + spot face » ports)
  - 3

- **S1 - S4 Options** (See page 79)
  - Without option
  - 0
  - Specific setting or flow
  - 1
  - Specific port
  - 2
  - Customized components
  - 3
  - Additional check valve
  - 6
  - Customized name plate (ID)
  - P
  - Shuttle valve
  - C
  - Special painting
  - D
Applications
VB3-010 modulating brake valve is a mechanically-controlled, three-way, graduated release pressure reducing valve. VB3-010 valve is used for the precision dosing of the output pressure (at F) proportionally to the angular displacement of the pedal, and therefore to the force applied to the pedal. This provides the feeling of braking.
In a braking circuit, VB3-010 is usually associated with the VB-100 single-circuit accumulator charging valve (or a VB-200 dual-circuit accumulator charging valve if VB3-010 is also associated with a VB3-002 emergency / parking brake valve).

Operation
When pedal is at rest (‘up’ position), the output pressure (at F) is zero and brake receptors are connected to tank (F to T).
When pedal is depressed, output pressure (at F) increases proportionally to the angular displacement of the pedal.
When pedal is fully depressed, output pressure (at F) is limited to the preset pressure of the valve irrespective of the supply pressure.
Overall dimensions of VB3-010 brake valve

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>250 [3626]</td>
<td>M14x1.5</td>
<td>Input</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>120 [1740]</td>
<td>M10x1</td>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>T *</td>
<td>1 [14.5]</td>
<td>M12x1.5</td>
<td>Tank</td>
<td>1 [2.20]</td>
</tr>
<tr>
<td>MF **</td>
<td>M10x1</td>
<td>Service brake pressure switch</td>
<td>Service brake pressure switch</td>
<td></td>
</tr>
</tbody>
</table>

* Available upon request = T > 3bar, design available to protect line (pressure peaks) and as consequence increased time to release brake, F -> T flow limitation.

** Option
Horizontal valve mechanical control

Floor mount pedal

Wall mount pedal

Rubber anti-skid pedal

Aluminium anti-skid (casted) pedal
Hydraulic diagram and characteristic curve

Estimated maximum actuator forces according to output pressure

• Force on pedal (Fa): \( Fa (\text{daN}) \approx 0.5 \times \text{max. output pressure (bar)} + 5 \)
• Force on pedal (Fb): \( Fb (\text{daN}) \approx \frac{Fa}{6} \)

To obtain the forces in lbf, convert the final result.
POCLAIN HYDRAULICS

**Model Code**

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V B 3</td>
<td>0 1 0</td>
<td>0 0 0</td>
<td>0 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**P2 - Service brake pressure**

Without
- 10 bar [145 PSI] 1
- 15 bar [217 PSI] 2
- 20 bar [290 PSI] 3
- 25 bar [362 PSI] 4
- 30 bar [435 PSI] 5
- 35 bar [507 PSI] 6
- 40 bar [580 PSI] 7
- 45 bar [652 PSI] 8
- 50 bar [725 PSI] 9
- 55 bar [797 PSI] A
- 60 bar [870 PSI] B
- 65 bar [942 PSI] C
- 70 bar [1 015 PSI] D
- 75 bar [1 087 PSI] E
- 80 bar [1 160 PSI] F
- 85 bar [1 232 PSI] G
- 90 bar [1 305 PSI] H
- 95 bar [1 377 PSI] I
- 100 bar [1 450 PSI] J
- 105 bar [1 522 PSI] K
- 110 bar [1 593 PSI] L
- 115 bar [1 667 PSI] M
- 120 bar [1 740 PSI] N
- 125 bar [1 815 PSI] O
- 130 bar [1 885 PSI] P
- 135 bar [1 957 PSI] Q
- 140 bar [2 030 PSI] R
- 145 bar [2 102 PSI] S
- 150 bar [2 175 PSI] T
- 155 bar [2 247 PSI] U
- 160 bar [2 320 PSI] V

For other operating pressures, please consult your Poclain Hydraulics application engineer.

**P4 - Pressure curve shape**

- Linear 1
- Bi-linear 2

**C1 - Control**

Without pedal 0

<table>
<thead>
<tr>
<th>Without pedal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain A</td>
</tr>
<tr>
<td>Metal anti-skid B</td>
</tr>
<tr>
<td>Rubber anti-skid C</td>
</tr>
<tr>
<td>Plain (lockable) D</td>
</tr>
<tr>
<td>Metal anti-skid (lockable) E</td>
</tr>
<tr>
<td>Rubber anti-skid (lockable) F</td>
</tr>
<tr>
<td>Rubber anti-skid (auto-lock) G</td>
</tr>
</tbody>
</table>

Floor mount pedal

<table>
<thead>
<tr>
<th>Without pedal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium anti-skid (casted) R</td>
</tr>
<tr>
<td>Rubber anti-skid (sheet metal) L</td>
</tr>
<tr>
<td>Metal anti-skid (sheet metal) K</td>
</tr>
</tbody>
</table>

4" Wall mount pedal

<table>
<thead>
<tr>
<th>Without pedal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium anti-skid (casted) I</td>
</tr>
<tr>
<td>Metal anti-skid (sheet metal) J</td>
</tr>
</tbody>
</table>

8" Wall mount pedal

<table>
<thead>
<tr>
<th>Without pedal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium anti-skid (casted)</td>
</tr>
<tr>
<td>Metal anti-skid (sheet metal)</td>
</tr>
</tbody>
</table>

**C2 - Pressure switch**

Without 0

Without and MF ready 1
On MF 1x service control 2

**R1 - Electrical connection**

Without 0

- Bare wire 1
- Deutsch 3
- AMP (6.3 x 0.8) 5
- AMP Superseal 6

**R3 - Hydraulic connection**

Without 0

- ISO 1179-1 (BSPP + spot face » ports) G1/4 3
- ISO 9974-1 (metric + spot face » ports) M14x1.5 4
- ISO 6149 (metric + cone » ports) M14x1.5 5
- ISO 11926-1 (SAE J514 fittings with O-ring) 9/16-18-UNF-2B 6

**S1 - S4 Options** (See page 79)

Without 0

- Special calibration 1
- Specific port * 2
- Customized component * 3
- Mechanical control adaptation * 4
- Pressure sensor 5
- Pedal back abutment 6
- Circuit pressurization * 7
- Special painting 8
- Pedal position sensor 9
- Lever with rubber protection H
- Customized name plate P
- Horizontal valve/pedal position (line back of the valve » top of pedal) L
- Horizontal valve/pedal position (with line back of the valve » top of pedal) M

* Please consult your Poclain Hydraulics application engineer.

**Limitations**

- Pressure rise < 1 bar [14.5 PSI] / ms
- Current: min. 100 mA to assure contact, max. 4 A for Resistor load, max. 2.5 A for Inductive load
- Voltage: max. 42 V
VB3-020

- Dual-circuit

Applications
VB3-020 service brake valve (VB-0E0 and VB-0F0) is a mechanically-controlled, three-way, graduated release double pressure reducing valve. VB3-020 (VB-0E0 and VB-0F0) valve provides precisely controlled output pressures (at F1 and F2) proportional to the pedal stroke and therefore to the force applied to the pedal. This provides the feeling of braking.

In a braking circuit, VB3-020 (VB-0E0 and VB-0F0) is usually associated with VB-200 dual-circuit accumulator charging valve.

Operation
When pedal is at rest (‘up’ position), the output pressures (at F1 and F2) are zero and the brake receptors are connected to the tank (F1 and F2 to T).

When pedal is depressed, output pressures (at F1 and F2) increase proportionally to the angular displacement of the pedal. Output pressures (at F1 and F2) can be equal or different according to a ratio $F2/F1 = 0.64$ (VB-0E0) or 0.44 (VB-0F0).

When pedal is fully depressed, output pressures (at F1 and F2) are limited to the preset pressures of the valve irrespective of the supply pressure.

Pressures at F1 and F2 are strictly independent. A failure in one of the circuits does not affect the operation of the other circuit.
## Overall dimensions of VB3-020 brake valve - small ports

![Image of VB3-020 brake valve]

**Connections**

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1-P2</td>
<td>250 [3 626]</td>
<td>M14x1.5, G1/4</td>
<td>Input</td>
</tr>
<tr>
<td>T *</td>
<td>3 [43.5] **</td>
<td>3/4-16 UNF-2B</td>
<td>Tank</td>
</tr>
<tr>
<td>MF1 ***</td>
<td></td>
<td>M10x1, M12x1.5, G1/4</td>
<td>Service brake pressure switch</td>
</tr>
<tr>
<td>MF2 ***</td>
<td></td>
<td>M10x1 (VB3-020), M12x1.5 (VB3-020, VB3-0E0), M14x1.5 (VB3-0F0), G1/4 (VB3-020)</td>
<td>Service brake pressure switch</td>
</tr>
</tbody>
</table>

* Available upon request = T > 3bar, design available to protect line (pressure peaks) and as consequence increased time to release brake, F -> T flow limitation.
** Please consult your Poclain Hydraulics application engineer for higher pressure value.
*** Option
Overall dimensions of VB3-020 brake valve - big ports
Mechanical Control

**Floor mount pedal**

![Floor mount pedal diagram](image1)

![Floor cut-out](image2)

**Wall mount pedal 4”**

![Wall mount pedal diagram](image3)

![Wall cut-out](image4)

**Aluminium anti-skid (casted) pedal**

![Aluminium anti-skid pedal diagram](image5)
Hydraulic diagram and characteristic curves

Estimated maximum actuator forces according to output pressure

- Force on pedal (Fa)
- Force on pedal (Fb)

\[
\begin{align*}
\text{Fa (daN)} & \geq \text{max. output pressure (bar)} + 27 \\
\text{Fb (daN)} & \geq \text{Fa}/5
\end{align*}
\]

To obtain the forces in lbf, convert the final result.

