Purpose

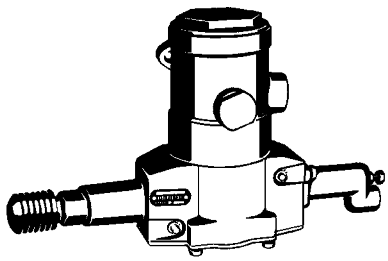
Load sensing valves are used to adjust the brake pressure of one axle (or on trailers, possibly of both axles) to the load carried. With properly designed braking forces, and assuming a dry road surface, this prevents locking of the wheels when the vehicle is unladen or partially laden.

On vehicles with air suspension the regulation happens according to the bellow pressure.

Design types

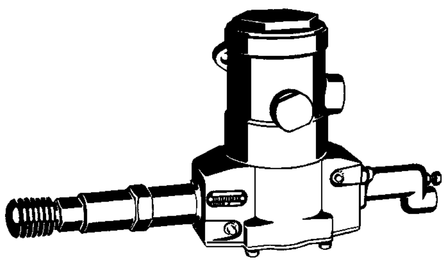
1. **Static Load-Sensing Valves**
   Load-sensing valves of the **475 700 ... 0** series are static valves. They are designed for a pilot pressure of 0.4 bar. The pressure reduction ratio is 4.0 : 1. The permissible operating pressure for the braking pressure is 10.0 bar, for the control pressure it is 8.0 bar. The load-sensing valves are available for single and dual-circuit control.

475 700 1.. 0



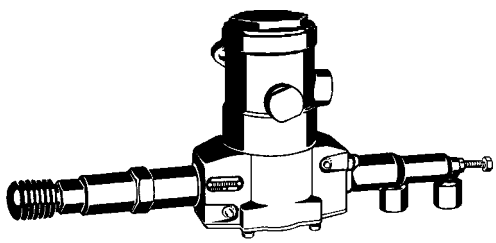
1.1 Load-sensing valve **475 700 1.. 0** is available in different variants which refer to different settings. Setting is done at the factory.

475 700 220 0



1.2 Load-sensing valve **475 700 220 0** can be used universally. Before it is installed, its settings have to be adjusted following our instructions.
(*) see “Testing and Settings for Load-Sensing Valves”

475 700 320 0 / 475 700 403 0



1.3 The use of load-sensing valve **475 700 320 0** is the same as that mentioned under 1.2 above. The piston valve of this load-sensing valve series consists of two identical piston surfaces which are, however, separated from each other and operates following a **medium pressure principle**. In the event of different pressures in the air suspension bellows, this prevents overbraking of the side on which the axle load is smaller.

1.4 The function of load-sensing valve **475 700 403 0** is identical to that of type 475 700 220 0. The only difference is that it has **dual-circuit control**, where the higher suspension pressure will define the brake pressure.

475 714 500 0 / 475 714 509 0

1.5 Load-sensing valves **475 714 500 0 / 475 714 509 0** are static types for universal purpose. The pressure reduction ratio is 8.0 : 1. The devices work according to the **dual-circuit principle**. On the control side, it has a test valve. The pilot pressure is 0.5 bar.

Before it is installed, its settings have to be adjusted following our instructions. See “Testing and Settings”.

In case of air suspension failure, the devices are moved to unladen position (unladen stop screw).

Please note

Load sensing valve 475 714 500 0 is delivered with accessories (a spring with another wire size and a spacer).

2. Dynamic Load-Sensing Valve

475 711 ... 0

2.1 Load-sensing valve **475 711 ... 0** works dynamically and has an **integrated relay valve**.. It is dual-circuit controlled, and the device is controlled according to the **middle pressure principle**.

Setting is done at the plant. The exploitable control ratio is 8 : 1 for a pre-engagement of 0.8 bar. The regulator is equipped with an integrated test connection on the control side. This allows the valve to be tested when the vehicle’s air suspension is switched off.

With a few exceptions, most variants are set to the “half laden” position if the air-suspension system fails.

475 721 ... 0

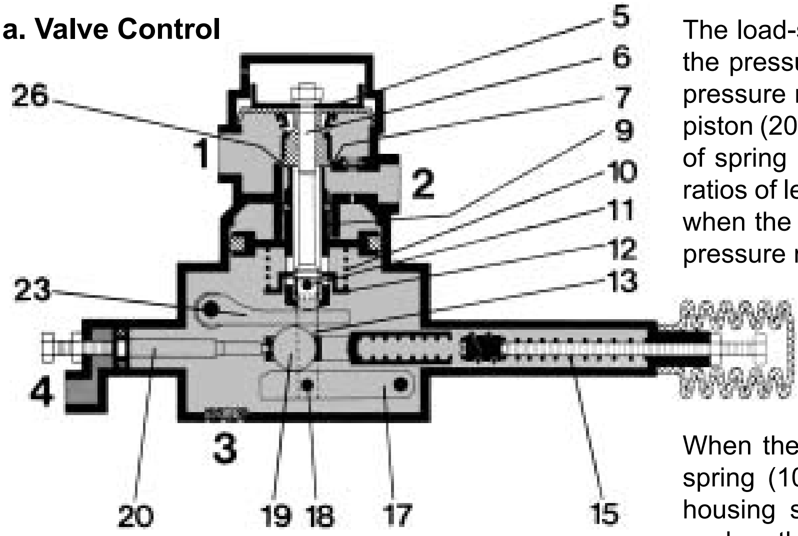
2.2 For adjusting load sensing valves **475 721 ... 0** is also a relay-valve equipped brake-power regulator which is dual-circuit controlled according to the **middle pressure principle**, and works dynamically.

Setting is done at the plant. The expoitable control ratio is 5.3 : 1. The regulator is equipped with an integrated test valve, both on the input side and on the control side. Its mini-design has a lot of advantages in terms of installation.

This device series replaces device series 475 711 ... 0.

Operation of Load-Sensing Valve 475 700 ... 0:

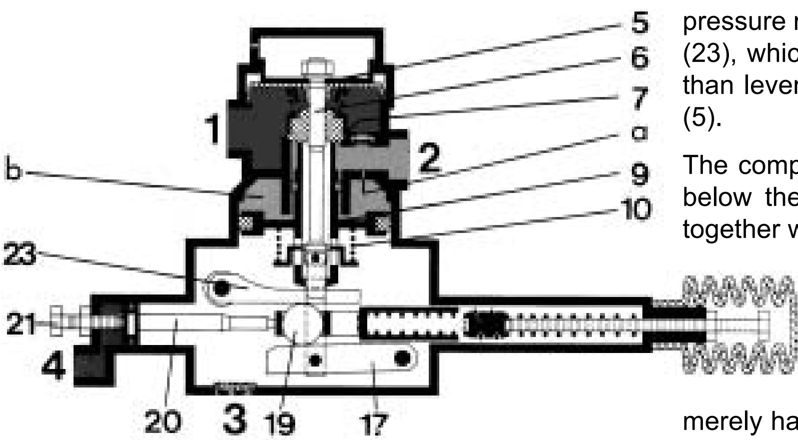
a. Valve Control



The load-sensing valve is controlled by the piston (20) via the pressure of the connected air bellows. As the bellows pressure rises (i. e. when the vehicle is being loaded), the piston (20) displaces the pressure roll (19) against the force of spring (15). This continuously causes the transmission ratios of levers (17) and (23) to change. On the other hand, when the bellows pressure falls, spring (15) will return the pressure roll (19) together with the piston (20).

When the vehicle's brakes are not actuated, the force of spring (10) holds the graduating piston (9) on the inner housing stop. At the same time the same spring force pushes the lever (23), together with the spring plate (12), pins (11) and (18), and brackets (13), downwards. Since the piston rod (6) with the sleeve piston (5) is also connected with the lower lever (17) via pins (11) and (18) and the brackets (13), the sleeve piston (5) rests in its lower position. This causes the outlet valve (26) on the graduating piston (9) to be closed, and the inlet valve (7) is open.

b. Braking Position "Unladen"



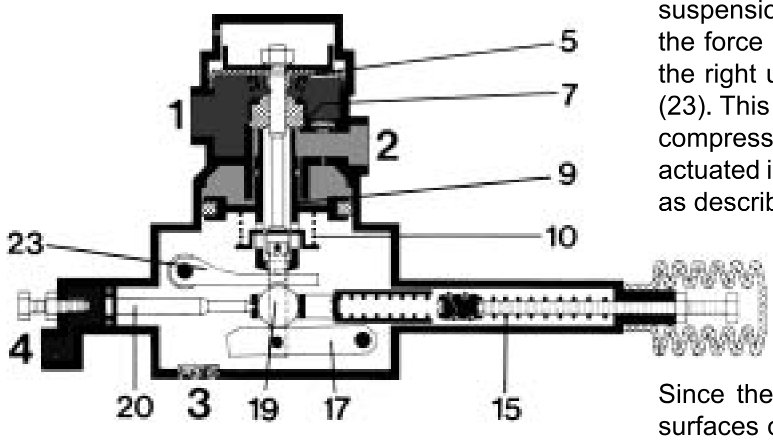
When the vehicle carries no load, the piston (20) is in contact with the adjusting screw (21). The position of the pressure roll (19) offers a better transmission ratio for lever (23), which works together with the graduating piston (9), than lever (17) which is connected with the sleeve piston (5).

The compressed air entering at port **(1)** builds up a force below the sleeve piston (5) which raises the piston (5), together with the piston rod (6) and levers (17) and (23).

merely having to overcome the force of spring (10). At the same time, compressed air flows through the open inlet valve (7) via port **(2)** to the brake cylinders. A pressure reduction between ports **(1)** and **(2)** is achieved by the compressed air in port **(2)** also flowing through hole (a) and into chamber (b).

Because of the larger surface of piston (9) compared with sleeve piston (5) and the more favourable transmission ratio of lever (23), a small amount of pressure in chamber (b) is sufficient to push the graduating piston (9) downwards against the pressure in chamber (b). This downward motion is followed by the whole of the control mechanism, and the inlet valve (7) is closed. Any further increase in the brake pressure results in sensitively graded reduction of the input pressure.

