Automatic load-dependent load sensing valve (LSV) 475 71.

LSV 475 712

Application
LSV controller with integrated trailer brake valve for leaf-spring semitrailers (mainly in Italy, France and the UK)

Purpose
Control of the two-line trailer brake systems when actuating the braking system of the towing vehicle. Automatic control of the braking force based on the charge status of the vehicle with the integrated LSV. Actuation of the automatic trailer braking with partial or total pressure drop in the supply line.

Maintenance
Special maintenance that extends beyond the legally specified inspections is not required.

Installation recommendation
- Install the LSV vertically so that the drain faces downward.
  The set screws on the top of the housing are used for fastening.
  For the linkage, use knuckle joint 433 306 003 0 if necessary.
- To determine the lever length L, draw a line in the respective nomograph using the scale for control ratio \( i \) (e.g. 2.8) to the scale for spring deflection \( f \) (e.g. 30).
  Extending this line crosses the scale for lever length \( L \) at 140 mm.
Automatic load-dependent load sensing valve (LSV) 475 71.

Nomograph

Legend

<table>
<thead>
<tr>
<th></th>
<th>Control ratio =</th>
<th></th>
<th>Spring deflection</th>
<th></th>
<th>Lever length</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td>$p_{on} -0.8 / p_{off} -0.5$</td>
<td>f</td>
<td></td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>
Automatic load-dependent load sensing valve (LSV) 475 71.

Installation dimensions

<table>
<thead>
<tr>
<th>Connections</th>
<th>Port threads</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 Energy supply or release (supply reservoir)</td>
<td>1, 4 M 16x1.5 - 12 deep</td>
<td>1) Stop at break of linkage</td>
</tr>
<tr>
<td>1 Energy supply</td>
<td>1-2 M 22x1.5 - 13 deep</td>
<td>2) Over travel</td>
</tr>
<tr>
<td>2 Energy delivery</td>
<td>2 M 22x1.5 - 13 deep (side)</td>
<td>3) Control stroke</td>
</tr>
<tr>
<td>3 Exhaust</td>
<td>2 M 16x1.5 - 122 deep (bottom)</td>
<td>4) Stop</td>
</tr>
<tr>
<td>4 Control port</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>475 712 000 0</th>
<th>475 712 004 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure</td>
<td>10 bar</td>
<td></td>
</tr>
<tr>
<td>Control range, dynamic effect</td>
<td>$\alpha = 20^\circ$</td>
<td>$\alpha = 30^\circ$</td>
</tr>
<tr>
<td>Usable lever length</td>
<td>50 to 290 mm</td>
<td>50 to 275 mm</td>
</tr>
<tr>
<td>Linkage</td>
<td>via linkage (see fig. Installation dimensions).</td>
<td>with integrated knuckle joint, see 475 713</td>
</tr>
<tr>
<td>Port 1, 1-2, 4 with filter</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>Max. permissible adjustment torque M2</td>
<td>20 Nm</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 °C to +80 °C</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>2.2 kg</td>
<td>2.6 kg</td>
</tr>
</tbody>
</table>
Automatic load-dependent load sensing valve (LSV) 475 71.

Pressure diagrams

**Legend**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_1$</td>
<td>Input pressure</td>
</tr>
<tr>
<td>$p_2$</td>
<td>Output pressure</td>
</tr>
<tr>
<td>$p_4$</td>
<td>Control pressure</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Lever travel [degrees]</td>
</tr>
</tbody>
</table>
The LSV is fixed on the vehicle frame and connected via a linkage with a fixed point on the axle resp. on the knuckle joint. The distance between the axle and the LSV is the longest in unladen condition, the lever (j) is in its lowest position.

When the vehicle is laden, the distance becomes smaller and the lever (j) is moved from its unladen position into full-load direction. The same adjustment of the cam disc with lever (j) moves valve tappet (l) to a position corresponding to the vehicle load.

Compressed air passes from the tractor through the supply line hose coupling to port 1, passes grooved ring (h) to connection 1-2 and on to the supply reservoir of the semitrailer. At the same time, the piston (k) – applied with supply pressure – moves down and takes the valve (g) with it. Outlet (n) opens and connections 2 are connected with vent 3.

Upon actuation of the tractor brakes, compressed air flows via the hose coupling "Brake" and port 4 to chamber A and pressurises the piston (b). This is forced downward, closing outlet (d) and opening inlet (p). The compressed air from port 4 flows into chamber C beneath the diaphragm (e), acting on the effective area of the relay piston (f).

At the same time, air flows into chamber B via opened valve (a) and passage E, acting on the upper side of diaphragm (e). This pressure predominance causes the reduction in the partially-laden range to be neutralized at low actuating pressures (up to maximum 1.0 bar). If the pilot pressure increases further, piston (r) is forced up against the load in pressure spring (s) and valve (a) closes.