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.
**C2 - Pressure switch**

- Without: 0
- Without and MF port ready: 1
- On MF or MF2: 2
- MF1 and MF2: 3

**R1 - Electrical connection**

- Without: 0
- Bare wire: 1
- Deutsch: 3
- AMP (6.3 x 0.8): 5
- AMP Superseal: 6

**R3 - Hydraulic connection**

- Without: 0
- ISO 1179-1 (BSPP + spot face » ports): 3
- ISO 9974-1 (metric + spot face » ports): 4
- ISO 6149 (metric + cone » ports): 8
- ISO 11926-1 (SAE J514 fittings with O-ring): 3

**P4 - Pressure curve shape**

- Linear: 1
- Bi-linear: 2

**C1 - Control**

- Without pedal: 0
- Floor mount pedal:
  - Plain: A
  - Metal anti-skid: B
  - Rubber anti-skid: C
  - Plain (lockable): D
  - Metal anti-skid (lockable): E
  - Rubber anti-skid (lockable): F
  - Rubber anti-skid (auto-lock): G
- Wall mount pedal 4*
  - Aluminum anti-skid (casted): R
  - Metal anti-skid (sheet metal): K
  - Rubber anti-skid (sheet metal): L
- Wall mount pedal 8*
  - Aluminum anti-skid (casted): I
  - Metal anti-skid (sheet metal): J

**R2 - Service brake pressure**

- 30 bar [435 PSI]: 3
- 35 bar [507 PSI]: F
- 40 bar [580 PSI]: 4
- 45 bar [652 PSI]: G
- 50 bar [725 PSI]: H
- 55 bar [797 PSI]: J
- 60 bar [870 PSI]: 5
- 65 bar [942 PSI]: K
- 70 bar [1 015 PSI]: A
- 75 bar [1 087 PSI]: L
- 80 bar [1 160 PSI]: 6
- 85 bar [1 232 PSI]: M
- 90 bar [1 305 PSI]: N
- 95 bar [1 377 PSI]: P
- 100 bar [1 450 PSI]: 7
- 105 bar [1 522 PSI]: Q
- 110 bar [1 595 PSI]: R
- 115 bar [1 667 PSI]: S
- 120 bar [1 740 PSI]: 8
- 125 bar [1 812 PSI]: T
- 130 bar [1 885 PSI]: U
- 135 bar [1 957 PSI]: V
- 140 bar [2 030 PSI]: 9
- 145 bar [2 102 PSI]: W
- 150 bar [2 175 PSI]: B
- 155 bar [2 247 PSI]: Z
- 160 bar [2 320 PSI]: C

**P1 - Pressure switch**

- Pressure rise: < 1 bar [14.5 PSI] / ms
- Current:
  - min. 100 mA to assure contact
  - max. 4 A for Resistor load
  - max. 2.5 A for Inductive load
- Voltage: max. 42 V

**For other operating pressures, please consult your Poclain Hydraulics application engineer.**

**S1 - S4 Options**

- Without: 0
- Special calibration: 1
- Specific port: 2
- Customized component: 3
- Mechanical control adaptation: 4
- Pressure sensor: 8
- Pedal back abutment: 9
- Circuit pressurization: 4
- SPECIAL painting: D
- Pedal position sensor: F
- Lever with rubber protection: H
- Customized name plate: P
- Horizontal valve/pedal position (line back of the valve » top of pedal): L
- Horizontal valve/pedal position (line back of the valve » top of pedal): M

**Please consult your Poclain Hydraulics application engineer.**

**Limitations**

<table>
<thead>
<tr>
<th>Pressure rise</th>
<th>Current</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 bar [14.5 PSI] / ms</td>
<td>min. 100 mA to assure contact</td>
<td>max. 42 V</td>
</tr>
</tbody>
</table>
VB3-012 brake control is a single-circuit braking assembly that combines:
- VB3-002 emergency / parking brake valve, which supplies an output pressure to control the automotive pump (inching),
- VB3-010 service brake valve, which supplies a pressure to control the service braking.

**Operation**

VB3-012 valve controls two independent pressures via a pedal. One pressure is for automotive pump control, and the other is for service braking control.

When operator presses pedal, VB3-012 supplies a pressure inversely proportional to the angular displacement of pedal to control the hydraulic pump.

If more braking is required, operator continues to press the pedal. VB3-012 then supplies an output pressure to the service brake in proportion to the angular displacement of the pedal.

**Applications**

VB3-012 brake control is a single-circuit braking assembly that combines:
- VB3-002 emergency / parking brake valve, which supplies an output pressure to control the automotive pump (inching),
- VB3-010 service brake valve, which supplies a pressure to control the service braking.
Mechanical control with standard valve orientation

**Connections**

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td></td>
<td>Tank</td>
<td></td>
</tr>
<tr>
<td>F (VB3-010)</td>
<td>120 [1 740]</td>
<td></td>
<td>Service braking</td>
<td>20 [290.1]</td>
</tr>
<tr>
<td>F (VB3-002)</td>
<td>20 [290.1]</td>
<td></td>
<td>Inching control</td>
<td></td>
</tr>
<tr>
<td>MF (VB3-010) *</td>
<td></td>
<td>M10x1.5</td>
<td>Service braking pressure switch</td>
<td>3.5 [7.72]</td>
</tr>
<tr>
<td>MF (VB3-002) *</td>
<td></td>
<td>M12x1.5 G1/4</td>
<td>Inching control pressure switch</td>
<td></td>
</tr>
</tbody>
</table>

* Option
Hydraulic diagram and characteristic curve

For different configurations, please consult your Poclain Hydraulics Application Engineer.

To calculate the actuator forces for your mechanical control: please contact your Poclain Hydraulics application engineer.

This valve is always sold with a mechanical control.
Model Code

P2 - Operating pressure
30 bar [435 PSI]  3
35 bar [507 PSI]  F
40 bar [580 PSI]  4
45 bar [652 PSI]  G
50 bar [725 PSI]  H
55 bar [797 PSI]  J
60 bar [870 PSI]  5
65 bar [942 PSI]  K
70 bar [1 015 PSI]  A
75 bar [1 087 PSI]  L
80 bar [1 160 PSI]  6
85 bar [1 232 PSI]  M
90 bar [1 305 PSI]  N
95 bar [1 377 PSI]  P
100 bar [1 450 PSI]  7
105 bar [1 522 PSI]  Q
110 bar [1 595 PSI]  R
115 bar [1 667 PSI]  S
120 bar [1 740 PSI]  8
125 bar [1 812 PSI]  T
130 bar [1 885 PSI]  U
135 bar [1 957 PSI]  V
140 bar [2 030 PSI]  9
145 bar [2 102 PSI]  W
150 bar [2 175 PSI]  B
155 bar [2 247 PSI]  Z
160 bar [2 320 PSI]  C

For other operating pressures, please consult your Poclain Hydraulics application engineer.

P3 - Inchning
10 bar [145 PSI]  2
20 bar [290 PSI]  3
30 bar [435 PSI]  A

P4 - Pressure curve shape
Linear  1
Bi-linear  2

C1 - Control
Without pedal  0

Floor mount pedal
Plain  A
Metal anti-skid  B
Rubber anti-skid  C
Plain (lockable)  D
Metal anti-skid (lockable)  E
Rubber anti-skid (manual lock)  F
Rubber anti-skid (auto-lock)  G

4" Wall mount pedal
Aluminium anti-skid (casted)  R
Rubber anti-skid (sheet metal)  L
Metal anti-skid (sheet metal)  K

8" Wall mount pedal
Aluminium anti-skid (casted)  I
Metal anti-skid (casted)  J

C2 - Pressure control **
Without  0
Without & MF port ready  1
MF; MF1; MF2  1x service brake  2
MF  1x inching control  4
MF and MF  A

R1 - Electrical connection
Without  0
Bare wire  1
Deutsch  3
AMP (6.3 x 0.8)  5
AMP Superseal  6

R2 - Voltage
Without  0
12V DC  1
24V DC  2

R3 - Hydraulic connection
Without  0
ISO 1179-1 (BSPP + spot face » ports) G1/4  3
ISO 9974-1 (metric + spot face » ports) M14x1.5  4
ISO 6149 (metric + cone » ports) M14x1.5  8
ISO 11926-1 (SAE J514 fittings with O-ring) 9/16-18 UNF-2B  A

S1 - S4 Options (See page 79)
Without  0
Special calibration  1
Specific port *  2
Customized component *  3
Mechanical control adaptation *  4
Pressure sensor  8
Pedal back abutment  9
Circuit pressurization *  B
Pedal position sensor  F
Lever with rubber protection  H
Customized name plate  P
Special painting  D
Horizontal valve/pedal position (line back of the valve » top of pedal)  L
Horizontal valve/pedal position (with line back of the valve » top of pedal)  M

** Limitations
Pressure rise < 1 bar [14.5 PSI] / ms
Current
min. 100 mA to assure contact
max. 4 A for Resistor load
max. 2.5 A for Inductive load
Voltage
max. 42 V

* Please consult your Poclain Hydraulics application engineer.
Applications
VB3-022 brake control is a dual-circuit braking assembly combining:

- VB3-002 emergency/parking brake valve, which provides an output pressure to control the automotive pump (inching).
- VB3-020 service brake valve, which provides two output pressures, F1 and F2, for independent braking circuits.

Output pressures F1 and F2 can be equal (VB3-022) or different according to a ratio F2/F1 = 0.64 (VB3-0E2) or 0.44 (VB3-0F2).

Operation
VB3-022 controls three independent pressures via a pedal. One pressure controls the automotive pump, and the other two pressures control the service braking.

- **Two-step braking:**
  When the operator presses the pedal, VB3-022 supplies a pressure that is inversely proportional to the angular displacement of the pedal, to control the hydraulic pump. If more braking is required, the operator continues to press the pedal. VB-022 then supplies an output pressure to the service brakes in proportion to the angular displacement of the pedal.
- **Simultaneous braking:**
  VB3-022, VB3-0E2 and VB3-0F2 simultaneously control the pump (hydrostatic braking) and the service braking (mechanical braking) for more aggressive dynamic braking.

Pressures at F1 and F2 are strictly independent. A failure in one of the circuits does not affect the operation of the other circuit.
Mechanical control with standard valve orientation

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>250 [3 626]</td>
<td>M14x1.5</td>
<td>Input</td>
</tr>
<tr>
<td>P1 - P2</td>
<td>250 [3 626]</td>
<td>M14x1.5</td>
<td>Input</td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M14x1.5</td>
<td>Tank</td>
</tr>
<tr>
<td>F1 - F2</td>
<td>150 [2 145]</td>
<td>M14x1.5</td>
<td>Service braking</td>
</tr>
<tr>
<td>X</td>
<td>20 [290.1] *</td>
<td>M14x1.5</td>
<td>Inching control</td>
</tr>
<tr>
<td>MF1 **</td>
<td>20 [290.1] *</td>
<td>M14x1.5</td>
<td>Service braking pressure switch</td>
</tr>
<tr>
<td>MF2 **</td>
<td>20 [290.1] *</td>
<td>M14x1.5</td>
<td>Service braking pressure switch</td>
</tr>
<tr>
<td>MF **</td>
<td>20 [290.1] *</td>
<td>M14x1.5</td>
<td>Inching control pressure switch</td>
</tr>
</tbody>
</table>

* Please consult your Poclain Hydraulics application engineer for higher pressure option.
** Option
Hydraulic diagram and characteristic curves

To calculate the actuator forces for your mechanical control: please contact your Poclain Hydraulics application engineer.