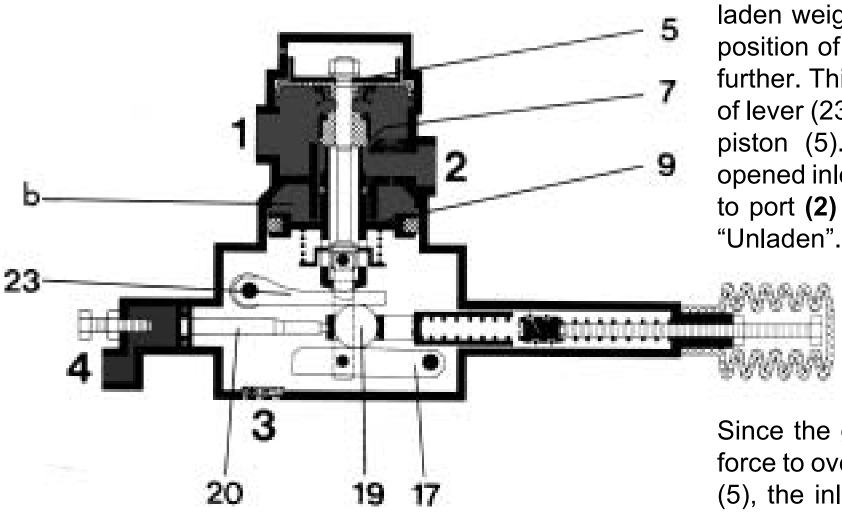
c. Braking Position "Half Laden"



As the air-sprung vehicle is loaded, the pressure in the air suspension bellows rises. This allows piston (20), against the force of spring (15), to push the pressure roll (19) to the right until it is in the centre between levers (17) and (23). This achieves a lever transmission ratio of 1 : 1. The compressed air entering at port (1) when the brakes are actuated initially causes the load-sensing valve to reverse as described under "Unladen".

Since the lever transmission has been neutralized, the surfaces of pistons (5) and (9) are now opposed to each other, taking into account the force of spring (10). As a consequence, the output pressure in port (2) in the "half laden" position is higher than it would be in the "unladen" position. After the load-sensing valve has reached its final braking position, the inlet valve (7) is closed.

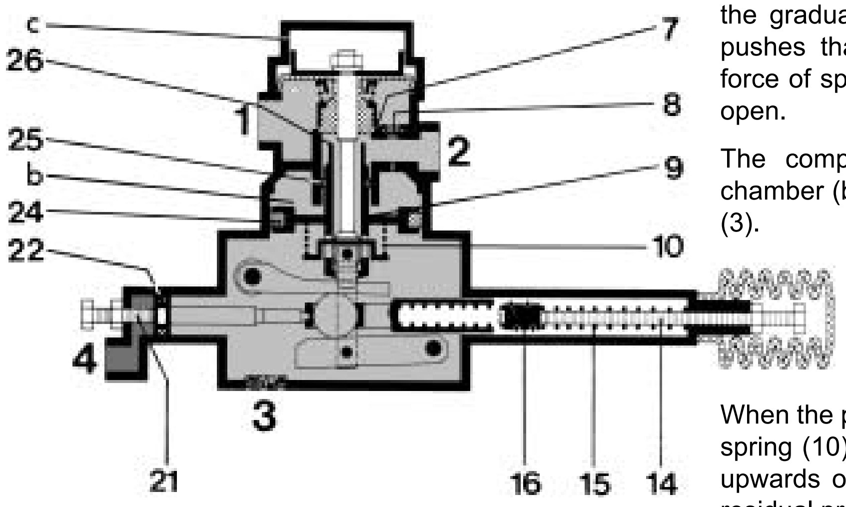
d. Braking Position "Fully Laden"



If the air-sprung vehicle is loaded up to its permissible laden weight, the pressure roll (19), due to the changed position of piston (20), has been forced to the right even further. This results in an unfavourable transmission ratio of lever (23) with piston (9), compared with lever (17) with piston (5). The compressed air entering through the opened inlet valve (7) when port **(1)** is pressurized passes to port **(2)** and on into chamber (b), as described under "Unladen".

Since the graduating piston (9) does not have sufficient force to overcome the pressure beneath the sleeve piston (5), the inlet valve (7) cannot close. The input pressure from port **(1)** is therefore passed, via port **(2)**, to the brake cylinders in full. This neutralizes the pressure reduction in the load-sensing valve.

e. Release Position



When the brakes are released, port **(1)** is exhausted via the brake valve. Since there is no counterforce acting on the graduating piston (9), the pressure in chamber (b) pushes that piston (9) further downwards against the force of spring (10). This causes the outlet valve (26) to open.

The compressed air in the brake cylinders and in chamber (b) can thus escape to atmosphere via exhaust (3).

When the pressure in chamber (b) has fallen, the force of spring (10) once again pushes the graduating piston (9) upwards once again, closing the outlet valve (26). Any residual pressure in port **(2)** is vented via the check valve (8). Since piston (9) can be raised further by the force of spring (10) until it makes contact with the housing, the inlet valve (7) opens. The load-sensing valve is now once again in its driving position.

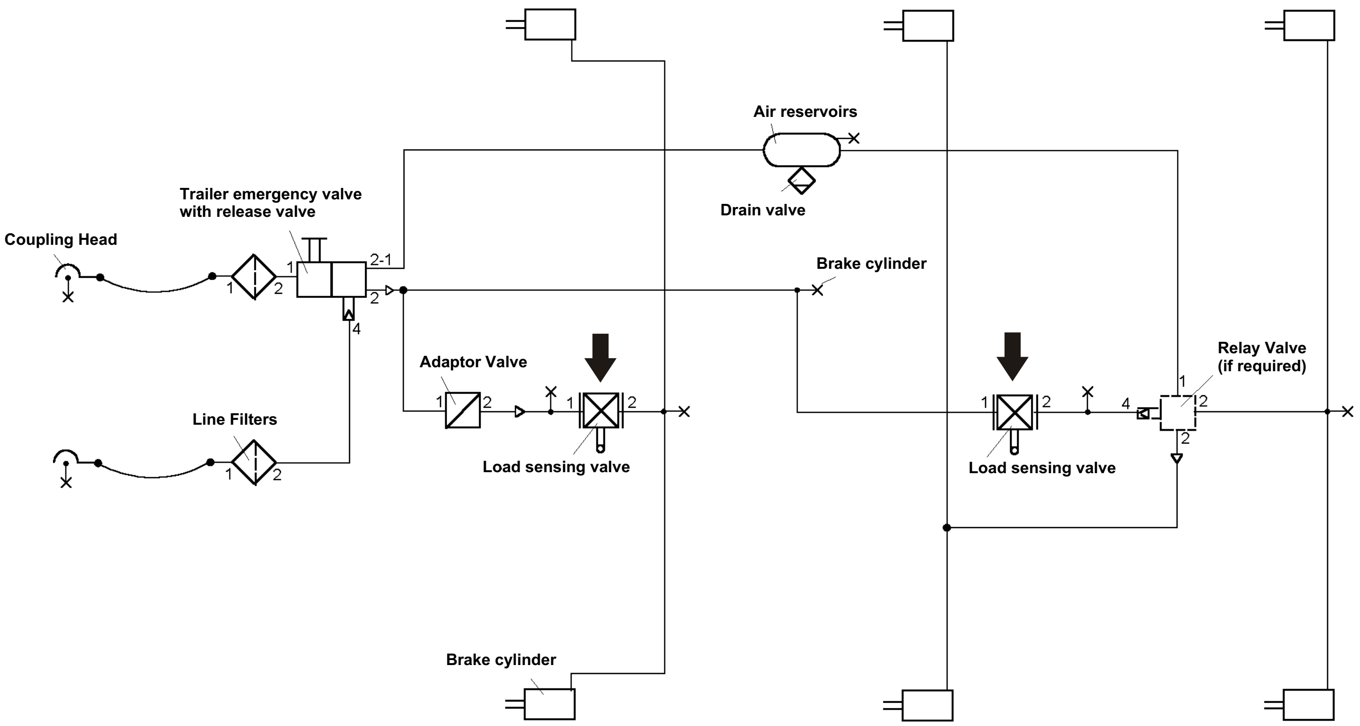
Maintenance

No maintenance is required beyond the checks required by law.

Testing

See “Testing and Settings”.

Schematic for Testing and Installation



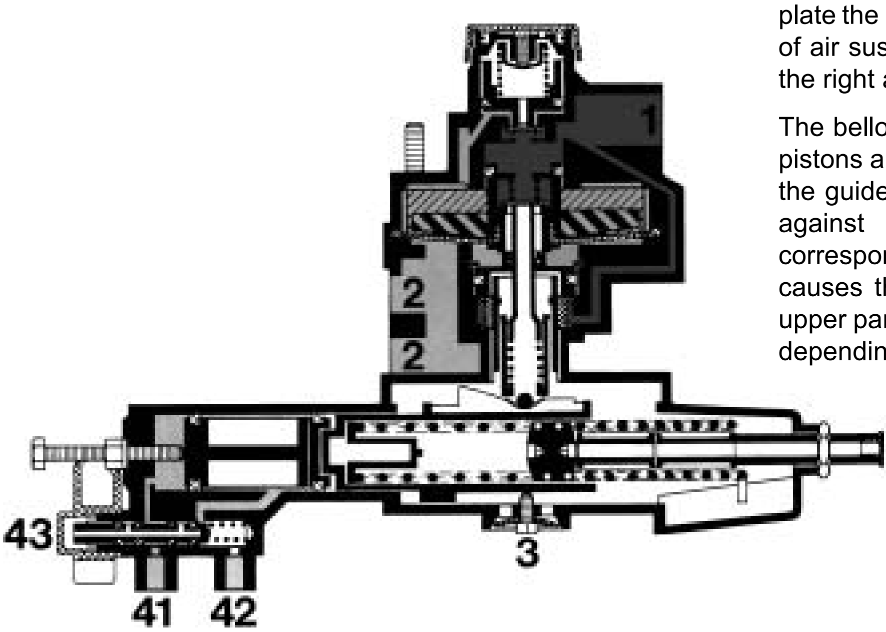
Function of Load-Sensing Valve 475 714

Controlling the Pressure Reduction

The top of the device and his function (controlling the pressure reduction through multiple-disk piston) correspond to the functions of the mechanical controlled, static load sensing valve **475 713** described in chapter 14.

Instead of using load control through lever and cam plate the load control follows only over the pressure of air suspension bellows at port **(41)** and **(42)** on the right and left-hand side of the vehicle.