The pressure building up in chamber C forces the relay piston (f) downwards. Outlet (n) opens and inlet (m) opens. The supply air at port 1-2 flows now via inlet (m) into room D and reaches via the ports 2 the downstream air brake cylinders. At the same time, pressure builds up in chamber D which acts on the underside of the relay piston (f). As soon as this pressure becomes a bit higher than the pressure in chamber C, the relay piston (f) moves upwards and the inlet (m) closes.

As piston (b) moves down, diaphragm (e) is forced against serrated disc (o) thereby continuing to increase the effective diaphragm surface area. As soon as the force in chamber C which acts on the underside of the diaphragm is equal to
the force acting on the piston (b), that piston moves upwards. The inlet (p) closes and an end position is reached.

The position of valve tappet (l), which depends upon the position of lever (j), determines the output pressure.

The piston (b) with the serrated disc (o) must make a stroke which corresponds to the position of the valve tappet (l), before the valve (c) starts working. This stroke also causes the effective area of the diaphragm (e) to be changed. In the fully laden position, the input pressure at port 4 is the same as that reaching chamber C. As full pressure is applied to relay piston (f), it keeps inlet (m) open and the applied brake pressure is not regulated.

When the tractor brakes are released, port 4 is vented and the pressure in ports 2 forces relay piston (f) upward to the end of its stroke.

Outlets (d and n) open and the compressed air existing in ports 2 and in chamber C passes through vent 3 to the atmosphere.

**Automatic braking**

When disconnected or in the event of a rupture in the supply line, port 1 is exhausted and the pressure acting on the upper side of piston (k) is reduced. Supply reservoir pressure existing from ports 1-2 moves the piston (k) upwards. The valve (g) closes outlet (n). As piston (k) continues to move up, it moves away from valve (g) and inlet (m) opens. The full reservoir pressure is sent via ports 2 to the brake cylinders. If there is a rupture in the brake line, the automatic braking is triggered – as described earlier – because the defective brake line drops the pressure in the supply in combination with the trailer control valve, as soon as the towing vehicle brakes.
LSV 475 713

Application
Static LSV for mechanical suspension vehicles (single-axles/axle assemblies) without EBS.
With axle assemblies, only in combination with trailer brake valve or relay valve to meet timing requirements in accordance with ECE R13.

Purpose
Automatic control of the braking force in pneumatic brake cylinders depending on the vehicle load.
Installation dimensions

Connections | Port threads | Legend
--- | --- | ---
1/4 Energy supply | 1/4 M 22x1.5 - 13 deep | 1) Stop at break of linkage
2 Energy delivery | 2 M 16x1.5 - 12 deep | 2) Over travel
3 Exhaust | |
Setting instructions

Load sensing valve program (LSV)
The required lever length can be determined with our calculation program instead of with Nomographs as well.
Open the WABCO website www.wabco-auto.com.
Then click on the links Diagnostics => WABCO System Diagnostics => Download => Load Sensing Valve Program (LSV).

The nomographs below are used to determine the LSV lever lengths to be set on the unit. Using an adjustment tool and a ø 3 mm pin, you can set the empty brake pressure at a certain input pressure (e.g. 6 bar) and clamp with the bolt SW 10. Before adjustments can be made on LSV (cable length, lever position, etc.), there is to be no pressure on the LSV.

After fitting the LSV in the vehicle (empty) and the knuckle joint on the axle shaft (In the process, the spring of the knuckle joint has to be prestressed by 15 mm using the fastening bolt) and after tightening and fixing the connecting cable (cable length Min. 50 mm, Max. 450 mm), the connecting cable must hang vertically below its fastening on the lever. When the pin is removed and the LSV is again pressurised, its output pressure must be the LSV unladen pressure.

Make small corrections to the unladen brake pressure by threading the fastening bolt in or out (max. 5 mm). If the empty pressure is correct, the knuckle joint is prestressed or raised by the amount of suspension travel of the trailer (difference in travel laden - empty). When the LSV is pressurised again, it must equalise the applied pressure. In the case of the output pressure being less than the input pressure, either the lever is too long or the spring excursion is insufficient. In the case of the output pressure being the same as the input pressure, the lever is lowered by approx. 10 % of the spring excursion towards "unladen". The resulting output pressure must be less than the input pressure. If this is not the case, either the LSV lever is too short or the suspension travel is too great.
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Nomograph for LSV 475 713 500 0

Legend

- \( i \)  Control ratio \( p_{\text{on}} - 0.8 / p_{\text{off}} - 0.5 \)
- \( f \)  Spring deflection
- \( L \)  Lever length