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.
### Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**F2 - Service brake**
- Dual circuit with F2/F1 = 1
- Dual circuit with F2/F1 = 0.64
- Dual circuit with F2/F1 = 0.44

**P2 - Service brake pressure**
- 40 bar [580 PSI]
- 60 bar [870 PSI]
- 80 bar [1160 PSI]
- 100 bar [1450 PSI]
- 120 bar [1740 PSI]
- 125 bar [1812 PSI]
- 130 bar [1855 PSI]
- 135 bar [1957 PSI]
- 140 bar [2030 PSI]
- 145 bar [2072 PSI]
- 150 bar [2102 PSI]
- 155 bar [2247 PSI]
- 160 bar [2320 PSI]

**For other operating pressures, please consult your Poclain Hydraulics application engineer.**

**P3 - Inching pressure**
- 10 bar [145 PSI]
- 20 bar [290 PSI]
- 30 bar [435 PSI]

**P4 - Pressure curve shape**
- Linear
- Bi-linear

**C1 - Control**
- Without pedal
- Floor mount pedal
  - Plain
  - Metal anti-skid
  - Rubber anti-skid
  - Plain (lockable)
  - Metal anti-skid (lockable)
  - Rubber anti-skid (manual lock)
  - Rubber anti-skid (auto-lock)
- 4” Wall mount pedal
- 8” Wall mount pedal

**C2 - Pressure switch**
- Without
- Without & MF port ready
- MF, MF1, MF2
- MF1 & MF2
- MF & MF1
- MF & MF1 & MF2

**R1 - Electrical connection**
- Without
- Deutsch
- AMP (6.3 x 0.8)
- AMP Superseal

**R3 - Hydraulic connection**
- Without
- ISO 1179-1 (BSPP + spot face » ports)
- ISO 9974-1 (metric + spot face » ports)
- ISO 6149 (metric + cone » ports)
- ISO 11926-1 (SAE J514 fittings with O-ring)

**S1 - S4 Options** (See page 79)
- Without
- Special calibration
- Specific port *
- Customized component *
- Mechanical control adaptation *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**S2 - S6 Options**
- Without
- Special calibration
- Specific port *
- Customized component *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**S7 - S9 Options**
- Without
- Special calibration
- Specific port *
- Customized component *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**C2 - Pressure switch**
- Without
- Without & MF port ready
- MF, MF1, MF2
- MF1 & MF2
- MF & MF1
- MF & MF1 & MF2

**R1 - Electrical connection**
- Without
- Deutsch
- AMP (6.3 x 0.8)
- AMP Superseal

**R3 - Hydraulic connection**
- Without
- ISO 1179-1 (BSPP + spot face » ports)
- ISO 9974-1 (metric + spot face » ports)
- ISO 6149 (metric + cone » ports)
- ISO 11926-1 (SAE J514 fittings with O-ring)

**S1 - S4 Options** (See page 79)
- Without
- Special calibration
- Specific port *
- Customized component *
- Mechanical control adaptation *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**S2 - S6 Options**
- Without
- Special calibration
- Specific port *
- Customized component *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**S7 - S9 Options**
- Without
- Special calibration
- Specific port *
- Customized component *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**S10 Options**
- Without
- Special calibration
- Specific port *
- Customized component *
- Pressure sensor
- Pedal back abutment
- Circuit pressurization *
- Pedal position sensor
- Lever with rubber protection
- Customized name plate
- Special painting
- Horizontal valve/ pedal position (line back of the valve » top of pedal)

**C10 - Controller**
- Without
- Floor mount pedal
- Plain
- Metal anti-skid
- Rubber anti-skid
- Plain (lockable)
- Metal anti-skid (lockable)
- Rubber anti-skid (manual lock)
- Rubber anti-skid (auto-lock)
- 4” Wall mount pedal
- Aluminium anti-skid (sheet metal)
- Metal anti-skid (sheet metal)
- 8” Wall mount pedal
- Aluminium anti-skid (sheet metal)
- Metal anti-skid (sheet metal)

**Pressure rise**
- < 1 bar [14.5 PSI] / ms

**Current**
- min. 100 mA to assure contact
- max. 4 A for Resistor load
- max. 2.5 A for Inductive load

**Voltage**
- max. 42 V

**Limitations**
- Please consult your Poclain Hydraulics application engineer.

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**VB3-022  POCLAIN HYDRAULICS**

15/10/2019
VB-0B0

VB-0B0 performs two types of braking:
- Left/right directional braking in field mode.
- Braking with equal power distribution in road mode.

Off-road mode:
VB-0B0 provides steering assistance for turning. In an off-road mode, the two pedals are actuated independently. When operator depresses either pedal, the pressure reducer and the selector associated with this pedal are actuated. VB-0B0 supplies a graduated release braking pressure exclusively to the service brakes associated with this pedal.

Road mode:
In a road mode, the two pedals are mechanically linked. When the operator depresses one pedal, the other one is driven, and so both selectors are actuated together. The VB-0B0 valve supplies an identical pressure to both brakes, proportional to the stroke of the pedals.

Applications
VB-0B0 valve is a single circuit brake valve that provides dynamic service braking in road mode and steering-assist braking in field mode.
VB-0B0 is actuated by two pedals, and supplies two independent brakes on rear axle. The VB-0B0 valve combines the following components in a single unit:
- A pressure reducer that supplies an output pressure proportional to the pedal stroke.
- Two circuit selectors, each one associated with one of the pedals of the VB-0B0.
Overall dimensions of VB-0B0 braking valve with auxiliary brake output (trailer brake signal - port FR)

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>250 [3626]</td>
<td></td>
<td>Input</td>
</tr>
<tr>
<td>T</td>
<td>10 [145]</td>
<td></td>
<td>Tank</td>
</tr>
<tr>
<td>F1</td>
<td>120 [1740]</td>
<td>M14x1.5</td>
<td>Left and/or right brake output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9/16-18 UNF-2B</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td></td>
<td></td>
<td>Right and/or left brake output</td>
</tr>
<tr>
<td>FR</td>
<td></td>
<td>M12x1.5</td>
<td>Auxiliary brake output (optional)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2-20 UNF-2B</td>
<td></td>
</tr>
<tr>
<td>MF</td>
<td></td>
<td>M10x1</td>
<td>Service braking pressure</td>
</tr>
</tbody>
</table>

* FR = F1 & F2. FR gives a braking pressure if both pedals are actuated (e.g. FR can be used to control a trailer brake valve). For further information, please contact your Poclain Hydraulics application engineer.
Overall dimensions of VB-0B0 braking valve without auxiliary brake output (trailer brake signal - port FR)

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>250 [3626]</td>
<td>M14x1.5</td>
<td>Input</td>
</tr>
<tr>
<td>T</td>
<td>10 [145]</td>
<td>M10x1</td>
<td>Tank</td>
</tr>
<tr>
<td>F1</td>
<td>120 [1740]</td>
<td>9/16-18 UNF-2B</td>
<td>Left and/or right brake output</td>
</tr>
<tr>
<td>F2</td>
<td></td>
<td></td>
<td>Right and/or left brake output</td>
</tr>
<tr>
<td>MF</td>
<td></td>
<td>M10x1</td>
<td>Service braking pressure</td>
</tr>
</tbody>
</table>

For further information, please consult your Poclain Hydraulics application engineer.
Hydraulic diagram and characteristic curve

![Hydraulic diagram]

Estimated maximum actuator forces according to output pressure

<table>
<thead>
<tr>
<th>Mode</th>
<th>Force Equation 1</th>
<th>Force Equation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field (Fs)</td>
<td>$1.63 \times \text{max. output pressure (bar)} + 67.443$</td>
<td>$3.04 \times \text{max. output pressure (bar)} + 67.443$</td>
</tr>
<tr>
<td>Road (Fa)</td>
<td>$2.76 \times \text{max. output pressure (bar)} + 112.404$</td>
<td>$5.58 \times \text{max. output pressure (bar)} + 112.404$</td>
</tr>
</tbody>
</table>

To obtain the forces in lbf, convert the final result.

* see next page, model code, section C
Model Code

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics Application Engineer.

For other operating pressures, please consult your Poclain Hydraulics application engineer.

** Limitations

| Pressure rise | < 1 bar [14.5 PSI] / ms |
| Current       | min. 100 mA to assure contact |
|              | max. 4 A for Resistor load |
|              | max. 2.5 A for Inductive load |
| Voltage       | max. 42 V |

P2 - Operating pressure

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 bar</td>
<td>30 bar</td>
</tr>
<tr>
<td>40 bar</td>
<td>40 bar</td>
</tr>
<tr>
<td>60 bar</td>
<td>60 bar</td>
</tr>
<tr>
<td>80 bar</td>
<td>80 bar</td>
</tr>
<tr>
<td>100 bar</td>
<td>100 bar</td>
</tr>
<tr>
<td>120 bar</td>
<td>120 bar</td>
</tr>
</tbody>
</table>

C1 - Control

Control with force feedback

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN12 cast</td>
<td>1</td>
</tr>
<tr>
<td>DN12 block</td>
<td>G</td>
</tr>
<tr>
<td>DN18 cast</td>
<td>2</td>
</tr>
<tr>
<td>DN18 block</td>
<td>H</td>
</tr>
</tbody>
</table>

C2 - Pressure switch **

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>On MF</td>
<td>2</td>
</tr>
</tbody>
</table>

R1 - Electrical connection

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>Deutsch</td>
<td>3</td>
</tr>
<tr>
<td>AMP (6.3 x 0.8)</td>
<td>5</td>
</tr>
</tbody>
</table>

R3 - Hydraulic connection

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9974-1 (metric + spot face ports)</td>
<td>4</td>
</tr>
<tr>
<td>ISO 11926-1 (SAE J514 fittings with O-ring)</td>
<td>A</td>
</tr>
</tbody>
</table>

S1 - S4 Options (See page 79)

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special calibration</td>
<td>1</td>
</tr>
<tr>
<td>Specific port</td>
<td>2</td>
</tr>
<tr>
<td>Customized component</td>
<td>3</td>
</tr>
<tr>
<td>Dual-slope spring mechanism</td>
<td>7</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>8</td>
</tr>
<tr>
<td>Improved watertightness</td>
<td>A</td>
</tr>
<tr>
<td>Circuit pressurization</td>
<td>B</td>
</tr>
</tbody>
</table>

* Please ask your Poclain Hydraulics application engineer.
**Applications**

VB-0D0 valve is a double circuit brake valve that provides dynamic service braking in road mode and steering-assist braking in field mode. Standard VB-0D0 product has dual slope characteristic and improved watertightness. VB-0D0 is actuated by two pedals, and supplies three independent brakes (two on the rear axle and one in the front axle). The VB-0D0 valve combines the following components in a single unit:

- A pressure reducer that supplies an output pressure proportional to the pedal stroke.
- Two circuit selectors, each one associated with one of the pedals of the VB-0D0.