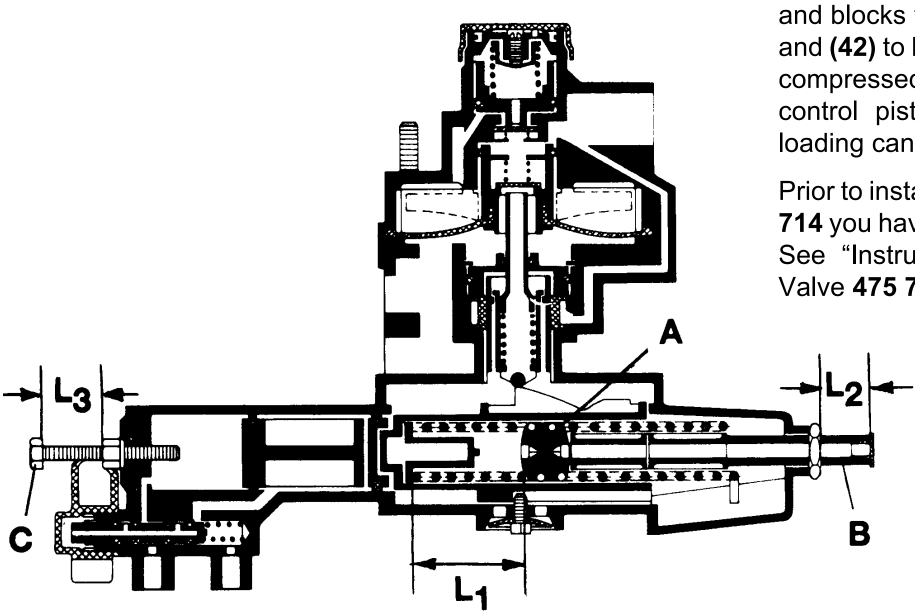
The bellow pressure has an effect on both control pistons and removes as the bellows pressure rises the guide sleeve with the fixed control curve on it against the spring, to a regulation position corresponding to the state of loading. This again causes the guide tube of the load sensing valve upper part with multiple-disk piston to be controlled depending on the load carried.



Notes:

For checking the load sensing valve a test hose is screwed at the test valve port **(43)**. Therefore the piston of the test valve is pushed into the device and blocks the connection of the control ports **(41)** and **(42)** to both control pistons. At the same time a compressed air connection from port **(43)** to both control pistons is build up. Thus any state of loading can be sinulated over the test valve

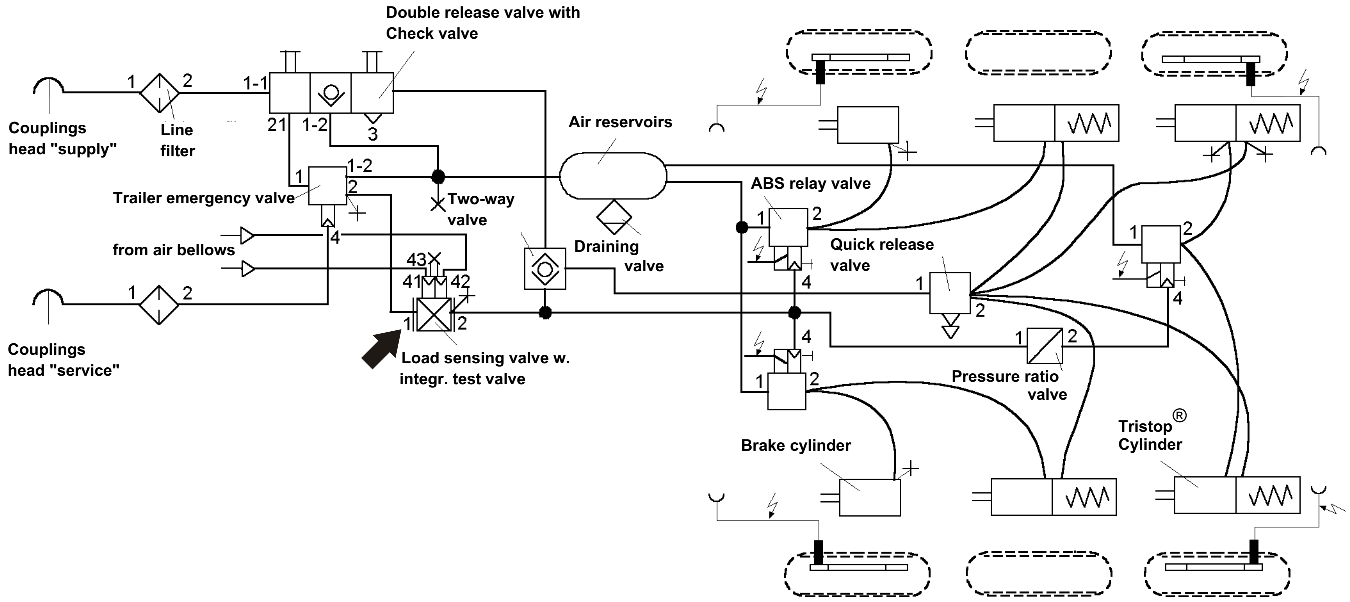
Prior to installation of a new load sensing valve **475 714** you have to make a basic setting at the device. See “Instructions for Settings of Load Sensing Valve **475 714**”.



Maintenance No maintenance is required beyond the checks required by law.

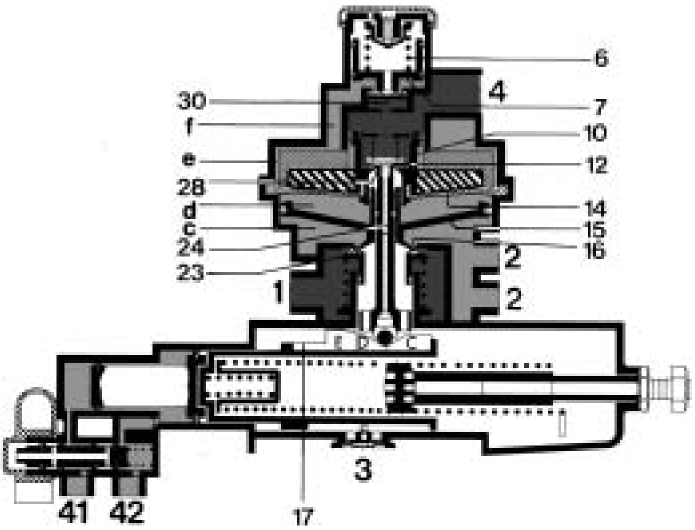
Testing See “Testing and Settings”.

Schematic for Testing and Installation



Operation of Load-Sensing Valve 475 711

a. Pilot Pressure

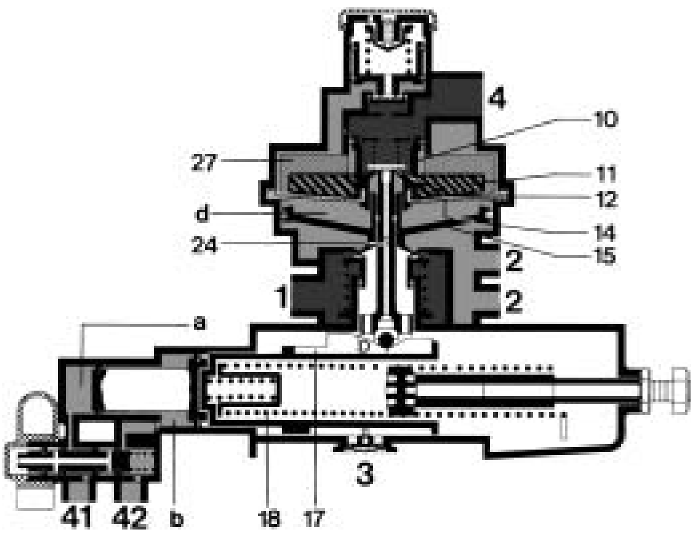


Regardless of the load on the vehicle, compressed air flows through the opened valve (30) into duct (f) and from there into chamber (e) when port **(4)** is pressurized. Thus pressure reaches the top of the diaphragm (14). At the same time, compressed air acts on the piston valve (10) which is firmly attached to the diaphragm (14), takes with it valve tappet (24) and lies on control curve **(C, D or E)** of piston (17). This allows the outlet valve (28) to close and the inlet valve (12) to open.

This allows the same pressure from port **(4)** to reach chamber (b) below the diaphragm (14), at the same time acting on the effective surface of the relay piston valve (15). As this moves downwards, outlet valve (16) is closed and inlet valve (23) opened. The reservoir pressure at port **(1)** now passes through opened inlet valve (23) to port **(2)** until the pressure in port **(4)** has risen to the level of the pilot pressure.

At a maximum pressure of 0.8 bar, piston (7) moves upwards against the force of spring (6), closing the pilot valve (30). The pressure now prevailing in chamber (c) raises piston (15) until the inlet valve (23) closes. Pilot control of the regulator has now been selected.

b. Braking Position “Unladen”

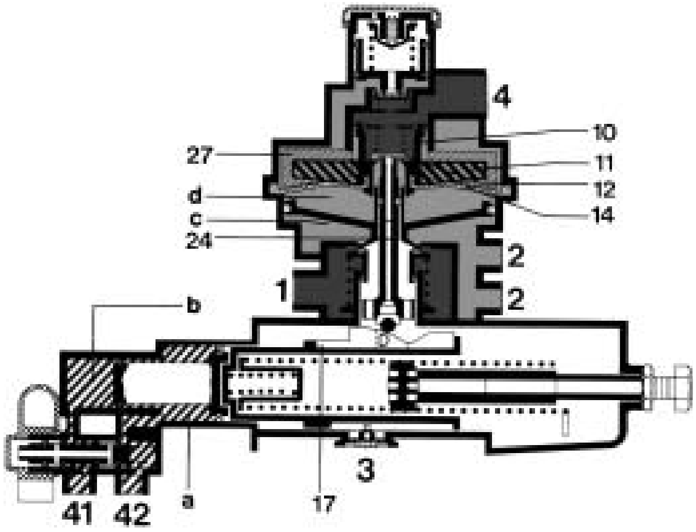


The **“unladen”** bellows pressure in chambers (a) and (b) holds the piston valve (17) against the force of spring (18) in the position in which the control curve **(section “D”)** is in the lower position towards the valve tappet (24).

Any further increase in pressure in port **(4)** automatically causes a proportional reduction of the output pressure at port **(2)**. This process is achieved by the multiple-disk piston (11), which is firmly attached to the piston valve (10), protrudes from the stationary multiple-disk piston (27). This continuously increases the effective surface of the diaphragm (14) - depending on the valve’s setting. As described under **“a”** above, the pressure passed through builds up in chamber (b) beneath the diaphragm (14).

Since the effective diaphragm surface is greater than that of the piston valve (10) in the **“unladen”** position, a small amount of pressure is sufficient for raising the diaphragm (14) together with the piston valve (10), once again closing inlet valve (12). The pressure now prevailing in chamber (d) actuates the relay piston valve (15). As described under **“a”** above, the pressure in port **(2)**, and thus in the brake cylinders, is increased.

c. Braking Position "Half Laden"



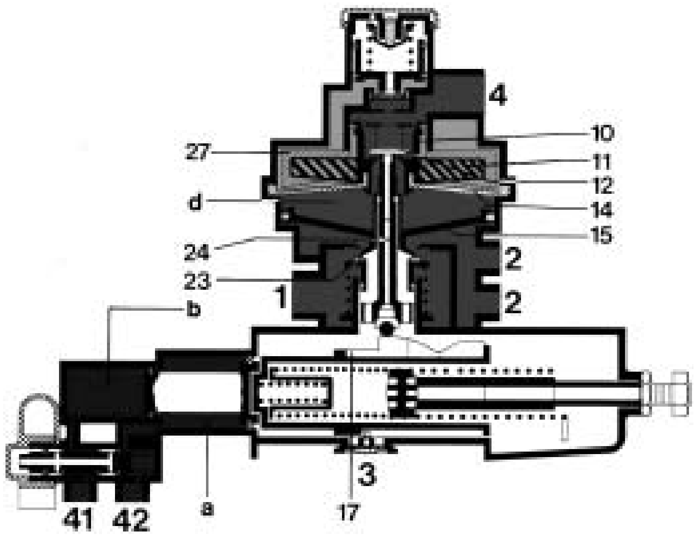
When the load on the vehicle is increased, the control pressure in ports **(41)** and **(42)**, and thus in chambers (a) and (b), rises. This causes the piston valve (17) to be pushed to the right until the control curve **(section "D")** is in the upper position to the valve tappet (24).