Nomograph for LSV 475 713 501 0

Legend

- \( i \)  Control ratio \( p_{\text{on}} - 0.8 / p_{\text{off}} - 0.5 \)
- \( f \)  Spring deflection
- \( L \)  Lever length
Technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>475 713 500 0</th>
<th>475 713 501 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure</td>
<td>10 bar</td>
<td></td>
</tr>
<tr>
<td>Max. control ratio</td>
<td>8:1</td>
<td></td>
</tr>
<tr>
<td>Nominal diameter</td>
<td>Ø 10 mm</td>
<td></td>
</tr>
<tr>
<td>Max. permissible adjusting torque $M_2$</td>
<td>20 Nm</td>
<td></td>
</tr>
<tr>
<td>Control stroke</td>
<td>$\alpha = 20^\circ$</td>
<td>$\alpha = 33^\circ$</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 °C to +80 °C</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1.8 kg</td>
<td></td>
</tr>
</tbody>
</table>

Pressure diagrams

Legend

$p_1$  Control pressure  $p_2$  Output pressure  $\alpha$  Lever travel [degrees]
**Operation**

The LSV is mounted on the vehicle chassis and is actuated via a connecting cable attached to the axle by means of a tension spring. The greatest distance between the axle and the brake force controller exists when unladen. The lever (f) is in its unladen brake pressure position.

As the vehicle is loaded, this distance is reduced and lever (f) moves from its empty position towards its fully laden position. The movement of lever (f) causes cam plate (g) to move valve tappet (i) to a position corresponding to the vehicle load. Output pressure from the relay emergency valve reaches chamber (A) via port 1, acting on piston (b).

Which is forced down, closing outlet (c) and opening inlet (k). The air now flows to chamber E below diaphragm (d) and via ports 2 to the downstream air-brake cylinders. At the same time, air flows into chamber (D) via opened valve (a) and channel (B), and acts on the upper side of diaphragm (e).

This pressure predominance causes the reduction in the partially-laden range to be neutralized at low actuating pressures. If the pilot pressure increases further, piston (l) is forced up against the load in pressure spring (m) and valve (a) closes.

The downward motion of piston (b) releases diaphragm (d) from its seat in the load sensing valve, pushing it against the fanned-out portion of piston (b). The effective surface area of the diaphragm is thus increased continuously until it exceeds the area of the upper side of the piston. Thus, piston (b) is raised again and inlet (k) closed. The end position has now been reached. (Inlet (k) will remain open only in fully laden condition "1:1"). The pressure delivered to the actuators of the fully laden vehicle corresponds to the pressure in the load sensing valve delivered from the relay emergency valve, with a partially laden or unladen vehicle, however, this pressure is reduced accordingly.

When the brake pressure has been reduced, piston (b) is forced up by the pressure in chamber E. Outlet (c) opens and the air is exhausted to atmosphere via valve tappet (i) and exhaust 3.
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With each brake application, air flows into chamber (F) via passage (C), acting on washer (e). This sealing washer is pushed against valve tappet (i) and at a brake pressure > 0.8 bar, a pressure contact is established between valve tappet (i) and the housing. The load sensing valve's reducing ratio is thus locked and remains so even when the distance between the axle and the chassis is changed further. Tension spring (h) compensates these variations in travel. An integral torsion spring in the load sensing valve moves valve tappet (i) into the "fully laden" position in the event of the linkage fracturing.
LSV 475 714

Application
Static controller for air-suspension vehicles without EBS.

Purpose
Automatic control of braking pressure from air brake cylinders on air-suspension axles (axle assemblies) depending on the control pressure of the air-suspension bellows (air-bags).

Maintenance
- To test the LSVs, fasten a test hose to connection 43.
  ➔ Screwing on presses the piston (n) into the housing, thereby interrupting connections 41 and 42 to the pistons (m and k). At the same time, a compressed air connection from connection 43 to the pistons (m and k) is created. In this state, the LSV generates a control position according to the compressed air in the test hose.

Installation recommendation
- Fasten the LSV onto the frame of the vehicle so that vent 3 faces downward.
- Make connections 41 and 42 with the air-suspension bellows (air-bags) on the right and left vehicle sides.
Automatic load-dependent load sensing valve (LSV) 475 71.

Installation dimensions

Legend
* When releasing the air from the device, air can escape at the sealing surfaces.
Setting instructions

Load sensing valve program (LSV)
The required lever length can be determined with our calculation program instead of with Nomographs as well.
Open the WABCO website www.wabco-auto.com.
Then click on the links Diagnostics => WABCO System Diagnostics => Download => Load Sensing Valve Program (LSV).