**Operation**

VB-0D0 performs two types of braking:

- **Off-road mode:**
  VB-0D0 provides steering assistance for turning. In off-road mode, the two pedals are actuated independently. When the operator depresses either pedal, the pressure reducer and the selector associated with this pedal are actuated. VB-0D0 supplies a graduated release braking pressure exclusively to the service brakes associated with this pedal.

- **Road mode:**
  In road mode, the two pedals are mechanically linked. When the operator depresses one pedal, the other one is driven, and so both selectors are actuated together. The VB-0D0 valve supplies an identical pressure to all brakes, proportional to the stroke of the pedals.
Overall dimensions of VB-0D0 braking valve

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>125 [1813]</td>
<td>M16x1.5</td>
<td>Rear axle supply</td>
<td>158 [217.6]</td>
</tr>
<tr>
<td>A2</td>
<td>15 [217.6]</td>
<td>M16x1.5</td>
<td>Front axle supply</td>
<td>158 [217.6]</td>
</tr>
<tr>
<td>T</td>
<td>15 [217.6]</td>
<td>M16x1.5</td>
<td>Tank</td>
<td>7.1 [15.7]</td>
</tr>
<tr>
<td>F1</td>
<td>125 [1813]</td>
<td>M12x1.5</td>
<td>Rear axle F1 braking</td>
<td>158 [217.6]</td>
</tr>
<tr>
<td>F2</td>
<td>125 [1813]</td>
<td>M12x1.5</td>
<td>Rear axle F2 braking</td>
<td>158 [217.6]</td>
</tr>
<tr>
<td>FR *</td>
<td>125 [1813]</td>
<td>M16x1.5</td>
<td>Auxiliary brake output (optional)</td>
<td>158 [217.6]</td>
</tr>
<tr>
<td>PTAV</td>
<td>125 [1813]</td>
<td>M16x1.5</td>
<td>Front axle brake output</td>
<td>158 [217.6]</td>
</tr>
</tbody>
</table>

* FR = F1 & F2. FR gives a braking pressure if both pedals are actuated (e.g. FR can be used to control a trailer brake valve). For further information, please contact your Poclain Hydraulics application engineer.
Hydraulic diagram and characteristic curve

Estimated maximum actuator forces according to output pressure

<table>
<thead>
<tr>
<th>Mode</th>
<th>Force Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field mode (Fs)</td>
<td>( 4.27 \times \text{max. output pressure (bar)} + 28.5 ) (daN)</td>
</tr>
<tr>
<td>Road mode (Fa)</td>
<td>( 7.41 \times \text{max. output pressure (bar)} + 54.5 ) (daN)</td>
</tr>
</tbody>
</table>

To obtain the forces in lbf, convert the final result.
Model Code

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics Application Engineer.

P2 - Operating pressure
- 30 bar [435 PSI] 3
- 40 bar [580 PSI] 4
- 60 bar [870 PSI] 5
- 80 bar [1 160 PSI] 6
- 100 bar [1 450 PSI] 7
- 120 bar [1 740 PSI] 8

For other operating pressures, please consult your Poclain Hydraulics application engineer.

** Limitations
- Pressure rise < 1 bar [14.5 PSI] / ms
- min. 100 mA to assure contact
- max. 4 A for Resistor load
- max. 2.5 A for Inductive load
- Voltage max. 42 V

C1 - Control
- Control without force feedback 0
- Control with force feedback DN20 Z

C2 - Pressure switch **
- Without 0
- On MF (service brake pressure) 2

R1 - Electrical connection
- Without 0
- Deutsch 3
- AMP (6.3 x 0.8) 5

R3 - Hydraulic connection
- ISO 9974-1 (metric + spot face » ports) 4
- ISO 11926-1 (SAE J514 fittings with O-ring) A

S1 - S4 Options (See page 79)
- Special calibration * 1
- Specific port * 2
- Customized component * 3
- Pressure sensor 8
- Circuit pressurization * B

* Please consult your Poclain Hydraulics application engineer.
**VB-100**

- Accumulator charging
- Single-circuit

**FLOW TYPES:**
- 45 l/min [12 GPM]
- 120 l/min [32 GPM]

**Applications**
VB-100 accumulator charging valve charges the accumulator(s) of a braking circuit and maintains its (their) pressure while supplying an auxiliary circuit.
In a braking circuit, valve VB-100 is associated with the VB-010 single-circuit service brake valve (or the VB-002 emergency / parking brake valve).

**Operation**
During accumulator charging phase, built-in divider taps a constant flow from the valve supply flow and diverts it to the accumulator.
When accumulator reaches maximum (cut-out) pressure, charging stops, and the entire supply flow is directed to output S (auxiliary circuit or tank return).
When operator actuates the pedal, the pressure in accumulator drops. When minimum (cut-in) pressure is reached, the valve again charges the accumulator until it reaches cut-out pressure.
Overall dimensions of VB-100 (45 l/min) accumulator charging valve

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>Loss of head * bar [PSI]</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3 046]</td>
<td>M18x1.5</td>
<td>Input</td>
<td>45 l/min</td>
<td>10 [145]</td>
</tr>
<tr>
<td>S</td>
<td>Cut-out pressure</td>
<td>3/4-16 UNF-2B</td>
<td>Auxiliary circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M14x1.5</td>
<td>Tank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Cut-out pressure</td>
<td>9/16-18 UNF-2B</td>
<td>Service braking accumulator</td>
<td>2.2 [4.8]</td>
<td>120 l/min</td>
</tr>
<tr>
<td>MA **</td>
<td>1/4 BSPP</td>
<td></td>
<td>Accumulator min. pressure switch</td>
<td></td>
<td>4 [58]</td>
</tr>
<tr>
<td>LS **</td>
<td>M14x1.5</td>
<td>9/16-18 UNF-2B</td>
<td>Load sensing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS **</td>
<td>M12x1.5</td>
<td></td>
<td>Pressure switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Loss of head (P to S) is given at a flow rate (Q = 30l/min, 8 GPM).
** Option
Overall dimensions of VB-100 (120 l/min) accumulator charging valve

Hydraulic diagram

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.
### Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### P1 - Cut-in / Cut-out range
- 110 - 130 bar (1595 - 1885 PSI) 3
- 120 - 140 bar (1740 - 2031 PSI) 4
- 135 - 160 bar (1958 - 2321 PSI) 5
- 160 - 190 bar (2321 - 2756 PSI) 6
- 170 - 200 bar (2466 - 2901 PSI) 7
- 180 - 210 bar (2611 - 3046 PSI) 8

#### Q1 - Flow rate to auxiliaries (P to S)
- 45 l/min [12 GPM] 4
- 120 l/min [32 GPM] 6

#### Q2 - Flow rate to accumulator (P to A)
- 2.75 l/min [0.73 GPM] 1
- 8 l/min [2.11 GPM] 2
- 15 l/min [3.96 GPM] 3

#### C2 - Pressure switch **

<table>
<thead>
<tr>
<th>Without</th>
<th>On MA (accumulator min. pressure)</th>
<th>On MS (auxiliary)</th>
<th>On MA and MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

#### R1 - Electrical connection

<table>
<thead>
<tr>
<th>Without</th>
<th>Deutsch</th>
<th>AMP (6.3 X 0.8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

#### R3 - Hydraulic connection

<table>
<thead>
<tr>
<th>ISO 9974-1 (BSPP + spot face » ports) M14x1.5</th>
<th>ISO 11 926-1 (SAE J514 fittings with O-ring) 9/16-18 UNF-2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

** Limitations

- Pressure rise: < 1 bar [14.5 PSI] / ms
- Current: min. 100 mA to assure contact, max. 4 A for Resistor load, max. 2.5 A for Inductive load
- Voltage: max. 42 V

*S1 - S4 Options (See page 79)*

<table>
<thead>
<tr>
<th>Special calibration *</th>
<th>Specific port *</th>
<th>Customized component *</th>
<th>LS Port</th>
<th>MS Port</th>
<th>MS + LS Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

* Please consult your Poclain Hydraulic application engineer.
Applications
VB-200 accumulator charging valve charges the accumulators of a braking circuit and maintains their pressure while supplying an auxiliary circuit.

In a braking circuit, valve VB-200 is associated with the VB-020 dual-circuit service brake valve (or the VB-010 single-circuit service brake valve and the VB-002 emergency / parking brake valve).

Operation
During the accumulator charging phase, the built-in divider taps a constant flow from the valve supply flow and diverts it to the accumulators. When the accumulators reach maximum (cut-out) pressure, charging stops, and the entire supply flow is directed to output S (auxiliary circuit or tank return).

When the operator actuates the pedal, the pressure in the accumulators drops. When minimum (cut-in) pressure is reached in at least one accumulator, the valve recharges the accumulators to cut-out pressure.

When a failure occurs in one of the braking circuits, the other circuit is immediately isolated by its safety valve. The circuit that remains operative can then be used as an emergency brake thanks to the energy stored in its accumulator.

VB-200

- Accumulator charging
- Dual-circuit

FLOW TYPES:
- 45 l/min [12 GPM]
- 120 l/min [32 GPM]
### Overall dimensions of VB-200 (45 l/min) accumulators charging valve

![Diagram of VB-200 charging valve]

### Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>Loss of head * kg [lbs]</th>
<th>Port 1</th>
<th>Port 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td></td>
<td>M18x1.5 3/4-16 UNF-2B</td>
<td>Input</td>
<td>45 l/min</td>
<td>210 [3046]</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Cut-out pressure</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Auxiliary circuit</td>
<td>10 [145]</td>
<td>1 [14.5]</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Tank</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Service braking accumulator</td>
<td>4 [8.8]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Service braking accumulator</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>120 l/min</td>
<td>4 [58]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA ***</td>
<td>Accumulator min. pressure switch</td>
<td>1/4 BSPP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS ***</td>
<td>Load sensing</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS ***</td>
<td>Pressure switch</td>
<td>M12x1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Loss of head (P to S) is given at a flow rate (Q = 30l/min, 8 GPM)
** Or max. allowable pressure for the accumulator.
*** Options
Overall dimensions of VB-200 (120 l/min) accumulators charging valve

Hydraulic diagram

Isolating ball valves
For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.

Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>2 0 0</td>
<td>0 0</td>
<td>0</td>
<td>0</td>
<td>0 0 4 4</td>
</tr>
</tbody>
</table>

**P1 - Cut-in/Cut-out range**

110 - 130 bar [1 595 - 1 885 PSI]  3
120 - 140 bar [1 740 - 2 031 PSI]  4
135 - 160 bar [1 958 - 2 321 PSI]  5
160 - 190 bar [2 321 - 2 756 PSI]  6
170 - 200 bar [2 466 - 2 901 PSI]  7
180 - 210 bar [2 611 - 3 046 PSI]  8

**Q1 - Flow rate to auxiliaries (P to S)**

45 l/min [12 GPM]  4
120 l/min [32 GPM]  6

**Q2 - Flow rate to accumulator (P to A)**

2.75 l/min [0.73 GPM]  1
8 l/min [2.11 GPM]  2
15 l/min [3.96 GPM]  3

**Limitations**

Pressure rise  < 1 bar [14.5 PSI] / ms

Current

- min. 100 mA to assure contact
- max. 4 A for Resistor load
- max. 2.5 A for Inductive load

Voltage  max. 42 V

**C2 - Pressure switch **

Without  0
On MA (accumulator min. pressure)  1
On MS (auxiliary)  3
On MA and MS  6

**R1 - Electrical connection**

Without  0
Deutsch  3
AMP (6.3 x 0.8)  5

**R3 - Hydraulic connection**

ISO 9974-1 (BSPP + spot face » ports)  M14x1.5  4
ISO11926-1 (SAE J514 fittings with O-ring)  9/16-18 UNF-2B A

**S1 - S4 Options** (See page 79)

- Special calibration *  1
- Specific port *  2
- Customized component *  3
- LS Port  5
- Isolating ball valves  6
- MS Port  C
- MS + LS Port  D

* Please consult your Poclain Hydraulics application engineer.
Applications
VB-110 modulating brake valve is a mechanically-controlled, three-way, graduated release pressure reducing valve. VB-110 braking assembly contains the following components in a single manifold:

• A single-circuit accumulator charging valve,
• A mechanically controlled single-circuit service brake valve.

The incorporation of these functions in a compact unit reduces the risk of leaks and makes the overall size more compact.

Operation
During the accumulator charging phase, a built-in divider taps a constant flow from the valve supply flow and diverts it to the accumulator. When accumulator reaches maximum (cut-out) pressure, charging stops, and the entire supply flow is directed to output S (auxiliary circuit or tank return).

When operator actuates the pedal, the pressure in the accumulator drops. When minimum (cut-in) pressure is reached, the valve recharges the accumulator to cut-out pressure.

VB-110 is used for the precision dosing of the output pressure (at F) proportionally to the angular displacement of the pedal, and therefore to the force applied to the pedal. This provides the feeling of braking. When pedal is at rest (‘up’ position), the output pressure (at F) is zero and brake receptors are connected to the tank (F to T).

When pedal is depressed, the output pressure (at F) increases proportionally to the angular displacement of the pedal.

When pedal is fully depressed, the output pressure (at F) is limited to the preset pressure of the valve irrespectively of the supply pressure.

FLOW TYPES
• 45 l/min [12 GPM]
• 120 l/min [32 GPM]
## Overall dimensions of VB-110 (45 l/min) brake valve

![Diagram of VB-110 brake valve]

## Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure</th>
<th>Connection</th>
<th>Function</th>
<th>Loss of head (P to S) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3046]</td>
<td>M18x1.5 3/4-16 UNF-2B</td>
<td>Input</td>
<td>VB-110 (45 l/min) 10 [145] at Q=30l/min [8 GPM] 5 [12.8]</td>
</tr>
<tr>
<td>S</td>
<td>Cut-out pressure</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Auxiliary circuit</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Tank</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>120 [1740] *</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Service braking</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Cut-out pressure **</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Service braking accumulator</td>
<td></td>
</tr>
<tr>
<td>MA ***</td>
<td>1/4 BSPP</td>
<td>Accumulator min. pressure switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MF ***</td>
<td>Service braking switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS ***</td>
<td>M14x1.5 9/16-18 UNF-2B</td>
<td>Load sensing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS ***</td>
<td>M12x1.5</td>
<td>MS pressure switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please consult your Poclain Hydraulics application engineer for higher pressure option.
** Or max. allowable pressure.
*** Option

---

*Note: All pressure values are in bar and kg [lbs].*
Overall dimensions of VB-110 (120 l/min) brake valve
Mechanical Controls

Hydraulic diagram and characteristic curve

Estimated max. actuator force as a function of output pressure

- Force on pedal (Fa) (45l/min) : $Fa \text{ (daN)} = 0.5 \times \text{max. output pressure (bar)} + 35$
- Force on pedal (Fa) (120 l/min) : $Fa \text{ (daN)} = 0.5 \times \text{max. output pressure (bar)} + 27$
- Force on pedal (Fb) : $Fb \text{ (daN)} = \frac{Fa}{5}$

To obtain the forces in lbf, convert the final result.
### Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>B</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### P1 - Cut-in / Cut-out range
- 110 - 130 bar [1 595 - 1 885 PSI] 3
- 120 - 140 bar [1 740 - 2 031 PSI] 4
- 135 - 160 bar [1 958 - 2 321 PSI] 5
- 160 - 190 bar [2 321 - 2 756 PSI] 6
- 170 - 200 bar [2 466 - 2 901 PSI] 7
- 180 - 210 bar [2 611 - 3 046 PSI] 8

#### P2 - Operating pressure
- 40 bar [580 PSI] 4
- 60 bar [870 PSI] 5
- 80 bar [1 160 PSI] 6
- 100 bar [1 450 PSI] 7
- 120 bar [1 740 PSI] 8

#### Q1 - Flow rate to auxiliaries (P to S)
- 45 l/min [12 GPM] 4
- 120 l/min [32 GPM] 6

#### Q2 - Flow rate to accumulator (P to A)
- 2.75 l/min [0.73 GPM] 1
- 8 l/min [2.11 GPM] 2
- 15 l/min [3.96 GPM] 3

#### C1 - Control
- Without pedal
  - Plain 0
  - Floor mount pedal
  - Plain (lockable) A
  - Metal anti-skid B
  - Rubber anti-skid C

#### C2 - Pressure switch **
- Without 0
- On MA (accumulator min. pressure) 1
- On MF (service brake) 2
- On MS (auxiliary) 3
- On MX (parking brake pressure) 4
- On MA and MF 5
- On MA and MS 6
- On MA, MF and MS 7

#### R1 - Electrical connection
- Without 0
- Deutsch 3
- AMP (6.3 x 0.8) 5

#### R3 - Hydraulic connection
- ISO 9974-1 (BSPP + spot face » ports) M14x1.5 4
- ISO11926-1
  - SAE J514 fittings with O-ring 9/16-18 UNF-2B A

#### S1 - S4 Options (See page 79)
- Special calibration * 1
- Specific port * 2
- Customized component * 3
- Mechanical control adaptation * 4
- LS Port 5
- Dual-slope spring mechanism * 7
- Pressure sensor 8
- Pedal back abutment 9
- Circuit pressurization* B
- MS Port C
- MS + LS Port D

** Limitations
- Pressure rise < 1 bar [14.5 PSI] / ms
- Current
  - min. 100 mA to assure contact
  - max. 4 A for Resistor load
  - max. 2.5 A for Inductive load
- Voltage
  - max. 42 V

* Please consult your Poclain Hydraulics application engineer.
**Applications**

VB-220 service brake valve is a mechanically-controlled, three-way, graduated release dual pressure reducing valve. The Poclain Hydraulics VB-220 braking assembly contains the following components in a single manifold:

- A dual-circuit accumulator charging valve,
- A mechanically controlled dual-circuit service brake valve,
- Two isolating valves for the braking circuits.

The output pressures (at F1 and F2), for the braking circuits, can be equal or different according to a ratio F2/F1 = 0.64 (VB-2E0) or 0.44 (VB-2F0).

The incorporation of these functions in a compact unit reduces the risk of leaks and makes the overall size more compact.

**Operation**

During the accumulator charging phase, the built-in divider taps a constant flow from the valve supply flow and diverts it to the accumulator. When the accumulator reaches maximum (cut-out) pressure, charging stops, and the entire supply flow is directed to output S (auxiliary circuit or tank return).

When the operator actuates the pedal, the pressure in the accumulator drops. When minimum (cut-in) pressure is reached, the valve recharges the accumulator to cut-out pressure. It is used for the precision dosing of the output pressures (at F1 and F2) proportionally to the angular displacement of the pedal, and therefore to the force applied to the pedal. This provides a feeling of braking. When the pedal is at rest (‘up’ position), the output pressures (at F1 and F2) are zero and the brake receptors are connected to the tank (F1 and F2 to T) When the pedal is depressed, the output pressures (at F1 and F2) increase proportionally to the angular displacement of the pedal. When the pedal is fully depressed, the output pressures (at F1 and F2) are limited to the preset pressure of the valve irrespective of the supply pressure. When a failure occurs in one of the braking circuits, the other circuit is immediately isolated by its safety valve. The circuit that remains operative can then be used as an emergency brake thanks to the energy stored in its accumulator.
overall dimensions of VB-220 (45l/min) brake valve

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>Loss of head (P to S) bar [PSI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3 046]</td>
<td>M18x1.5</td>
<td>Input</td>
<td>VB-110 (45 l/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M18x1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/4-16 UNF-2B</td>
<td></td>
<td>10 [145] at Q=30l/min (8 GPM)</td>
</tr>
<tr>
<td>S</td>
<td>Cut-out pressure</td>
<td>M14x1.5</td>
<td>Auxiliary circuit</td>
<td>VB-110 (45 l/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M14x1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9/16-18 UNF-2B</td>
<td></td>
<td>6 [13.2] at Q=60l/min (16 GPM)</td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M14x1.5</td>
<td>Tank</td>
<td></td>
</tr>
<tr>
<td>F1-F2</td>
<td>120 [1 740] *</td>
<td>M14x1.5</td>
<td>Service braking</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M14x1.5</td>
<td>Service braking accumulator</td>
<td>VB-110 (120 l/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9/16-18 UNF-2B</td>
<td></td>
<td>4 [58] at Q=60l/min (16 GPM)</td>
</tr>
<tr>
<td>A1-A2</td>
<td>Cut-out pressure **</td>
<td>M14x1.5</td>
<td>Parking brake connection</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td>M14x1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td>1/4 BSPP</td>
<td>M10x1</td>
<td>Accumulator min. pressure switch</td>
<td>VB-110 (45 l/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M10x1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M10x1 (VB-220)</td>
<td></td>
<td>10 [145] at Q=30l/min (8 GPM)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M12x1 (VB-2E0)</td>
<td></td>
<td>6 [13.2] at Q=60l/min (16 GPM)</td>
</tr>
<tr>
<td>MF1</td>
<td>M10x1</td>
<td>M10x1</td>
<td>Service pressure switch</td>
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<tr>
<td></td>
<td></td>
<td>M10x1 (VB-220)</td>
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<td></td>
</tr>
<tr>
<td>MF2</td>
<td>M14x1.5</td>
<td>M14x1.5</td>
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<tr>
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<td>9/16-18 UNF-2B</td>
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<td></td>
</tr>
<tr>
<td>LS ***</td>
<td>M14x1.5</td>
<td>M12x1.5</td>
<td>MS pressure switch</td>
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<tr>
<td></td>
<td></td>
<td>M12x1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please consult your Poclain Hydraulics application engineer for higher pressure option.
** Or max. allowable pressure for the accumulator.
*** Option
Overall dimensions of VB-220 (120 l/min) brake valve

Hydraulic diagram and characteristic curves
Mechanical controls: 45l/min

Mechanical controls: 120l/min
Estimated max. actuator force as a function of output pressure

• Force on pedal (Fa)
  \( Fa (\text{daN}) = 0.5 \times \text{max. output pressure (bar)} + 35 \)
• Force on pedal (Fb)
  \( Fb (\text{daN}) = \frac{Fa}{5} \)

To obtain the forces in lbf, convert the final result.