The compressed air entering at port **(4)** when the brakes are actuated pushes the piston valve (10) downwards, as described under **"b"** above Since the valve tappet (24) is now in a higher position that it was in the **"unladen"** position, the compressed air flowing into chamber (d) must raise multiple-disk piston (11) higher above the diaphragm (14) in order to close the inlet valve (12).

This causes multiple-disk piston (11) to dip into multiple-disk piston (27), thus causing a part of the effective diaphragm surface (14) to rest on multiple-disk piston (27). Since the effective surface of the diaphragm (14) is thus reduced, the pressure in chamber (d) has to be increased. When the forces between the piston valve (10) and the diaphragm (14) have been balanced, inlet valve (12) is closed by the upward motion of the piston valve (10).

As described under **"a"** above, the pressure prevailing in chamber (c) triggers the relay effect of the load-sensing valve, thereby increasing the pressure in the brake cylinders via port (2), depending on the load added to the vehicle.

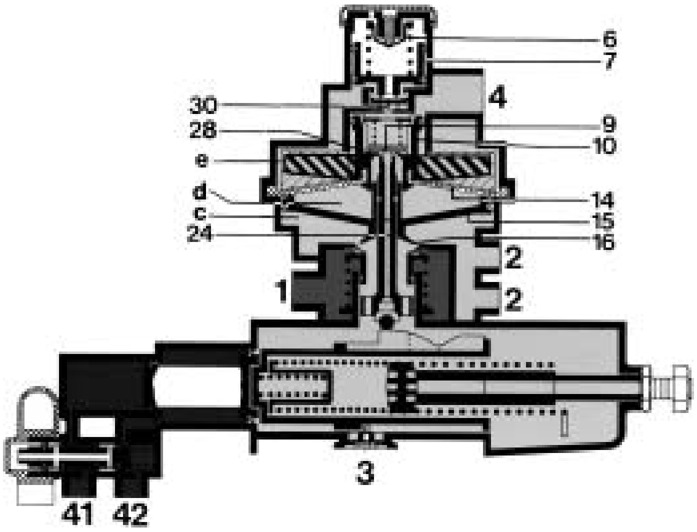
d. Braking Position "Fully Laden"



As described under **"c"** above, the pressure in chambers (a) and (b) rises as the load on the vehicle is increased. When the vehicle is fully laden, piston (17) is in a position in which the control curve **(section "E")** is in its upper position to valve tappet (24).

When port **(4)** is pressurized, the piston valve (10) moves downwards. After relatively short travel, the passage to chamber (b) is released by the opened inlet valve (12). This allows the diaphragm (14), together with the piston valve (10), to be raised again, so that after short travel, multiple-disk piston (11) dips fully into multiple-disk piston (27) and the effective surface of the diaphragm (14) rests on multiple-disk piston (27). The counterforce has thus been neutralized. The input pressure in port **(4)** passes into chamber (d) at a ratio of 1 : 1. Being fully pressurized, the relay piston valve (15) is forced downwards, opening inlet valve (23). This allows full reservoir pressure to flow from port (1) via ports **(2)** and on to the brake cylinders.

e. Release Position

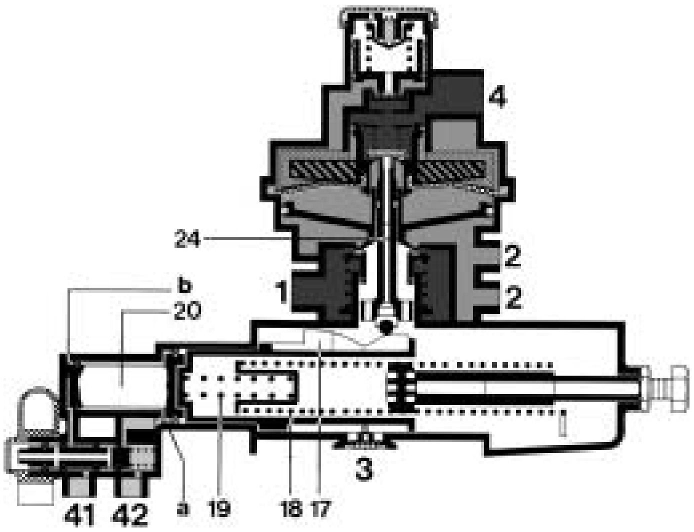


Irrespective of the laden condition, port **(4)** is vented when the brakes are released. At the same time, the pressure acting on the piston valve (10) and valves (9) and (30) is reduced.

This enables the force of spring (6) to move piston (7) downwards once again, opening valve (30). The pilot pressure prevailing in chamber (e) is thus reduced via port **(4)**.

At the same time, the pressure in chamber (d) raises the diaphragm (14) and the piston valve (10), thereby opening outlet valve (28). The pressure in chamber (d) is reduced via the valve tube (24), and the braking pressure in chamber (c) pushes piston (15) upwards, opening outlet valve (16). Via vent **(3)**, the pressure from the brake cylinders escapes to atmosphere.

f. Function of Load-Sensing Valves with Half Laden Facility after failure of the Air-Suspension System

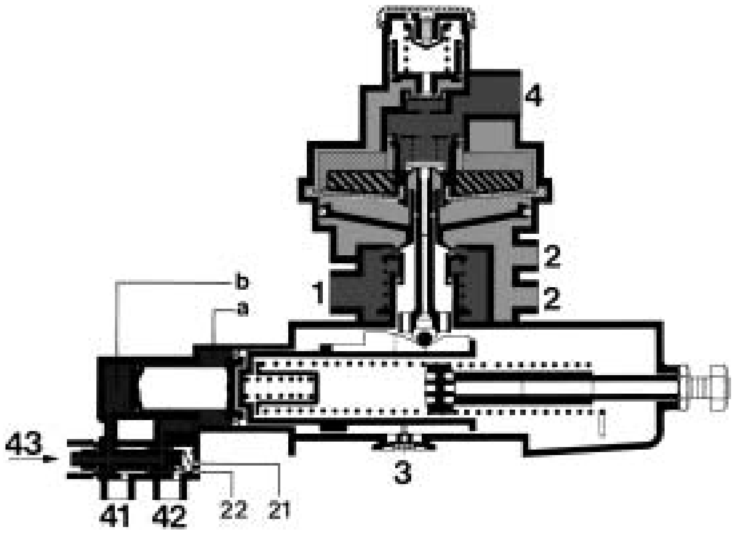


If the **air suspension system** fails altogether, ports **(41)** and **(42)** and thus chambers (a) and (b) are vented. The force of springs (18) and (19) can now slide pistons (17) and (20) to the left until they make contact with the housing. The control curve **(sector "C")** is now in its upper position to the valve tappet (24). Thus the load-sensing valve will always output about half the pressure **(see "partially laden" position)** at port **(2)**. This function is necessary to reach the emergency braking effort if the air suspension system fails.

Maintenance

No maintenance is required beyond the checks required by law.

Preparing for Testing



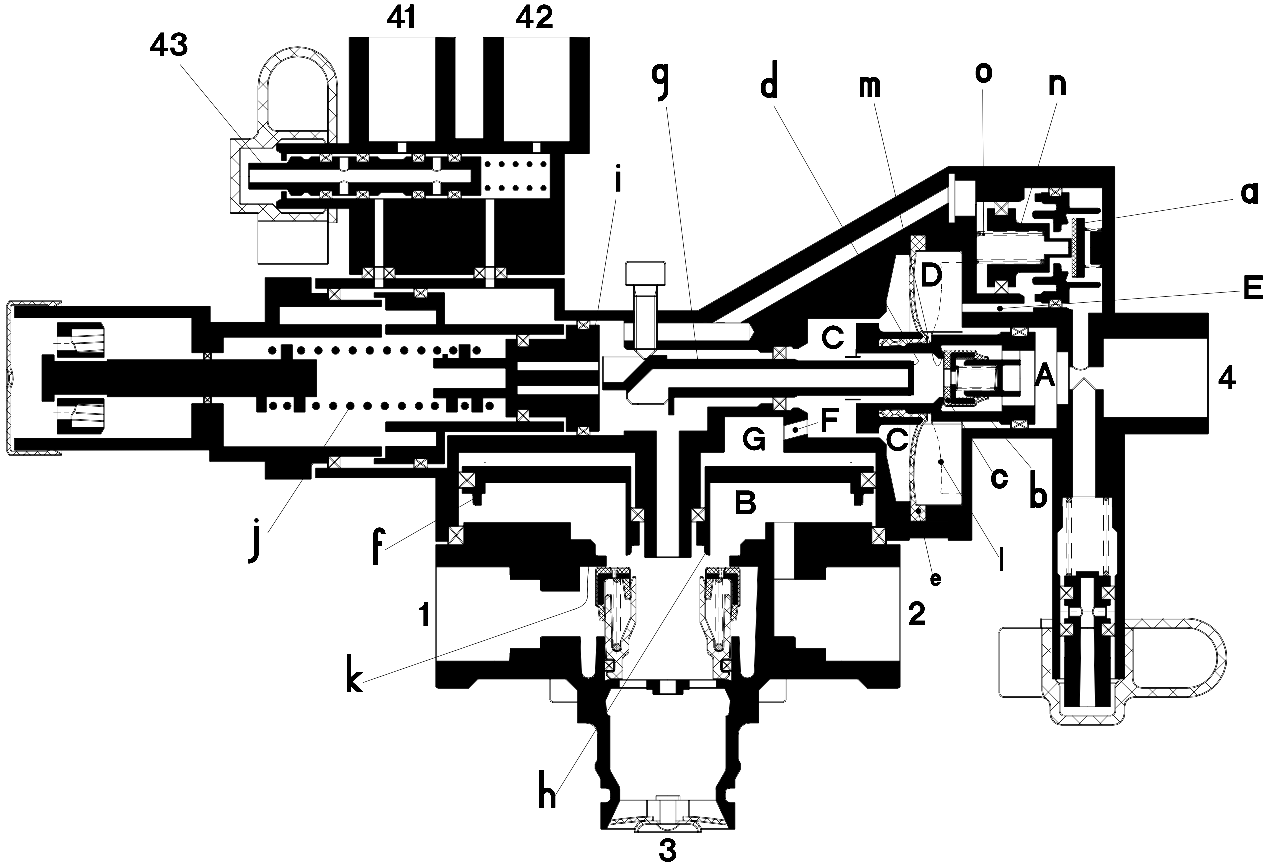
The load-sensing valve has a test valve at port **(43)**. After removing the rubber cap, a test hose with a union nut (M 16 × 1.5) can be screwed onto the threaded housing. This causes the test valve slide (22) to be pushed to the right against the force of spring (21) until ports **(41)** and **(42)** are blocked by the O-rings.