Description of the nomographs I and II for setting the LSVs 475 714 500 0:

**Nomograph I for determining the compression spring and spring length L₁**

- **Legend**
  - \( p_{\text{on}} -0.8 / p_{\text{off}} -0.5 \)
  - \( S₂ \) Bolt 896 512 360 4 Pressure spring (wire ø 4 mm)
  - \( \Delta p_L \) Air suspension bellows - pressure difference; Unladen-Laden
  - \( D \) Separator 896 512 370 4 Pressure spring (wire ø 3.2 mm)
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Nomograph II for determining the bolt set length $L_2$ and the spacers $N$ as well as $L_3$

Legend

<table>
<thead>
<tr>
<th>$L_1$</th>
<th>Spring length</th>
<th>$N$</th>
<th>Number of spacers</th>
<th>$H_1$</th>
<th>Subsidiary line 1 896 512 370 4</th>
<th>Pressure spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_2$</td>
<td>Bolt length</td>
<td>$i$</td>
<td>Control ratio</td>
<td>$H_2$</td>
<td>Subsidiary line 2 896 512 360 4</td>
<td>Pressure spring</td>
</tr>
<tr>
<td>$L_3$</td>
<td>Unladen stop bolt (W)</td>
<td>$p_{41}/p_{42}$</td>
<td>Air-suspension bellows pressure &quot;Unladen&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Determining the compression springs and set length $L_1$

<table>
<thead>
<tr>
<th>Required adjustment values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_{on} (p_1) = 6.5$ bar</td>
</tr>
<tr>
<td>$p_{bellows \text{ unladen}} = 0.2$ bar</td>
</tr>
</tbody>
</table>

- Calculating the control ratio:
  
  $i = (p_{on} - 0.8) / (p_{off} - 0.5) = (6.5 - 0.8) / (1.75 - 0.5) = 4.56$

- Enter the control ratio in nomographs I and II (point A).

- In addition, mark the air-suspension bellows pressure difference in nomograph I ($p_{bellows \text{ laden}} - p_{bellows \text{ unladen}}$), here 3.9 bar (point B).

- Connect points A-B to obtain point C at the cross-point with the identified suspension.

  You can now read the spring length $L_1$ (free hanging) and the springs to be used here.

- In nomograph II, enter the spring length $L_1$ (point D) and the used spring with spring length $L_1$ (point E).

- After you have entered the air-suspension bellows pressure for the unladen vehicle (point F), connect points A-D and E-F together and extend them past D and E up to help-lines 1 and 2.

  Connect the resulting points G and H with one another.

  At the crossing point with the help lines, you have point J, at which you can read the required number of spacers and the length of bolt $L_2$. 


Automatic load-dependent load sensing valve
(LSV) 475 71.

The values that are determined using the nomograph are guidelines and may have to be corrected.

Setting the LSVs

Before each adjustment to the bolts and pressure \( p_4 \), connection 1 must be depressurised, otherwise the integrated LSV statics will not be able to be set to the required values.

Because of the production tolerances and the hysteresis, after adjusting the pressures \( (p_1 \) and \( p_{41/42} \)), it is always a good idea to readjust starting from 0 bar, if nothing else is specified.

- After you have installed the right springs with clamp X (set dimension L1) and the number of spacers N in the LSV, thread in bolt 2 (L2) until you can feel a noticeable resistance.

Setting the unladen stop bolt

After charging \( p_1 \) with the calculated pressure (in this case, 6.5 bar), the LSV must apply the unladen brake pressure (in this case, 1.75 ±0.1 bar) at connection 2.

- If the unladen brake pressure is too high, unscrew the unladen stop bolt W (L3); if the unladen brake pressure is too low, screw the unladen stop bolt in.

Unscrew the unladen stop bolt W to a maximum of 23 mm.

Setting the unladen brake pressure

After charging connections 41 and 42 with the unladen bellows pressure +0.2 bar (in this case, 0.4 bar) and connection 1 with the calculated pressure, the LSV must apply a pressure that is 0.2 bar higher than the unladen brake pressure with a tolerance of ±0.1 bar (in this case 1.95 ±0.1 bar).

- If the pressure is too low, unscrew bolt 2; if the pressure is too high, screw in bolt 2.
- Counter-lock bolt 2.

Setting the brake pressure for the laden vehicle

After charging connections 41 and 42 with the bellows pressure for the laden vehicle -0.1 bar (in this case, 4.0 bar), the LSV must apply the input pressure -0.3 bar with a tolerance of ±0.2 bar (in this case 6.2 ±0.2 bar).