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.

Model Code

<table>
<thead>
<tr>
<th>T</th>
<th>F</th>
<th>P</th>
<th>Q</th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>B</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F2 - Service brake
Dual circuit with ratio F2/F1 = 1
Dual circuit with ratio F2/F1 = 0.64
Dual circuit with ratio F2/F1 = 0.44

P1 - Cut-in / Cut-out range
110 - 130 bar [1 595 - 1 885 PSI] 3
120 - 140 bar [1 740 - 2 031 PSI] 4
135 - 160 bar [1 958 - 2 321 PSI] 5
160 - 190 bar [2 321 - 2 756 PSI] 6
170 - 200 bar [2 466 - 2 901 PSI] 7
180 - 210 bar [2 611 - 3 046 PSI] 8

P2 - Operating pressure
30 bar [435 PSI] 3
40 bar [580 PSI] 4
60 bar [870 PSI] 5
80 bar [1 160 PSI] 6
100 bar [1 450 PSI] 7
120 bar [1 740 PSI] 8

Q1 - Flow rate to auxiliaries (P to S)
45 l/min [12 GPM] 4
120 l/min [32 GPM] 6

Q2 - Flow rate to accumulator (P to A)
2.75 l/min [0.73 GPM] 1
8 l/min [2.11 GPM] 2
15 l/min [3.96 GPM] 3

S1 - S4 Options (See page 79)
Special calibration * 1
Specific port * 2
Customized component * 3
Mechanical control adaptation * 4
LS Port 5
Isolating ball valves 6
Dual-slope spring mechanism * 7
Pressure sensor 8
Pedal back abutment 9
Circuit pressurization * B
MS Port C
MS + LS Port D

* Please consult your Poclain Hydraulics application engineer.

** Limitations
- Pressure rise < 1 bar [14.5 PSI] / ms
- Current min. 100 mA to assure contact max. 4 A for Resistor load max. 2.5 A for Inductive load
- Voltage max. 42 V

For other operating pressures, please consult your Poclain Hydraulics application engineer.
Applications

The service brake valve is a mechanically-controlled, three-way, graduated release dual pressure reducing valve. VB-22E braking assembly contains the following components in a single manifold:

- A dual-circuit accumulator charging valve,
- A mechanically controlled dual-circuit service brake valve,
- An electrically controlled parking brake valve,
- Two isolating valves for the braking circuits.

The incorporation of these functions in a compact unit reduces the risk of leaks and makes the overall size more compact.

Operation

During the accumulator charging phase, the built-in divider taps a constant flow from the valve supply flow and diverts it to the accumulators. When the accumulators reach maximum (cut-out) pressure, charging stops, and the entire supply flow is directed to output S (auxiliary circuit or tank return).

Each time the operator actuates the pedal, the pressure in the accumulator drops. When minimum (cut-in) pressure is reached in at least one accumulator, the valve recharges the accumulators to cut-out pressure, and so on.

VB-22E is used for the precision dosing of the output pressures (at F1 and F2) proportionally to the angular displacement of the pedal, and therefore to the force applied to the pedal. This provides the feeling of braking. When the pedal is at rest (‘up’ position), the output pressures (at F1 and F2) are zero and the brake receptors are connected to the tank (F1 and F2 to T). When the pedal is depressed, the output pressures (at F1 and F2) increase proportionally to the angular displacement of the pedal. When the pedal is fully depressed, the output pressures (at F1 and F2) are limited to the preset pressure of the valve irrespective of the supply pressure.

When a failure occurs in one of the braking circuits, the other circuit is immediately isolated by its safety valve. The circuit that remains operative can then be used as an emergency brake thanks to the energy stored in its accumulator. The parking brake valve has on/off solenoid control.
Overall dimensions of VB-22E (45 l/min) brake valve

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
<th>Loss of head (P to S) bar [PSI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3 046]</td>
<td>M18x1.5</td>
<td>Input</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Cut-out pressure</td>
<td>M14x1.5</td>
<td>Auxiliary circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td></td>
<td>Tank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1 - F2</td>
<td>120 [1 740] *</td>
<td>M14x1.5</td>
<td>Service braking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Parking brake</td>
<td></td>
<td>8 [17.6]</td>
</tr>
<tr>
<td>A1 - A2</td>
<td>Cut-out pressure **</td>
<td>M14x1.5</td>
<td>Service braking accumulator</td>
<td></td>
<td>10 [145]</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td></td>
<td>Parking brake connection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td>1/4 BSPP</td>
<td></td>
<td>Accumulator min. pressure switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MF2</td>
<td>M10x1</td>
<td></td>
<td>Service brake pressure switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MX</td>
<td>1/4 BSPP</td>
<td></td>
<td>Parking brake pressure switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS</td>
<td>M14x1.5</td>
<td></td>
<td>Load sensing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>M12x1.5</td>
<td></td>
<td>MS pressure switch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please consult your Poclain Hydraulics application engineer for higher pressure option.
** Or max. allowable pressure for the accumulator.
*** Option
Connections

Mechanical Controls

Hydraulic diagram and characteristic curve

Output pressure

Angular displacement

Pedal stroke

Isolating ball valves
Estimated max. actuator force as a function of output pressure

- Force on pedal (Fa)
- Force on pedal (Fb)

\[ Fa (\text{daN}) = 0.5 \times \text{max. output pressure (bar)} + 35 \]
\[ Fa (\text{daN}) = 5 \times Fa \]

To obtain the forces in lbf, convert the final result.

For information concerning special operating conditions (environment, temperatures, etc.), please contact your Poclain Hydraulics application engineer.

Model Code

- P1 - Cut-in / Cut-out range
  - 110 - 130 bar (1595 - 1885 PSI) 3
  - 120 - 140 bar (1740 - 2031 PSI) 4
  - 135 - 160 bar (1958 - 2321 PSI) 5
  - 160 - 190 bar (2178 - 2611 PSI) 6
  - 170 - 200 bar (2466 - 2901 PSI) 7
  - 180 - 210 bar (2611 - 3056 PSI) 8

- P2 - Operating pressure
  - 30 bar (435 PSI) 1
  - 40 bar (580 PSI) 2
  - 60 bar (870 PSI) 3
  - 80 bar (1160 PSI) 4
  - 100 bar (1450 PSI) 5
  - 120 bar (1740 PSI) 6

- P3 - Parking brake pressure
  \( P3 = P1 \)
  \( P3 = P1 \)

- Q1 - Flow rate to auxiliaries (P to S)
  - 45 l/min (12 GPM) 4

- Q2 - Flow rate to accumulator (P to A)
  - 2.75 l/min (0.73 GPM) 1
  - 8 l/min (2.11 GPM) 2
  - 15 l/min (3.96 GPM) 3

- C1 - Control
  - Without pedal or lever 0
  - Plain 0
  - Metal anti-skid 1
  - Rubber anti-skid 2
  - Metal anti-skid (lockable) 3
  - Rubber anti-skid (lockable) 4

** Limitations
- Pressure rise < 1 bar (14.5 PSI) / ms
- Current min. 100 mA to assure contact max. 4 A for Resistor load max. 2.5 A for Inductive load
- Voltage max. 42 V

- C2 - Pressure switch **
  - Without 0
  - On MA (accumulator min. pressure) 1
  - On MF (service brake) 2
  - On MS (auxiliary) 3
  - On MX (parking brake) 4
  - On MA and MF 5
  - On MA and MS 6
  - On MA, MF and MS 7
  - On MA, MF and MX 8
  - On MA, MF, MS and MX 9

- R1 - Electrical connection (solenoid valve)
  - Bare wires 1
  - Packard 2
  - Deutsch 3
  - Hirschmann 4
  - AMP 5

- R2 - Electrical connection (solenoid valve)
  - 12 V CC 1
  - 24 V CC 2

- R3 - Hydraulic connection
  - ISO 9974-1 (BSPP + spot face » ports) 4

S1 - S4 Options (See page 79)
- Special calibration * 1
- Specific port * 2
- Customized component * 3
- Mechanical control adaptation * 4
- LS Port 5
- Isolating ball valves 6
- Two-slope spring mechanism * 7
- Pressure sensor 8
- Pedal back abutment 9
- Circuit pressurization * 10
- MS Port 11
- MS + LS Port 12

** Please consult your Poclain Hydraulics application engineer.
**Applications**

VS Valve is designed for applications with long brake lines or very large brake cylinder volume, requiring high flow 70 l/min [18.5 GPM].

VS Valve is a 3-way valve with an external hydraulic control. It supplies and drains high volume brakes by connecting accumulator to service brakes on large machines.

Main use: braking systems.

**Operation**

VS valve is normally used with full power brake as "Relay Valve" and with parking brake as "Quick Return Valve".

**VS as Relay Valve:**
Control pressure (F1 & F2) is supplied to the VS valve proportionally to brake pedal angle on full power brake valve (VB-220). VS relay valve provides high flow directly from the accumulators (A1 & A2) to the brakes, proportional to the control pressure, i.e. directly proportional to the pedal position. The braking is progressive. As soon as brake pedal is released, VS transfers oil from brakes to the tank (T).

- External hydraulic pilot.
- Located between the accumulator(s) and the brake(s).
- Controlled and used with a modulating brake valve.

**VS as Quick Return Valve:**
The VS quick return valve transfers the flow coming from the brakes to the tank (T) proportional to the control pressure, i.e. directly proportional to the SAHR actuation. The braking is progressive.