The pressure (e. g. bellows pressure “unladen” to “laden”) now applied via a precision control valve (ALB Tester **435 008 000 0**) can now fill chambers (a) and (b) through the identical internal connection.

Testing

See section **“Testing and Settings of automatic Brake Pressure Control”**.

Operation of Load-Sensing Valve 475 721 ... 0



The brake-power regulator is controlled by the pressure of the two circuits of the air-suspension bellows via ports **41** and **42.** The control piston (i) which is pressurized by the bellow pressure moves the valve tappet (g) against the force of the spring (j) into the position corresponding to the load. Thus the average value of the bellow pressures **41** and **42** is effective.

The compressed air supplied by the brake valve in ALB port **4** flows into Chamber A and acts on the piston (b). Piston (b) is moved to the left, closes outlet (d) and opens inlet (m). The compressed air delivered at port **4** flows into room C left of the diaphragm (e), as well as through channel F into room G and pressurizes the active surface of the relay piston (f). At the same time, compressed air flows via the open valve (a) and channel E into room D and pressurizes the right side of the diaphragm (e). This pressure predominance causes the reduction in the partially-laden range to be neutralized at low actuating pressures. When the input pressure increases again, the piston (n) is moved against the force of the spring (o) and the valve closes.

The pressure which builds-up in room G moves the relay piston (f) downwards. The outlet (h) closes and the inlet (k) opens. The supply air at port **1** flows now via inlet (k) into room B and reaches via the ports **2** the subsequent air brake cylinders. At the same time, pressure builds up in Chamber B which acts on the underside of the relay piston (f). As soon as this pressure becomes a bit higher than the pressure in room G, the relay piston (f) moves upwards and the inlet (k) closes.

While the piston (b) is moving to the left, the diaphragm (e) touches the washer (l), and thus increases constantly the active surface of the diaphragm. As soon as the force which acts in room C on the left side of the diaphragm, is identic to the force which acts on the piston (b), piston (b) moves to the right. The inlet (m) closes and a final position is reached. The position of the valve tappet (g), which depends on the position of the control piston (i), is decisive for the active surface of the diaphragm and thus for the delivered brake pressure.

The piston (b) with the washer (l) must make a stroke which corresponds to the position of the valve tappet (g), before the valve (c) starts working. This stroke also causes the effective area of the diaphragm (e) to be changed. In full-load position the active surfaces of diaphragm (e) and piston (b) have the same size. Thus the pressure delivered at port 4 is delivered in 1:1 ratio into chamber C and so also into chamber G. As the relay piston (f) is pressurized with full pressure, the relay part delivers the pressure 1:1. That means, there is no reduction of the input brake pressure.

After the control pressure at port **4** is exhausted, the pressure in room C moves the piston (b) to the right and the pressure in the ports **2** move the relay piston (f) upwards. The outlets (d and h) open and the compressed air escapes to atmosphere via exhaust **3**.

If the pressure in one air bellows fails, the load-sensing valve automatically moves to a position which approximately corresponds to half the pressure in the intact actuating circuit. If both bellows pressures fail, the valve moves automatically into unladen position.

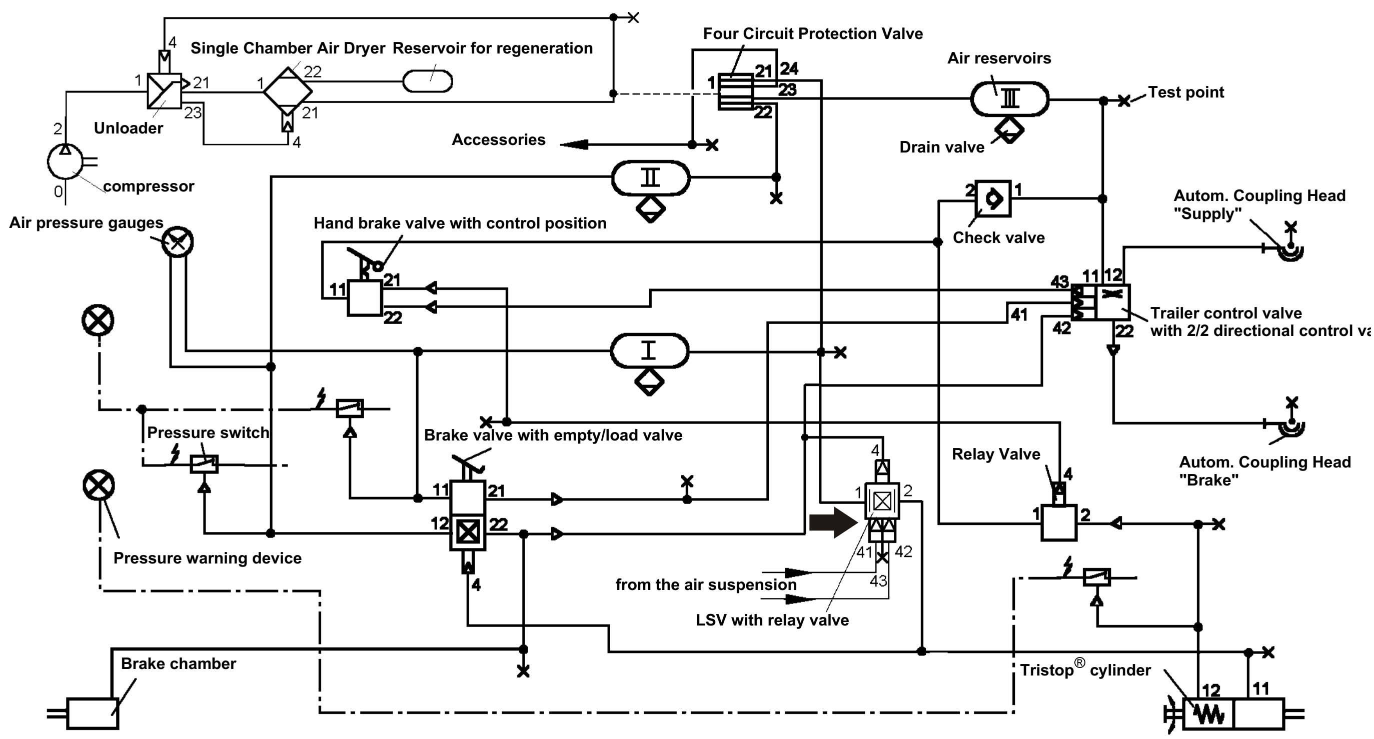
Maintenance

No maintenance is required beyond the checks required by law.

Preparing for Testing

The load-sensing valve has a test valve at port **(43)**. After removing the rubber cap, a test hose with a union nut (M 16 × 1.5) can be screwed onto the threaded housing. In this process, the test valve spool is moved as much as possible to the right against the force of the spring, until ports **41** and **42** are blocked by the O-rings.

Schematic for Testing and Installation



Introduction

As outlined for mechanical load-sensing valves, the information on the reference plate for the load-sensing device must be used as a basis when checking a controlled vehicle axle.

Example 475 700 220 0


WABCO

Automatisch - lastabhängige Bremskraftregeleinrichtung (ALB) für Typ:
Load sensing decive for type:
Dispositif de correction automatique de freinage pour type:
⊕ Nach Angabe des Fahrzeugherstellers

Eingangsdruck. Input pressure
Pression d' entrée 7,0 bar

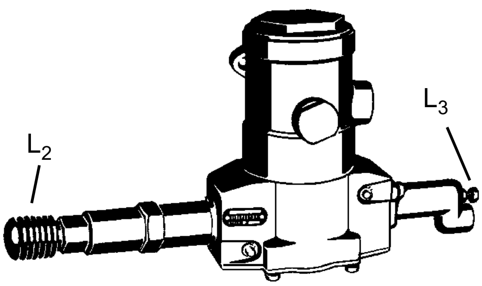
Vorderachse. Front axle. Essieu avant			Hinterachse. Rear axle. Essieu arrière		
Ventile Nr Valves No Valves N°	475 700 220 0		Ventile Nr Valves No Valves N°	—	
Achslast Axle load Charge essieu kg	Federungsdruck Suspension pressure Pression suspension bar	Ausgangsdruck Output pressure Pression de sortie bar	Achslast Axle load Charge essieu kg	Federungsdruck Suspension pressure Pression suspension bar	Ausgangsdruck Output pressure Pression de sortie bar
Leer ⊕	1,0	3,0	–	–	–
Beladen ⊕	4,3	7,0	–	–	–

What must be tested

1. **The input pressure (p_{in})**
2. **The output pressure (p_{out})** for the laden and the unladen vehicle depending on the **"unladen"** and the **"laden"** bellows pressure

Please note

475 700 220 0



If the brake pressures shown on the reference plate are not achieved within a range of ± 0.5 bar, adjusting screws **"L_2"** (for "laden" braking pressure) and **"L_3"** (for "unladen" braking pressure) can be used to readjust them.

No other readjustments are possible **without first setting the basic values**.