Output pressure too low

- Determine \( \Delta p \) (pressure difference between nominal value and actual value).
- Lower the input pressure to 0 bar.
- Lower the bellows pressure to 0 bar and increase the value for the unladen vehicle +0.2 bar (in this case, 0.4 bar).
- Screw out bolt 2 (\( \Delta p = 0.1 \) bar corresponds to 3 mm).
- Screw out the spring clamp until nominal value (in this case, 1.95 ±0.1 bar) is achieved.
- Repeat the test "Setting the brake pressure for the laden vehicle".

Output pressure too high

- Determine \( \Delta p \).
- Lower the input pressure to 0 bar.
- Lower the bellows pressure to 0 bar and increase to the value for the unladen vehicle +0.2 bar (in this case, 0.4 bar).
- Screw in bolt 2 (\( \Delta p = 0.1 \) bar corresponds to 3 mm).
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- Screw in the spring clamp until nominal value (in this case, 1.95 ±0.1 bar) is achieved.
- Repeat the test “Setting the brake pressure for the laden vehicle”.
- Actuate all test points again after setting the LSV.
- Tighten the counter nuts on bolts W and 2 to the specified torque (8±2 Nm).
- Enter the data on the LSV plate (order number 899 144 631 4) and fasten it on the vehicle.

Technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>475 714 500 0</th>
<th>475 714 509 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating pressure $p_1$</td>
<td>10 bar</td>
<td></td>
</tr>
<tr>
<td>Max. control ratio</td>
<td>8:1</td>
<td></td>
</tr>
<tr>
<td>Max. control pressure $p_{41, 42}$</td>
<td>12 bar</td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 °C to +80 °C</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1.8 kg</td>
<td></td>
</tr>
</tbody>
</table>

Pressure diagrams

Legend

- $p_1$: Input pressure
- $p_2$: Output pressure
- $p_{41} = p_{42}$: Control pressure
Operation

The air pressure (control pressure) from the air-suspension bellows affects the pistons (m and k). Depending on the air pressure (corresponds with the charge status), the guide sleeve (i) is pushed against the spring (z) with the control curve indicated (h) and set to a control position corresponding with the charge status.

When actuating the compressed air braking system, pressure output from the relay emergency valve reaches chamber A via port 1, acting on piston (d). The piston (d) is forced down, closing outlet (e) and opening inlet (c). The air now flows to chamber B below diaphragm (f) and via ports 2 to the downstream air-brake cylinders. At the same time, compressed air flows via the opened valve (b) and channel F into chamber C and pressurises the top side of diaphragm (f). This pressure predominance causes the reduction in the partially-laden range to be neutralized at low actuating pressures. If the pilot pressure increases further, piston (a) is forced up against the load in pressure spring (s) and valve (b) closes. The downward motion of piston (d) releases diaphragm (f) from a seat in the control valve, pushing it against the fanned-out portion of piston (d). The effective diaphragm surface on the underside of the diaphragm (f) expands continuously until the forces from the top of the piston and the bottom of the piston are equal to the underside of the diaphragm. Thus, piston (d) is raised again and inlet (c) closed. The end position has now been reached. (Inlet (c) will remain open only in fully laden condition). The pressure that is then measured in the brake cylinders corresponds with the charged status and the brake pressure applied by the towing vehicle or the trailer brake valve.

When the brake pressure has been reduced (brake released), piston (d) is forced up by the pressure in chamber B. Outlet (e) opens and the air is exhausted to atmosphere via valve tappet (r) and vent 3. With each brake application, air flows into chamber E via channel D, acting on rubber seal (p). This seal (p) is pushed against valve tappet (r) and at a brake pressure > 0.8 bar, a pressure contact is established between valve tappet (r) and the housing. The controller reduction ratio is therefore blocked and remains blocked during the braking procedure with dynamic axle load transfers. If the pressure in the air-suspension bellows should be increased in the partially laden range, the roller (g) is pressed against the spring (o). The tappet (r) remains in the control position as it was when introducing the braking process.
LSV trailer braking valve 475 715

Application

Static LSV with integrated trailer brake valve for air-suspension semitrailers with multiple axles without Trailer EBS.

Purpose

Control of the two-line trailer brake systems when actuating the braking system of the towing vehicle.
Automatic control of braking force with the integrated LSV depending on the load status of the vehicle and therefore from the control pressure of the air-suspension bellows (air-bags).
Actuation of the automatic trailer braking with partial or total pressure drop in the supply line.
The LSV trailer brake valve is specially designed for air-suspension semitrailers with multiple axles.

Maintenance

– To test the LSVs, fasten a test hose to connection 43.

➤ Screwing on presses the piston (q) into the housing, thereby interrupting connections 41 and 42 to the pistons (p and o). At the same time, a compressed air connection from connection 43 to the pistons is created. In this state, the LSV generates a control position according to the compressed air in the test hose.