- Internal hydraulic pilot.
- Located between the Spring Applied Hydraulically Released (SAHR) brake(s) and the tank.
- Controlled by and used with VB-002.
Overall dimensions of VS Relay valve

**Ratio 1:1**

![Diagram showing dimensions for ratio 1:1]

**Ratio 1:1,7 and 4:1**

![Diagram showing dimensions for ratio 1:1,7 and 4:1]

### Installation

**Chassis mounting**

<table>
<thead>
<tr>
<th>Ref.</th>
<th>M6</th>
<th>Quantity</th>
<th>Class</th>
<th>N.m [lb.ft] ± 10 %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(as per standard DIN 912)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8.8</td>
<td>10 [7.4]</td>
<td></td>
</tr>
</tbody>
</table>

### Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Max. pressure bar [PSI]</th>
<th>Connection</th>
<th>Function</th>
<th>kg [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>210 [3 046]</td>
<td>M22x1.5</td>
<td>Input</td>
<td>1 [2.20]</td>
</tr>
<tr>
<td>U</td>
<td>210 [3 046]</td>
<td>M14x1.5</td>
<td>Output</td>
<td>2.5 [5.5]</td>
</tr>
<tr>
<td>A</td>
<td>210 [3 046]</td>
<td>M22x1.5</td>
<td>Control pressure</td>
<td>Ratio 1:1.7</td>
</tr>
<tr>
<td>T</td>
<td>1 [14.5]</td>
<td>M22x1.5</td>
<td>Tank</td>
<td>2 [4.4]</td>
</tr>
</tbody>
</table>

**Part number**

- R00260000J
- R00260001K
- A16052X
- A29073B

**Compatibility**

- Braking circuits
Hydraulic diagram and characteristic curve

Pressure drop

Pressure drop $U \rightarrow T$

Pressure drop $P \rightarrow U$

![Graph showing pressure drop $U \rightarrow T$](image1)

![Graph showing pressure drop $P \rightarrow U$](image2)
## OPTIONS

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Special calibration&lt;br&gt;Pressure (braking, pressure switch, etc.) or specific flow rate.</td>
</tr>
<tr>
<td>2</td>
<td>Specific port&lt;br&gt;Without changing the standard of the other ports.</td>
</tr>
<tr>
<td>3</td>
<td>Customized component&lt;br&gt;Installation of a non-standard component (potentiometric sensor, special pressure switch, etc.)</td>
</tr>
<tr>
<td>4</td>
<td>Mechanical control adaptation</td>
</tr>
</tbody>
</table>

### Notes:
- Please contact your Poclain Hydraulics application engineer for further information on Options 1 through 4.

5. **LS Port (for VB-100, VB-200, VB-110 and VB-220)**

The Load Sensing port (M14x1.5 or 9/16-18 UNF-2B) is created on request on the standard valve body.

6. **Isolating ball valves (for VB-100, VB-200, VB-110, VB-220)**

In the event of failure of one of the braking circuits, this function acts in a similar way to isolating spool valves by keeping an energy reserve in the accumulator of the non-faulty circuit (limited reserve in the accumulator) and does not maintain pressure in the S line when a circuit has failed (if the steering is fed by the S port of the valve, choose spool valves).

Example of a VB-200 assembly:

- Ball valve

6. **Additional check valve (for VB-00M)**

7. **Two-slope spring mechanism (for VB-0B0 and VB-0D0)**

For certain applications, the braking sensation, the ergonomics of the pedal board, and the overall performance of the braked vehicle require a special braking curve. The first part, with its gradual slope, provides gentle, progressive braking to slow the vehicle. The second part, with a steeper slope, provides a braking finish that is progressive but firmer, for emergency braking. According to the shape of the pedal, the user's impression can be similar to a master cylinder. Please ask us about the available pressures.

8. **Pressure sensor**

The sensor (refer to mobile electronics catalog No. A01888C) is installed on the MF port (single-circuit valves) or the MF1 port (dual-circuit valve). It sends a pressure signal to the electronic circuit in the form of an electrical signal that is proportional to the pressure. It can also replace the MF pressure switch in its stop light control function.
Pedal back abutment
Prevents the pedal from tilting backward when the floor is inclined.

Improved watertightness (for VB only. At VB3 this is standard and not an option.)
There is a version of the spring mechanism with internal drainage via the brake tank return line for applications in harsh conditions (high humidity, exposed valve, etc.). It is mandatory for open-cabin applications.

Circuit pressurization

MS Port (for VB-100, VB-200, VB-110 and VB-220)
The MS port (12 x 1.5) is added on request to the standard valve body. It is normally used for the installation of the MS pressure switch.

Additional check valve (for VB3-002)

Shuttle valve (for VB-00M)

MS + LS Port
See Options 5 and C.

Orientation of the mechanical control with respect to the ports
E : Ports oriented to the right (East)  
N : Ports oriented to the front (North)  
S : Ports oriented to the back (South)  
W : Ports oriented to the left (West).

The installation orientation is defined by the relative position of the valve ports with respect to the conventional direction of operation of a classic vehicle, assuming that the mechanical controls are oriented as follows when idle:
Pedal: Top of pedal towards the front of the vehicle
Horizontal lever: Button towards the front of the vehicle
Vertical lever: Ball towards the front of the vehicle.

Pedal position sensor

Lever with rubber protection
**P** Customized name plate

A: Customized QR code  
B: Your company logotype  
C: Your product ID (upon request)

**L** Horizontal valve/ pedal position  
Line back of the valve to top of pedal

**M** Horizontal valve/ pedal position  
Line back of the valve to top of pedal
INSTALLATION

Warnings

Before Installation

- Take all necessary safety precautions (people and machines) and comply with safety regulations in effect.
- Confirm that mobile equipment is immobilized.
- Confirm that the hydraulic system’s energy generator (motor) is stopped and electrical power is disconnected.
- Lay out a safety perimeter.
- Do not perform work on a hydraulic system that is hot or under pressure (discharge the accumulators).

> Oil that is hot or under pressure can cause serious burns and infection. Consult a physician in case of accident.

- Never heat hydraulic fluid which can ignite at high temperature. Some solvents are also inflammable.
- Do not smoke while working on the system.

- The valves are intended to operate in closed cabins. For applications in harsh conditions (severe weather, marine environment, etc.), please consult your Poclain Hydraulics Application Engineer.

- The immediate vicinity of the machine should be declared a security zone. Observe all regulations regarding personnel safety.
General Information

Component Identification

A: Serial Number WW/YY
   WW: Week of manufacture
   YY: Year of manufacture
   This number is supplemented by a serial number that is marked by cold heading on the valve body.

B: Model code:
   e.g. VB-002-00A-00-M0-00A-4AE0

C: Poclain Hydraulics catalog number
   e.g. A23075G

D: Customer catalog number (on request)

Delivery

Valves are delivered in individual bags.

Paint

- Use paints compatible with the existing base coat.
- The Poclain Hydraulics components (like any mechanical component) can rust. They must be effectively and regularly protected according to the environment where they are used. During installation, any trace of rust must be eliminated before painting the machine.

Primer Specifications

<table>
<thead>
<tr>
<th>Number</th>
<th>Color</th>
<th>Brilliance ISO 2813</th>
<th>Saline mist ISO 9227</th>
<th>Adhesion ISO 2409</th>
<th>Hardness ASTM D3363</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAL 9005</td>
<td>Black</td>
<td>40%</td>
<td>&gt; 400 h</td>
<td>0</td>
<td>HB</td>
</tr>
</tbody>
</table>

Legend

A - No specific precaution; only check the proper mounting of the plugs and covers.
B - Fill up with hydraulic fluid
C - Rinse with storage fluid
D - Fill up with storage fluid.

Storage

The valves are supplied in bags. If they are to be stored, leave them in the bags. If this is not possible, the valves should be kept in a dry location and protected from dust.

Storage Interval

Depending on the interval and storage conditions, it is necessary to protect the internal components of the hydraulic parts. These operations must be performed before storing components or before stopping use of the machine.

<table>
<thead>
<tr>
<th>Climate</th>
<th>Storage interval (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperate</td>
<td>3 6 12 18</td>
</tr>
<tr>
<td>Tropical</td>
<td>B C D D</td>
</tr>
</tbody>
</table>

Storage areas must not be open (without a roof). The valves must not be laid on the ground.

These specifications vary with the supplier, but meet these minima. For more information, consult your Poclain Hydraulic’s application engineer.
Circuits
Checking Connections

Piping and Connections
The different components of the hydraulic circuit (tank, pumps, distributors, filters, sinks, etc.) are connected together by rigid piping or flexible hoses.

Suggested connection:

Comply with the connection directions given by the manufacturers for each part: function and marking of the ports, types of connections, diameters, types of lines (flexible or rigid), etc.

Rigid Tubes
For high-pressure pipes, only use unwelded cold-drawn steel pipes.

Take the following precautions for making up the tubes:
- After cutting to length, cold bending and crimping, the tubes must be carefully deburred, rinsed with oil and blown before connection.
- After welding or bending, the tubes must be etched (solution based on sulfuric acid) then rinsed with oil and neutralized (solution based on sodium hydroxide).
- The connections, threaded plugs, etc. must be deburred and cleaned before assembly.
- If assembly is not done immediately, seal the ports with plugs.

Flexible Tubes
Only use flexible tubes with crimped ends.

Avoid contacts likely to break down the flexible tubes. As needed protect them with armor.

Avoid kinks. Observe the minimum radius of curvature.

The tube's interior diameter must be greater than or equal to the diameter of the connection openings of the components.

Connection

Check the compatibility of the types of connections between the tubes and the motor's ports. If they are not compatible, use adapter fittings.

Ensure that the class of fitting is suitable for the operating pressure.
Bleed
To bleed your braking system, refer to the brake manufacturer’s recommendations.

⚠️ Rinse the brakes pilot circuit before connection.

Oils

Fluid Selection

General Recommendations
Poclain Hydraulics recommends the use of hydraulic fluids defined by the ISO 12922 and ISO 6743-4 standards. For temperate climates, the following types are recommended.
- HM 46 or HM 48 for fixed installations.
- HV 46 or HV 68 for mobile installations.
- HEES 46 for mobile installations.

These specifications correspond to category 91H of the CETOP standard, parts 1, 2 and 3 of the DIN 51524 standard, and grades VG32, VG 46 and VG68 of the ISO 6743-4 standards.

It is also possible to use ATF, HD, HFB, HFC or HFD type hydraulic fluid upon Poclain Hydraulics specific approval of the components’ operating conditions.

Standardized designations for the fluids
- **HM**: Mineral fluids having specific antioxidant, anticorrosion and antiwear properties (HLP equivalent to DIN 51524 parts 1 and 2).
- **HV**: HM mineral fluids providing improved temperature and viscosity properties (DIN 51524 part 3).
- **HEES**: Biodegradable fluids based on organic esters.

Class 32 (ISO VG 32): Viscosity of 32 cSt at 40°C.
Class 46 (ISO VG 46): Viscosity of 46 cSt at 40°C.
Class 68 (ISO VG 68): Viscosity of 68 cSt at 40°C.