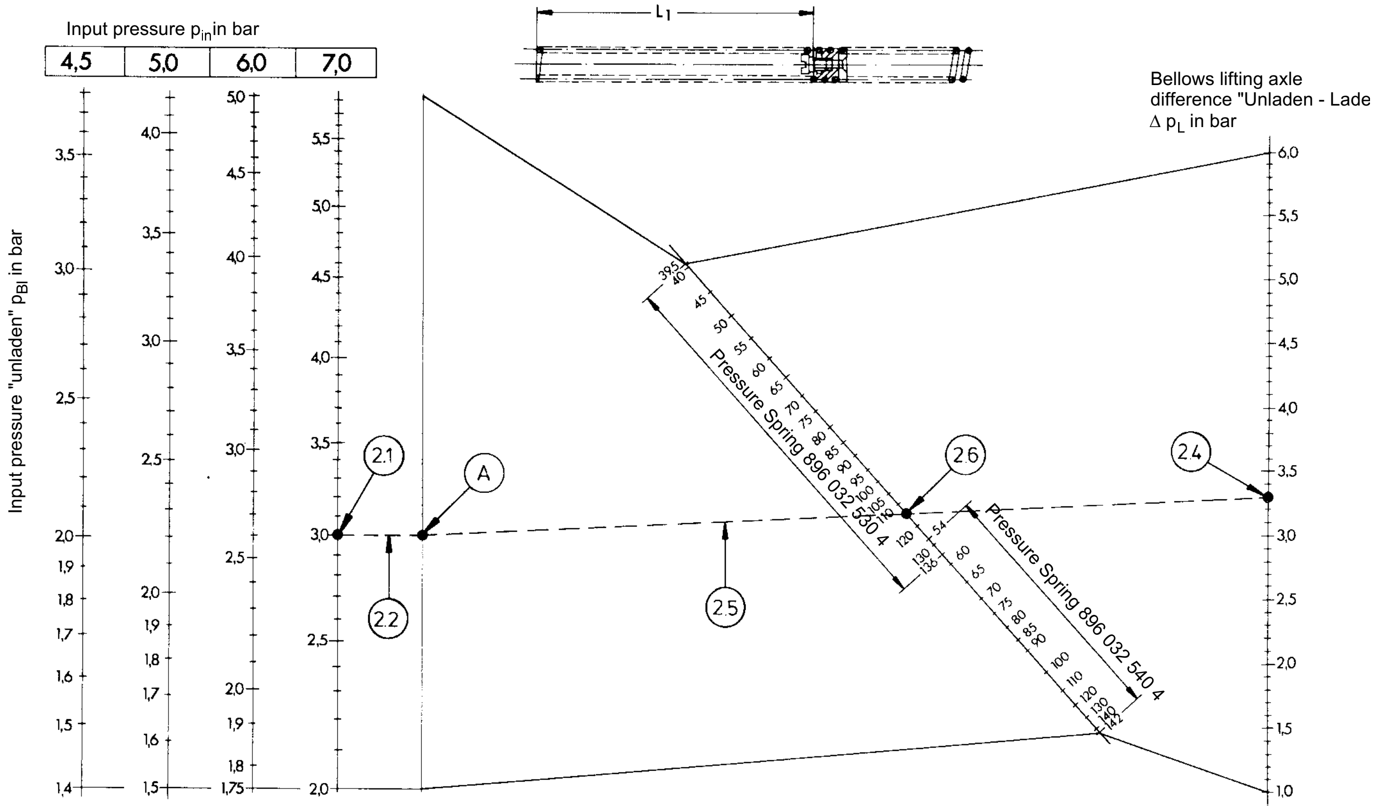
Adjustment of Automatic Brake Pressure Control 475 700 220 0

Example according to Reference Plate for Load-Sensing Valve

input pressure (p_{in}) = 7.0 bar
Output pressure (p_{out}) = 3.0 bar
Bellows pressure “unladen” ($p_{unladen}$) or (P_{Lu}) = 1.0 bar
Bellows pressure “unladen” ($p_{unladen}$) or (P_{Lb}) = 4.3 bar

Nomograph I

Determining spring length **(L_1)**



Operations

2.1 On the numerical column of input pressures (P_{Bi} = 7.0 bar) we mark off the “unladen” brake pressure (p_{Bu} = 3.0 bar).

2.2 From this position we draw a horizontal line to the intersecting point on subsidiary line “A”.

2.3 Now we first calculate the difference in pressures for the air suspension bellows (Δp_l). In our example it is

$$\Delta p_l = p_{Ll} - p_{Lu}$$

$$\Delta p_l = 4.3 \text{ bar} - 1.0 \text{ bar} = 3.3 \text{ bar}$$

2.4 This pressure we mark off on numerical column Δp_L.

2.5 Now we connect “**A**” with **“2.4”** by drawing a straight line.

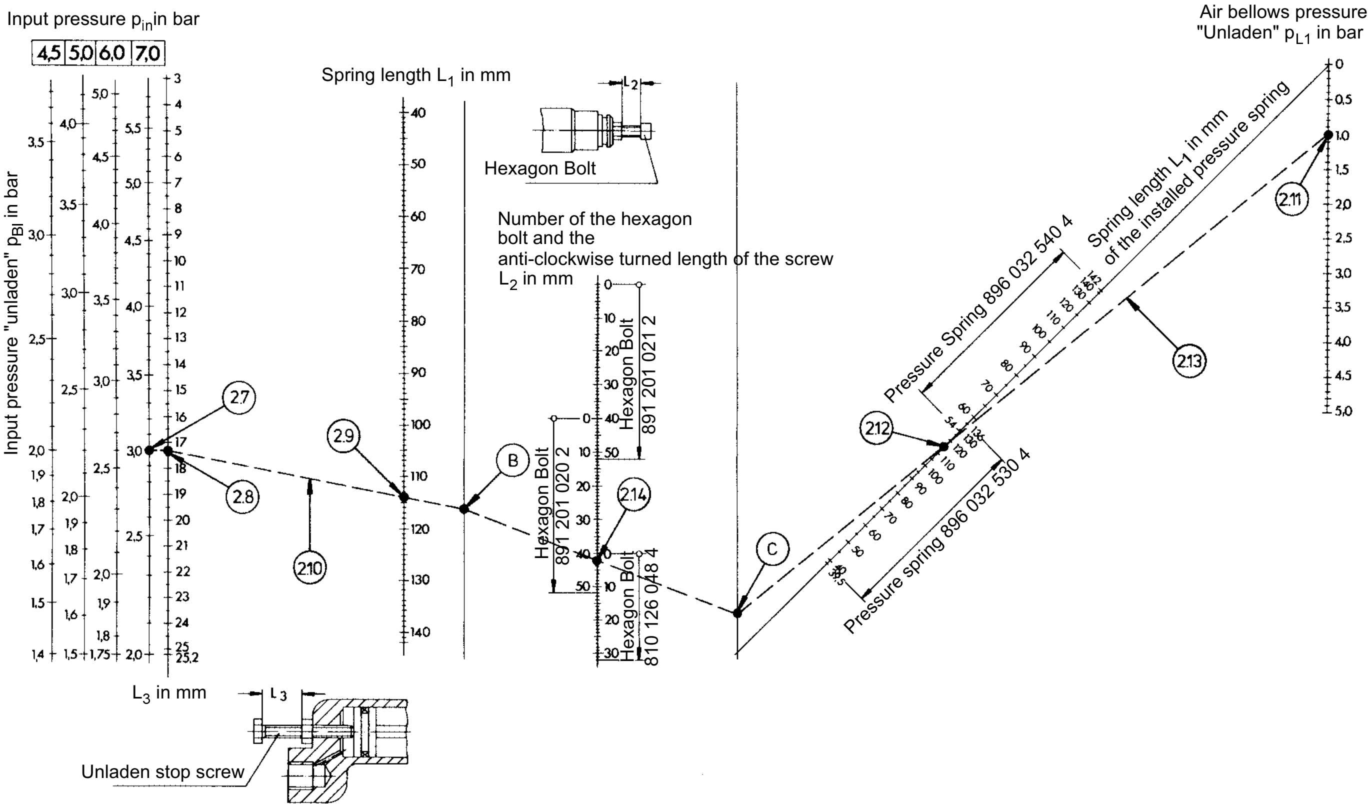
2.6 Where these straight lines intersect we determine spring **896 032 530 4** with an effective spring length **“L_1”** of **114 mm**.

Please note

Pressure spring 896 032 530 4 is always used if the subsidiary line for determining the spring length (L_1) passes through the nomograph column between 39.5 mm and 136 mm.

Nomograph II

determining settings L_2 and L_3.



Operations

2.7 On the numerical column of input pressures (P_{Bi}= 7.0 bar) we mark off the "unladen" brake pressure (p_{Bu} = 3.0 bar).

2.8 From this position we draw a horizontal line to numerical column $\mathbf{L_3}$. At the point of intersection with this numerical column we determine the setting for $\mathbf{L_3}$ screw to be **17.4 mm**.

2.9 Now we mark off the spring length of **114 mm**on numerical column $\mathbf{L_1}$.

2.10 By connecting **2.8** and **2.9** we determine, by means of a straight line, the intersection on subsidiary line "B" in its extension.

2.11 On numerical column p_{Lu} we now mark off the "unladen" pressure of the air suspension bellows at 1.0 bar.

2.12 In the next operation we again mark off the spring length **L1 = 114 mm** on the numerical column of the spring fitted (896 032 530 4).

2.13 Positions **2.11** and **2.12** are now connected in a straight line running to subsidiary line **"C"**.

Result

2.14 By connecting positions "B" and "C" we determine the intersection, the hexagon head screw **891 201 020 2** with a setting of $\mathbf{L_2}$ **= 42 mm**.

Please note

In the event of any overlaps in the nomographs for **"L2"**, the longer setting is always used. The settings determined by means of the nomograph are approximate values only which may have to be adjusted when testing the load-sensing valve.

Included in Accessory Kit

The unit is fitted with a pressure spring and a hexagon-head screw (L_2) at the factory which allow the factory settings to be changed, following the nomographs below, to account for a number of additional combinations of braking pressures and pressures for the air suspension bellows.

If, going by the vehicle data, the nomographs show that the pressure spring or the hexagon-head screw are not suitable, these parts can be exchanged, following the table below, for the parts included in the accessory kit supplied with the load-sensing valve.

compression spring fitted in the device		Hexagon Bolt fitted in the device	
Order number	wire-∅	Order number	M 6 × …
896 032 530 4	2.0	810 126 048 4	50
	enclosed to bag		
896 032 540 4	1.6	891 201 020 2	90
		891 201 021 2	130

Instructions for Settings and Testing

3. Setting Approximate Values

After setting the spring length **"L_1"**, the load-sensing valve is installed and the adjusting screws **"L_2"** and **"L_3"** are set to the determined approximate values.

4. Testing

4.1 Connect load-sensing valve and pressurize with full braking pressure.

4.2 At a bellows pressure of 0 bar, the braking pressure "unladen" (p_{Bu}) must be put out. If the output pressure is too low, screw **"L_3"** must be turned clockwise - or if the pressure is too high, it is turned anti-clockwise. This setting may not be changed after this point.

4.3 Input the bellows pressure "unladen" (P_{Lu}) + 0.3 bar. Now the "unladen" braking pressure must be higher than in operation 4.2 by a maximum of 0.3 bar (increasing tendency). If the increase in pressure is greater than this value, screw **"L_2"** is turned slightly in a clockwise direction. If an increasing tendency is, however, not perceived, screw **"L_2"** must be turned anti-clockwise.

4.4 Input into the bellows pressure "laden" (P_{Lu}) + 0.3 bar. The load-sensing valve's pressure reduction must now be neutralized. If this is not the case, the effective spring length **"L_1"** must be extended via the clamp. In parallel, screw **"L_2"** is turned slightly anti-clockwise.

4.5 Reduce the bellows pressure "laden" (P_{Ll} + 0.3 bar) by 0.6 bar. When the load-sensing valve is now fully pressurized, the output pressure must be lower by a maximum of 0.3 bar than in the operation described under **4.4** (falling tendency). If this is not the case, the effective spring length **"L_1"** must be shortened via the clamp. Screw **"L_2"** is adjusted to the new spring length by turning it slightly in a clockwise direction. This procedure must be repeated until the load-sensing valve shows the falling tendency.