Installation recommendation

– Fasten the LSV trailer brake valve onto the frame of the vehicle so that vent 3 faces downward.
– Make connections 41 and 42 with the air-suspension bellows (air-bags) on the right and left vehicle sides.
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Installation dimensions

<table>
<thead>
<tr>
<th>Connections</th>
<th>Port threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 Energy supply / Energy delivery</td>
<td>1-4 Energy supply</td>
</tr>
<tr>
<td>2 Energy delivery</td>
<td>3 Exhaust</td>
</tr>
<tr>
<td>41, 42 Control port</td>
<td>43 Test connection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connections</th>
<th>Port threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M 16x1.5 - 12 deep</td>
</tr>
<tr>
<td>2</td>
<td>M 16x1.5 - 12 deep (bottom)</td>
</tr>
<tr>
<td>2</td>
<td>M 12x1.5 - 10 deep</td>
</tr>
<tr>
<td>1-2, 1/4</td>
<td>M 22x1.5 - 13 deep</td>
</tr>
<tr>
<td>2</td>
<td>M 22x1.5 - 13 deep (side)</td>
</tr>
</tbody>
</table>
Setting instructions

Load sensing valve program (LSV)
The required lever length can be determined with our calculation program instead of with Nomographs as well.
Open the WABCO website www.wabco-auto.com.
Then click on the links Diagnostics => WABCO System Diagnostics => Download => Load Sensing Valve Program (LSV).

Description of the nomographs I and II for setting the LSV trailer brake valve 475 715 5.. 0

Legend

<table>
<thead>
<tr>
<th>i</th>
<th>Control ratio ((p_{on} - 0.8) / (p_{off} - 0.5))</th>
<th>D</th>
<th>Separator</th>
<th>896 512 360 4</th>
<th>Pressure spring (wire Ø 4 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>Bolt</td>
<td>Δp_L</td>
<td>Air suspension bellows - pressure difference; (p_{Bellows laden} - p_{Bellows unladen})</td>
<td>896 512 370 4</td>
<td>Pressure spring (wire Ø 3.2 mm)</td>
</tr>
</tbody>
</table>
Automatic load-dependent load sensing valve (LSV) 475 71.

Legend

<table>
<thead>
<tr>
<th>L1</th>
<th>Spring length</th>
<th>H1</th>
<th>Subsidiary line 1</th>
<th>N</th>
<th>Number of spacers</th>
<th>p_{\text{on}}</th>
<th>p_{\text{off}}</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>Bolt length</td>
<td>H2</td>
<td>Subsidiary line 2</td>
<td>i</td>
<td>Control ratio</td>
<td>p_{\text{on}} - 0.8</td>
<td>p_{\text{off}} - 0.5</td>
</tr>
<tr>
<td>L3</td>
<td>Unladen stop bolt (W)</td>
<td>p_{\text{Bellows laden}}/p_{\text{Bellows unladen}}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Determining the compression springs and set length L1 and the number of spacers

Required adjustment values

<table>
<thead>
<tr>
<th>p_{\text{on}} (p_1) = 6.5 bar</th>
<th>p_{\text{Bellows laden}} = 4.1 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>p_{\text{Bellows unladen}} = 0.2 bar</td>
<td>p_{\text{off}} = p_{\text{2 unladen}} = 1.75 bar</td>
</tr>
</tbody>
</table>

Calculate the control ratio:

\[ i = \frac{p_{\text{on}} - 0.8}{p_{\text{off}} - 0.5} = \frac{6.5 - 0.8}{1.75 - 0.5} = 4.65 \]

Enter the control ratio in nomographs I and II (point A).

In addition, mark the air-suspension bellows pressure difference in nomograph I (\( p_{\text{Bellows laden}} - p_{\text{Bellows unladen}} \)), here 3.9 bar (point B).

Connect points A-B to obtain point C at the cross-point with the identified suspension.

You can now read the spring length L1 (free hanging) and the springs to be used here.

In nomograph II, enter the spring length L1 (point D) and the used spring with spring length L1 (point E).

After you have entered the air-suspension bellows pressure for the unladen vehicle (point F), connect points A-D and E-F together and extend them past D and E up to help-lines 1 and 2.

Connect the resulting points G-H with one another.
**Automatic load-dependent load sensing valve (LSV) 475 71.**

At the crossing point with the help lines, you have point J, at which you can read the required number of spacers and the length of bolt L2. The values that are determined using the nomograph are guidelines and may have to be corrected.

**Setting the LSVs**

Before each adjustment to the bolts and pressure $p_{41/42}$, connection 4 must be depressurised, otherwise the integrated statics of the LSV trailer brake valve 475 715 5.. 0 will not be able to be set to the required values. Because of the production tolerances and the hysteresis, after adjusting the pressures ($p_1$ and $p_{41/42}$), it is always a good idea to readjust starting from 0 bar, if nothing else is specified.