Viscosity must always be between 9 and 500 cSt. If not, check the appropriateness of the cooling circuit, the design, or the grade of oil.
For all applications outside these limits, please consult your Poclain Hydraulics application engineer.
### Extract of the NF ISO 11 158 Standard

<table>
<thead>
<tr>
<th>Tests</th>
<th>Test Methods or Standards</th>
<th>HM Category</th>
<th>HV Category</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Viscosity Grade</td>
<td>Viscosity Grade</td>
<td>mm² / s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>32</td>
<td>46</td>
</tr>
<tr>
<td>Kinematic viscosity at 40°C</td>
<td>ISO 3104</td>
<td>19.8 to 24.2</td>
<td>28.8 to 35.2</td>
<td>41.4 to 50.6</td>
</tr>
<tr>
<td>Minimum viscosity index (a)</td>
<td>ISO 2909</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Acidity index, maximum (b)</td>
<td>ISO 6618</td>
<td>(c)</td>
<td>(c)</td>
<td>(c)</td>
</tr>
<tr>
<td>Water content, maximum</td>
<td>ASTM D 1744</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Flash point Cleveland in open-cup, min.</td>
<td>ISO 2592</td>
<td>140</td>
<td>160</td>
<td>180</td>
</tr>
<tr>
<td>Foaming at 24°C, max. 93°C, max.</td>
<td>ISO 6247</td>
<td>150/0</td>
<td>150/0</td>
<td>150/0</td>
</tr>
<tr>
<td>Deaeration at 50°C, maximum</td>
<td>ISO 9120</td>
<td>5</td>
<td>160</td>
<td>180</td>
</tr>
<tr>
<td>Copper blade corrosion at 100°C, 3 h maximum</td>
<td>ISO 2160</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Anti-wear property, FZG A/8, 3/90, minimum</td>
<td>DIN 51354-2</td>
<td>(e)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Aptitude to separate from water: Time needed to obtain 3 ml of emulsion at 54°C, max.</td>
<td>ISO 6614</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

(a) These limits should only be taken into consideration for fluids made from hydrocracked or hydro-isomerized mineral oils.
(b) Both base fluids and additives contribute to the initial acidity index.
(c) The performance criteria or the values of properties must be the subject of negotiation between the supplier and the end user.
(d) The DIN 51777-2 standard applies in cases where interference caused by certain chemical compounds must be avoided. Free bases, oxidizing or reducing agents, mercaptans, some nitrogenous products or other products that react with iodine interfere.
(e) Not applicable to ISO 22 viscosity grade.
Extract of the ISO 15 380 Standard

<table>
<thead>
<tr>
<th>Tests</th>
<th>Test Methods or Standards</th>
<th>HM Category</th>
<th>HV Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Viscosity Grade</td>
<td>Viscosity Grade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>32</td>
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<tr>
<td></td>
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<td>Kinematic viscosity at 40°C</td>
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<td></td>
<td>ISO 3104</td>
<td>19.8 to 24.2</td>
<td>28.8 to 35.2</td>
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<tr>
<td></td>
<td>ISO 2909</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>ISO 6618</td>
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<td>ASTM D 1744</td>
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<td></td>
<td>DIN 51777-1</td>
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<td>DIN 51777-2</td>
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<td>ISO 2592</td>
<td>165</td>
<td>175</td>
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<tr>
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<td>ISO 6247</td>
<td>75/0</td>
<td>75/0</td>
</tr>
<tr>
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<td>ISO 9120</td>
<td>7</td>
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<td>ISO 2160</td>
<td>2</td>
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<td>ISO 3016</td>
<td>-21</td>
<td>-18</td>
</tr>
<tr>
<td></td>
<td>ISO 6614</td>
<td>(c)</td>
<td>(c)</td>
</tr>
</tbody>
</table>

(a) These limits should only be taken into consideration for fluids made from hydrocracked or hydro-isomerized mineral oils.
(b) Both base fluids and additives contribute to the initial acidity index.
(c) The performance criteria or the values of properties must be the subject of negotiation between the supplier and the end user.
(d) The DIN 51777-2 standard applies in cases where interference caused by certain chemical compounds must be avoided. Free bases, oxidizing or reducing agents, mercaptans, some nitrogenous products or other products that react with iodine interfere.
(e) Not applicable to ISO 22 viscosity grade.
Temperature and Viscosity

The best performance is obtained by having the system operate in the regimes shaded gray.

Zone A
- Zone of maximum efficiency.
- In this zone, temperature variations have a weak effect on the response time, efficiency and life expectancy of the components.
- Poclain Hydraulics components can operate at all speeds, pressures and powers specified in their technical documentation.

Zone B
- High speeds can lead to vibrations and drops in mechanical efficiency. The booster pump can cavitate if the intake conditions are too tight but without risk for the system as long as the pump remains boosted.
- The Poclain Hydraulics components can operate at the pressures specified in their documentation but it is not advisable to use the pumps at full displacement.
- In a translation circuit, a rapid rise in the pump speed from zone B is allowed, but ordering the translation when the temperature has reached zone A is recommended.

Zone C
- The efficiency is less and the use of effective antiwear additives is required.
- The Poclain hydraulics components can temporarily operate at a power under 20 to 50% of that stated in the technical documentation, or during 20% of the operating time at the stated power.

Zone D
- The stated restrictions for zone B likewise apply to zone D.
- Further, the pumps must startup at low speed and no displacement. They must not be used in their normal operating conditions as long as the booster pressure has not stabilized and the hydraulic fluid temperature in the reservoir has not come up to zone B.

Zone E
- The efficiency is reduced and the risk of wear on the pump and hydraulic fluid is increased.
- The system can operate in zone E at low-pressure and during short periods.
- The temperature of the hydraulic fluid in the power circuit must not be more than 10°C above the temperature of the hydraulic fluid in the reservoir, and must not be more than 20°C warmer than the hydraulic fluid in the components’ cases.
Water Content
The ISO 12922 standard calls for a water content ≤ 0.05%.

Poclain Hydraulics components tolerate up to 0.1%.

Checking Water Content

Visual Inspection
• The oil appears cloudy once it has a water concentration greater than or equal to 1%.

We suggest two possible verification methods:

1- Quick Elementary Check

• The "crackle test."

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Make a small cup using household aluminum foil.</td>
</tr>
<tr>
<td>2</td>
<td>Put a drop of oil to test in the bottom of the cup.</td>
</tr>
<tr>
<td>3</td>
<td>Heat it by placing it over a flame using tongs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>If bubbles appear, the water content of the fluid exceeds 0.05%.</td>
</tr>
<tr>
<td></td>
<td>If bubbles do not appear, the water content in the fluid is less than 0.05%.</td>
</tr>
</tbody>
</table>

2- Laboratory analysis
To determine the exact water content of the fluid, we recommend a laboratory analysis.

Poclain Hydraulics performs laboratory analyses of water content in fluids. Contact us for further information.

Decontamination and Filtration

The life of hydraulic components is lengthened when the contamination level is low.
The hydraulic fluid must be maintained at ISO standard 4406 -1999 decontamination level 18/16/13 (class 7 from NAS 1638) using a filter.

**Braking circuit example:**

1. Vent on the tank
2. A 10 µm strainer on the intake line.
3. Pump

Consult manufacturer’s instructions for components (filters, pumps, valves, etc.).

The recommended intake filter size is four-time state of the booster pump.

New fluid is generally of lower quality than our requirements. Poclain Hydraulics asks its customers to fill or adjust the levels in the reservoirs in a clean environment using a pump and filter.

Return line
It is **ESSENTIAL** to connect the valve return line directly to the tank.

Any counterpressure on the return line can cause premature brake wear without any use of the pedal.

**Accumulators**
- Select accumulators whose maximum allowable pressure is compatible with the valve pressures.
- Accumulator charging valve: any pressure on S (higher than the cut-out pressure) ends up in the accumulator(s) of the braking circuit.
## Mounting

The mounting is defined for each valve type, and depends on the type of mechanical control selected.

- **Warning:** When the valve is installed, the pedal must not be obstructed during its stroke.

- **Warning:** The valve bodies must never touch other components (min. clearance 5 mm [0.20 in]).

### Recommended screw torques:

<table>
<thead>
<tr>
<th>Screws and Bolts</th>
<th>Nominal Dimension</th>
<th>Quality Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>8.8 N.m [lb.ft]</td>
</tr>
<tr>
<td>C HC Normal Spaced Threads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>49 [36]</td>
<td>69 [51]</td>
</tr>
<tr>
<td>M12</td>
<td>86 [63]</td>
<td>120 [89]</td>
</tr>
<tr>
<td>M14</td>
<td>135 [100]</td>
<td>190 [140]</td>
</tr>
<tr>
<td>M18</td>
<td>290 [214]</td>
<td>405 [299]</td>
</tr>
<tr>
<td>M20</td>
<td>410 [303]</td>
<td>580 [428]</td>
</tr>
<tr>
<td>M24</td>
<td>710 [524]</td>
<td>1000 [738]</td>
</tr>
</tbody>
</table>

### Normal Spaced Threads

<table>
<thead>
<tr>
<th>Connectors Nominal Dimension</th>
<th>Tightening Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10 x 1</td>
<td>45 [33]</td>
</tr>
<tr>
<td>M12 x 1</td>
<td>45 [33]</td>
</tr>
<tr>
<td>M12 x 1.5</td>
<td>45 [33]</td>
</tr>
<tr>
<td>M14 x 1.5</td>
<td>45 [33]</td>
</tr>
<tr>
<td>M16 x 1.5</td>
<td>60 [44]</td>
</tr>
<tr>
<td>M18 x 1.5</td>
<td>70 [52]</td>
</tr>
<tr>
<td>M22 x 1.5</td>
<td>100 [74]</td>
</tr>
<tr>
<td>M27 x 2</td>
<td>200 [148]</td>
</tr>
<tr>
<td>Ø 13</td>
<td>30 [22]</td>
</tr>
<tr>
<td>Ø 17</td>
<td>55 [41]</td>
</tr>
<tr>
<td>Ø 21 (BP)</td>
<td>100 [74]</td>
</tr>
<tr>
<td>Ø 21 (HP)</td>
<td>160 [118]</td>
</tr>
<tr>
<td>Ø 27</td>
<td>200 [148]</td>
</tr>
<tr>
<td>1&quot;1/16 - 12 UNF</td>
<td>170 [125]</td>
</tr>
<tr>
<td>3/4&quot; - 16 UNF</td>
<td>70 [52]</td>
</tr>
<tr>
<td>9/16&quot; - 18 UNF</td>
<td>35 [26]</td>
</tr>
<tr>
<td>7/8&quot; - 14 UNF</td>
<td>100 [74]</td>
</tr>
</tbody>
</table>

(BP): Low Pressure  
(HP): High Pressure
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Illustrations are not binding.

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