4.6 Check load-sensing valve once again as described under **4.3** and **4.4.**

Please note

If the load-sensing valve cannot be adjusted, this is due to a functional defect.

Please note

Nomographs I and II for load-sensing valve 475 700 220 0 can also be used for the **475 700 3.. 0 and 475 700 401 0**. is to be used.

Note for accessories

The unit is fitted with a pressure spring and a hexagon-head screw (L_2) at the factory which allow the factory settings to be changed, following the nomographs below, to account for a number of additional combinations of braking pressures and pressures for the air suspension bellows.

If, going by the vehicle data, the nomographs show that the pressure spring or the hexagon-head screw are not suitable, these parts can be exchanged, following the table below, for the parts included in the accessory kit supplied with the load-sensing valve.

compression spring fitted in the device		Hexagon Bolt fitted in the device	
Order number	wire-∅	Order number	M 6 × …
896 032 530 4	2.0	810 126 048 4	50
	enclosed to bag		
896 032 540 4	1.6	891 201 020 2	90
		891 201 021 2	130

Note for handling with normographs

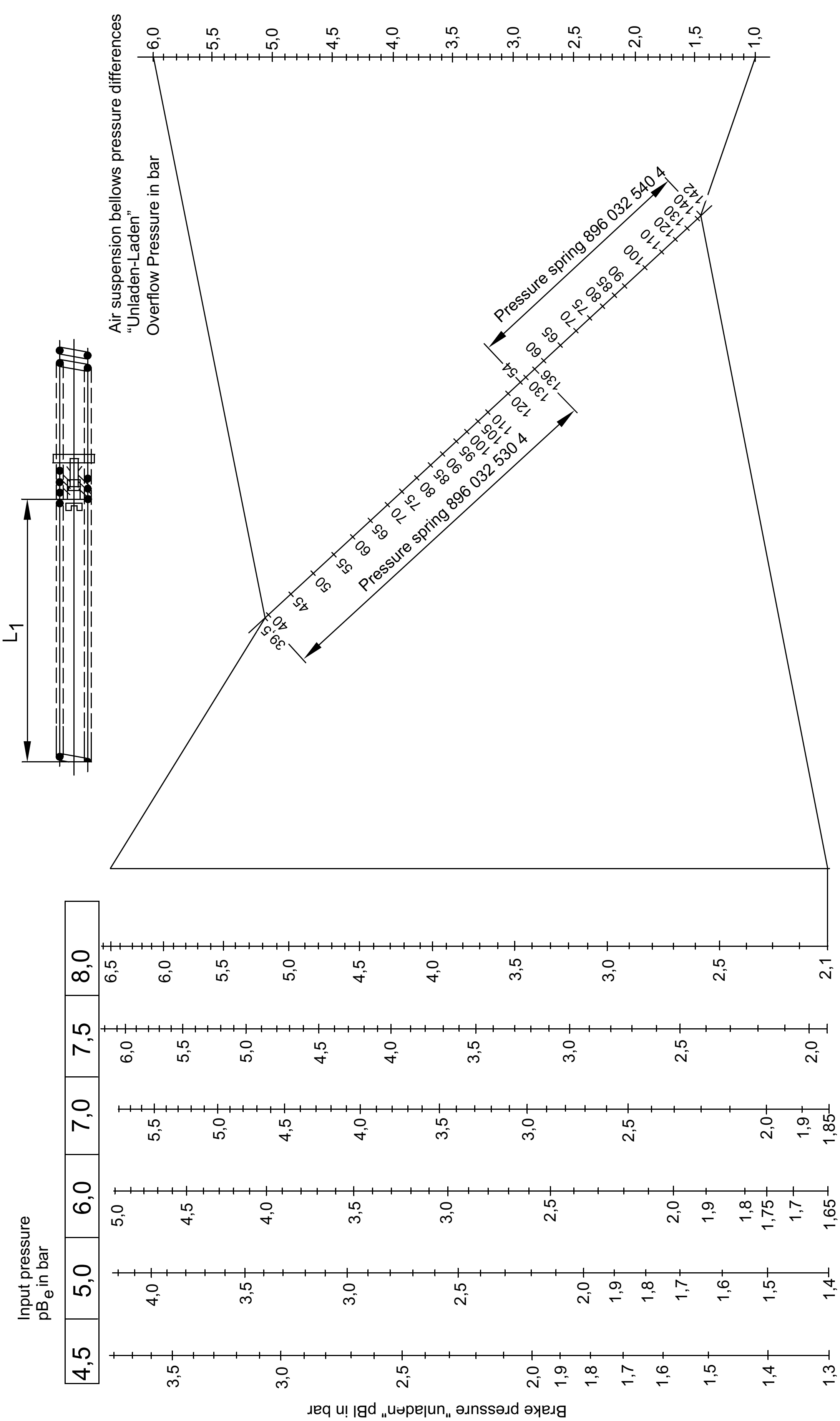
Pressure spring 896 032 530 4 (wire-∅ 2.0 mm) is always used if the subsidiary line for determining the spring length (L_1) passes through the nomograph column between 39.5 mm and 136 mm.

In the event of any overlaps in the nomographs for “L_2”, the longer setting is always used.

The settings determined by means of the nomograph are approximate values only which may have to be adjusted when testing the load-sensing valve.

Nomograph I

for automatic Load-Sensing Valve 475 700 220 0 and 475 700 403 0

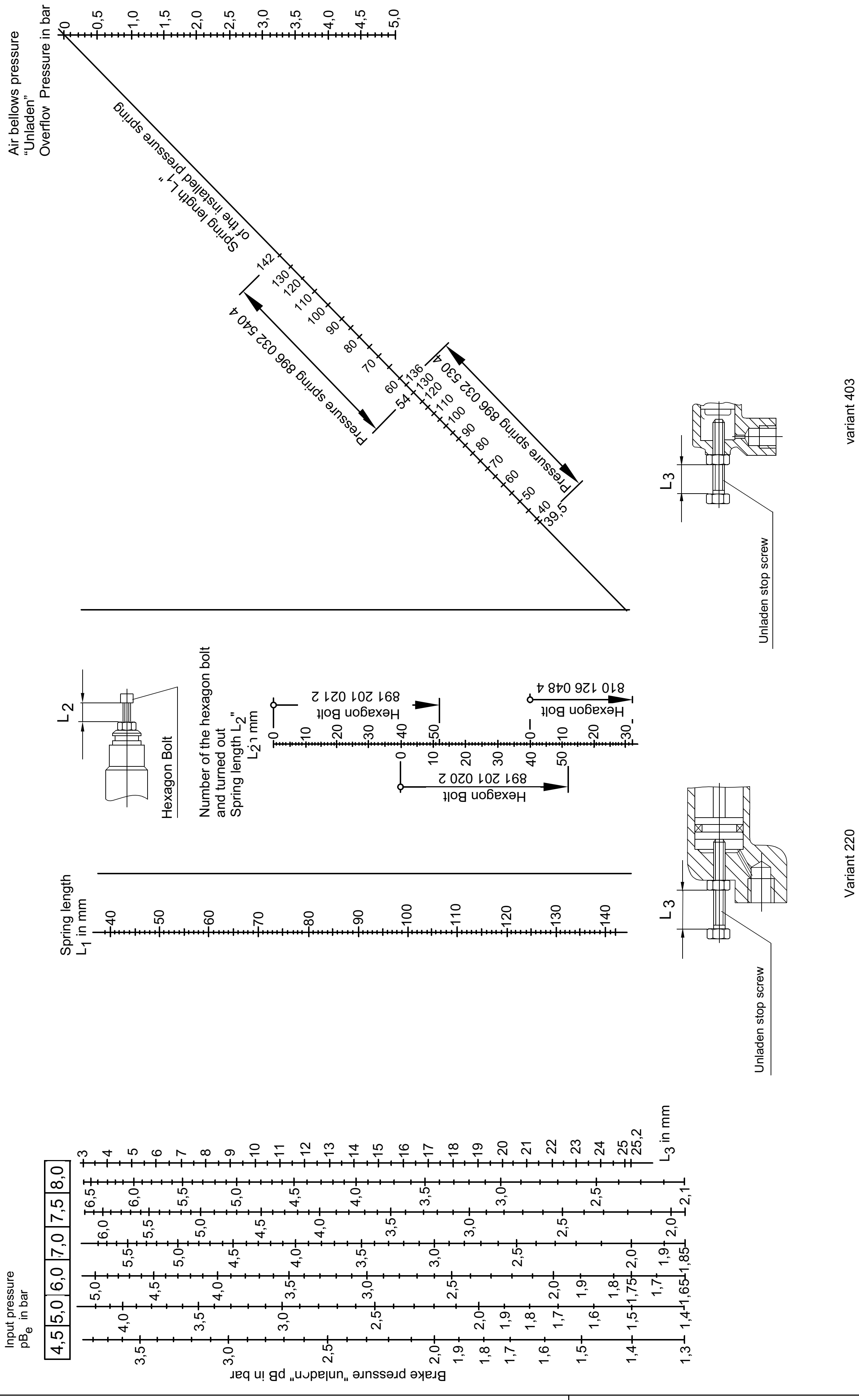


The settings determined by means of the nomograph are only approximate values which may have to be adjusted while testing the load-sensing valve.

The right of amendment is reserved

Nomograph II

for automatic Load-Sensing Valve 475 700 220 0 and 475 700 403 0



The right of amendment is reserved

Adjustment of Automatic Brake Pressure Control 475 714 500 0

Introduction

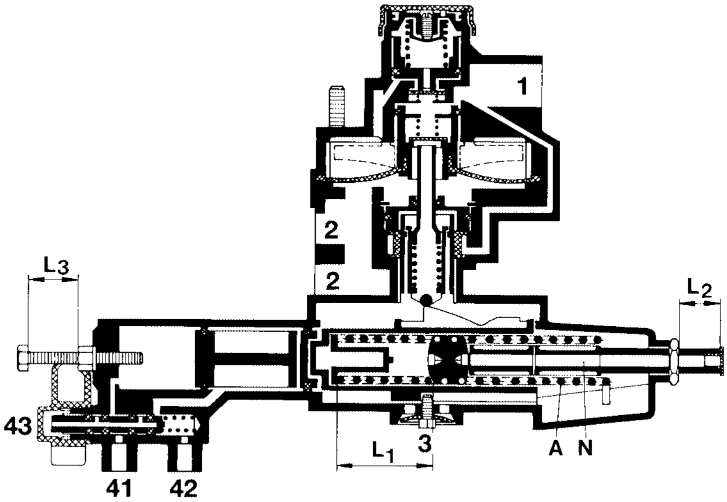
As mentioned under **“Types”**, this is a universal load-sensing valve in terms of its settings. The following parts are included in its accessory kit.