- After you have installed the right springs with clamp X (set dimension L1) and the number of spacers N in the LSV, thread in bolt 2 until you can feel a noticeable resistance.

**Setting the unladen stop bolt**

After charging $p_4$ with the calculated pressure (in this case, 6.5 bar), the LSV trailer brake valve must apply the unladen brake pressure (in this case, 1.75 ±0.1 bar) at connection 2.

- If the unladen brake pressure is too high, unscrew the unladen stop bolt W (L3); if the unladen brake pressure is too low, screw the unladen stop bolt in Unscrew the unladen stop bolt W to a maximum of 23 mm.

**Setting the unladen brake pressure**

After charging connections 41 and 42 with the unladen bellows pressure +0.2 bar (in this case, 0.4 bar) and connection 4 with the calculated pressure, the LSV trailer brake valve must apply a pressure that is 0.2 bar higher than the unladen brake pressure with a tolerance of ±0.1 bar (in this case 1.95 ±0.1 bar).

- If the pressure is too low, unscrew bolt 2; if the pressure is too high, screw in bolt 2.
- Counter-lock bolt 2.

**Setting the brake pressure for the laden vehicle**

After charging connections 41 and 42 with the bellows pressure for the laden vehicle -0.1 bar (in this case, 4.0 bar), the LSV must apply the input pressure -0.3 bar with a tolerance of ±0.2 bar (in this case 6.2 ±0.2 bar).

**Output pressure too low**

- Determine $\Delta p$ (pressure difference between nominal value and actual value).
- Lower the input pressure to 0 bar.
- Lower the bellows pressure to 0 bar and increase to the value for the unladen vehicle +0.2 bar (in this case, 0.4 bar).
- Screw out bolt 2 ($\Delta p = 0.1$ bar = 3 mm).
- Screw out the spring clamp until nominal value (in this case, 1.95 ±0.1 bar) is achieved.
- Repeat the test “Setting the brake pressure for the laden vehicle”.

**Output pressure too high**

- Determine $\Delta p$.
- Lower the input pressure to 0 bar.
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- Lower the bellows pressure to 0 bar and increase to the value for the unladen vehicle +0.2 bar (in this case, 0.4 bar).
- Screw in bolt 2 (Δp = 0.1 bar = 3 mm).
- Screw in the spring clamp until nominal value (in this case, 1.95 ±0.1 bar) is achieved.
- Repeat the test "Setting the brake pressure for the laden vehicle".
- Actuate all test points again after setting the LSV.
- Tighten the counter nuts on bolts W and 2 to the specified torque (8 +2 Nm).
- Enter the data on the LSV plate (order number 899 144 631 4) and fasten it on the vehicle.

Technical data

<table>
<thead>
<tr>
<th>Order number</th>
<th>475 715 500 0</th>
<th>475 715 507 0</th>
<th>475 715 513 0</th>
<th>475 715 514 0</th>
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<tbody>
<tr>
<td>Max. operating pressure p₁/₄</td>
<td>10 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. control ratio</td>
<td>8:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. control pressure p₄₁₄₂</td>
<td>12 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-40 °C to +80 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>1.8 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pressure diagrams
Automatic load-dependent load sensing valve (LSV) 475 71.

Legend

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_2$</td>
<td>Output pressure</td>
</tr>
<tr>
<td>$p_4$</td>
<td>Input pressure</td>
</tr>
<tr>
<td>$p_{41} = p_{42}$</td>
<td>Control pressure</td>
</tr>
</tbody>
</table>
Operation

The air pressure (control pressure) from the air-suspension bellows affects the pistons (p and o). Depending on the control pressure — corresponds with the charge status — the guide sleeve (n) is pushed against the spring (m) with the control curve indicated and set to a control position corresponding with the charge status.

Compressed air passes from the tractor through the supply line hose coupling to port 1, passes grooved ring (h) to connection 1-2 and on to the supply reservoir of the semitrailer. At the same time, the piston (r) — applied with supply pressure — moves down and takes the valve (g) with it. Outlet (t) opens and connections 2 are connected with vent 3.

Upon actuation of the tractor brakes, compressed air flows via the hose coupling "Brake" and port 4 to chamber A and pressurises the piston (b). The piston (b) is forced downward, closing outlet (d) and opening inlet (v). The compressed air from port 4 flows into chamber C beneath the diaphragm (e), acting on the effective area of the relay piston (f).

At the same time, air flows into chamber B via opened valve (a) and passage G, acting on the upper side of diaphragm (e). This pressure predominance causes the reduction in the partially-laden range to be neutralized at low actuating pressures (up to maximum 1.0 bar). If the pilot pressure increases further, piston (w) is forced up against the load in pressure spring (x) and valve (a) closes.

The pressure building up in chamber C forces the relay piston (f) downwards. Outlet (t) opens and inlet (s) opens. The air supply at port 1-2 now flows via chamber D and is sent through ports 2 to the downstream compressed air brake cylinders.

Pressure builds up in chamber D which acts on the underside of the relay piston (f). As soon as this pressure becomes a bit higher than the pressure in chamber C, the relay piston (f) moves upwards and the inlet (s) closes.

As piston (b) moves down, diaphragm (e) is forced against serrated disc (u) thereby continuing to increase the effective diaphragm surface area. As soon as the force in chamber C which acts on the underside of the diaphragm is equal to
Automatic load-dependent load sensing valve (LSV) 475 71.

the force acting on the piston (b), that piston moves upwards. The inlet (v) closes and an end position is reached.

The position of the valve tappet (i) which depends on the position of the guide sleeve (n) determines the output control pressure. The piston (b) with the serrated disc (u) must make a stroke which corresponds to the position of the valve tappet (i), before the valve (c) starts working. This stroke also causes the effective area of the diaphragm (e) to be changed. In the fully laden position, the input pressure at port 4 is the same as that reaching chamber C. As full pressure is applied to relay piston (f), it keeps inlet (s) continually open and the applied brake pressure is not regulated.

When the tractor brakes are released, port 4 is vented and the pressure in ports 2 forces relay piston (f) upward to the end of its stroke. Outlets (d and t) open and the compressed air existing in ports 2 and in chamber C passes through vent 3 to the atmosphere.

With each brake application, air flows into chamber E via channel F, acting on rubber seal (k). This is pushed against valve tappet (i) and at a brake pressure > 0.8 bar, a forced contact is established between valve tappet (i) and the housing. The controller reduction ratio is therefore blocked and remains blocked during the braking procedure with dynamic axle load transfers. If the pressure in the air-suspension bellows should be increased in the partially laden range, the roller (l) is pressed against the spring (j). The tappet (i) remains in the control position as it was when introducing the braking process.

Automatic braking

When disconnected or in the event of a rupture in the supply line, port 1 is exhausted and the pressure acting on the upper side of piston (r) is reduced. The existing supply reservoir pressure at connection 1-2 causes the piston (r) to move upward and the valve (g) closes outlet (t). As piston (r) continues to move up, it moves away from valve (g) and inlet (s) opens. The full reservoir pressure is now sent via ports 2 to the brake cylinders.
Plates "Set values LSV“ 899 144 63. 4

The vehicle is to be equipped according to the required LSV specifications conforming with EC Guideline 71/320 EWG Appendix II Annex to II/1.1.4.2 Paragraph 7 and the ECE provision No. 13 Appendix 10 Paragraph 7. The respective signs can be obtained from WABCO (see following figures). These signs correspond with the draft for standards DIN 74267 of September 1982 Form C and D. They are provided in three languages and offer the capability for table entries for axle loads and the output pressures of the LSV.

The pressures to be entered in the LSV sign must be measured immediately before and after the LSV, so that it is not influenced by the characteristics of other devices of the brake system.

In the configuration of the brake systems, test connections are to be designed according to standard ISO standard 3583/1974 before and after the LSV controller. On control connection 41 or 42 from pneumatically hydraulically actuated LSVs, a special test connection is required. It blocks the control pressure from the air-suspension bellows or the overflow cylinders when the test hose is connected. When the trailer is empty, any charge status can be simulated with the help of test apparatus 435 008 000 0.

With mechanically hinged LSVs, the required charge status for checking the LSVs is achieved with a manual adjustment.

With two LSVs with different input pressure, both pressures are to be noted on the LSV sign, e.g. 6.5/5.7.
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Nomographs

Open the WABCO website www.wabco-auto.com. Click on Product Catalogue INFORM => Product number. Enter the desired LSV number into the search field. Click the Start button. Click the link Publications.

<table>
<thead>
<tr>
<th>LSV</th>
<th>Nomographs</th>
</tr>
</thead>
<tbody>
<tr>
<td>475 710 040 0</td>
<td>475 710 902 3</td>
</tr>
<tr>
<td>475 712 000 0</td>
<td>475 710 902 3</td>
</tr>
<tr>
<td>475 713 50. 0</td>
<td>475 713 902 3</td>
</tr>
<tr>
<td>475 714 5.. 0</td>
<td>475 714 902 3</td>
</tr>
<tr>
<td>475 715 ... 0</td>
<td>475 715 902 3</td>
</tr>
</tbody>
</table>