Pressure Spring **896 512 360 4**, (∅ = **4.0 mm**)
Separator **893 981 741 4**

The spring fitted at the factory with a ∅ = **3.2 mm** has the part number **896 512 370 4.**

Requirement

For setting the individual values, the following data have to be determined: (normograph or pc program Load Sensing Valve)



1. Which pressure spring **(A)** is required?
2. What is the effective spring length **(L_1)**?
3. How many separators **(N)** are required?
4. What screw settings are necessary for **“L_2”** and **“L_3”**?

Example of a Setting

WABCO

Automatisch - lastabhängige Bremskraftregeleinrichtung (ALB) für Typ:
Load sensing decive for type:
Dispositif de correction automatique de freinage pour type:
⊕ Nach Angabe des Fahrzeugherstellers

Eingangsdruck, Input pressure, Pression d' entrée: 6,0 bar

	Vorderachse, Front axle, Essieu avant		Hinterachse, Rear axle, Essieu arriére		
Ventile Nr / Valves No / Valves N°	475 714 500 0		Ventile Nr / Valves No / Valves N°	—	
Achslast / Axle load / Charge essieu kg	Federungsdruck / Suspension pressure / Pression suspension bar	Ausgangsdruck / Output pressure / Pression de sortie bar	Achslast / Axle load / Charge essieu kg	Federungsdruck / Suspension pressure / Pression suspension bar	Ausgangsdruck / Output pressure / Pression de sortie bar
Leer ⊕	0,2	1,8	—	—	—
Beladen ⊕	4,1	6,0	—	—	—

Determining the control range (i_R)

Input pressure (p_{in}) = 6.0 bar
output pressure (p_{out})= 1.8 bar

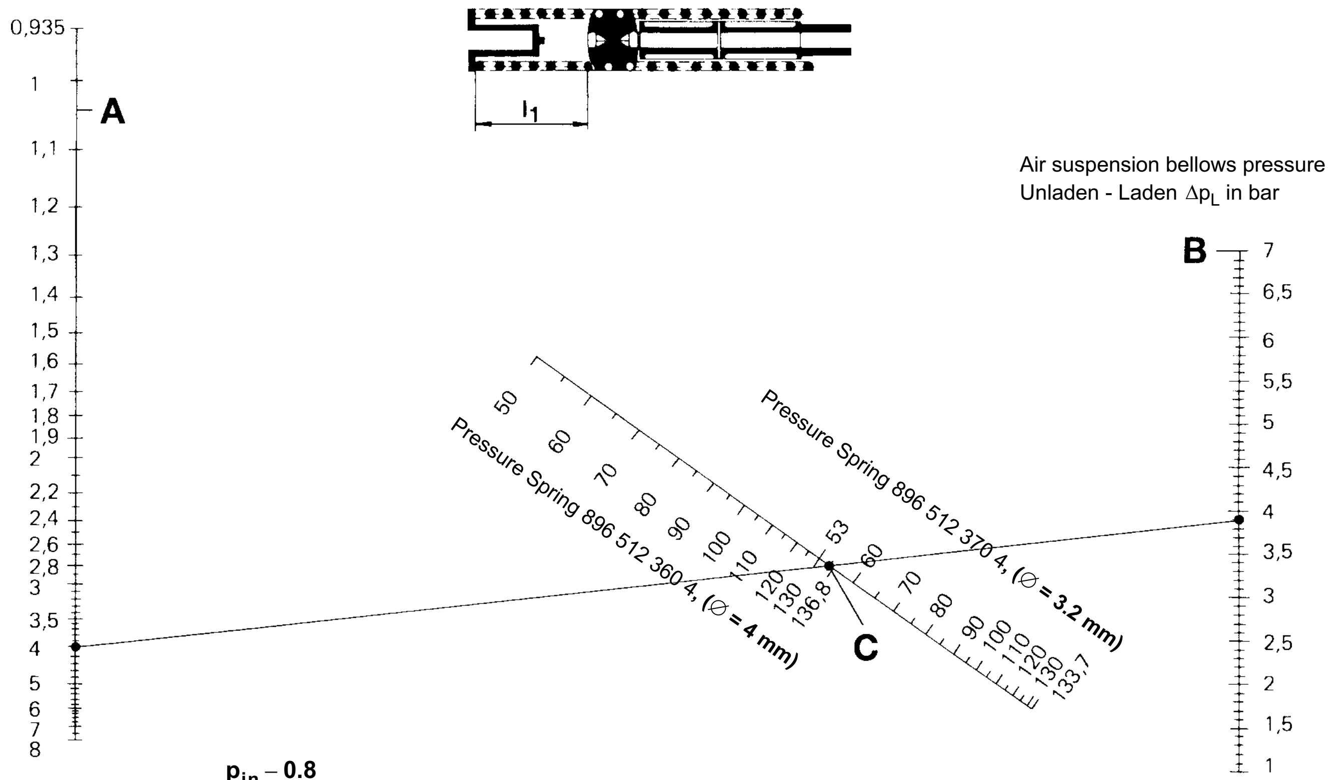
$$i_R = \frac{p_{in} - 0.8}{p_{out} - 0.5} = \frac{6.0 - 0.8}{1.8 - 0.5} = \frac{4.0}{1}$$

Determining the difference in bellows pressures (Δp_L)

Bellows pressure “laden” = 4.1 bar
bellows pressure “unladen” = 0.2 bar
difference in bellows pressures Δp_L = 3.9 bar)

Setting Approximate Values (Nomograph I)

From Nomograph **I**, the spring **(∅ 3.2 or 4.0 mm)** and the effective spring length **(L_1)** are determined.



control range (i_R) = $\frac{p_{in} - 0.8}{p_{out} - 0.5}$

How to Use the Nomograph (values from example above)

First I_R = 4.0 : 1 on nomograph column **(A)** and Δp_L = 3.9 bar on nomograph column **(B)** are marked off. By connecting these positions, the intersecting point **(C)** is determined.

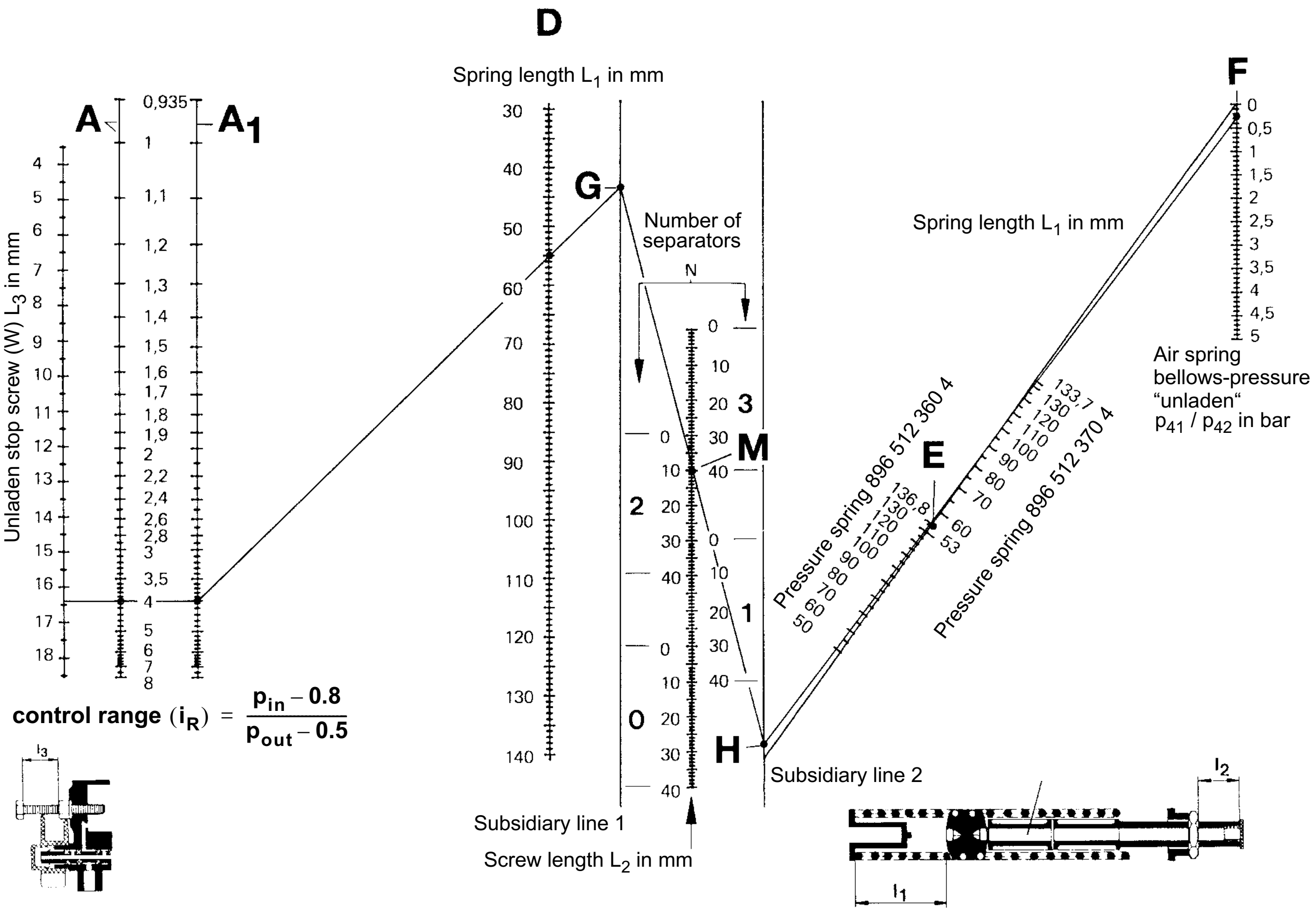
Evaluation

Intersecting point **(C)** lies within the nomographs of both springs. We shall use spring **896 512 370 4** with an effective spring length **(L_1)** of **55 mm** when released, and a wire diameter of **3.2 mm**.

Setting Approximate Values
(Nomograph II)

From Nomograph **II,** the screw lengths to be set **("L_2"** and **"L_3")** and the number of separators **(N)** are determined.

Nomograph II
For determining the bolts setting lenght **L_2** and the separators **(N)** as well as **L_3**:



How to Use the Nomograph (values from example)

First **i_R** = 4.0:1 on nomograph column **(A)** is marked off again. . From this position, a horizontal line is drawn to the left and to the right. Where this straight line intersects, we find **"L_3"** and **"A_1"**.

Then we mark off the spring length **L_1 = 55** mm in position **(D)**. By connecting intersecting points **(A_1)** and **(D)** and extending this line, we find position **(G)** on **subsidiary line "1"**.

Afterwars **"L_1"** in postion **(E)** on numerical column **896 512 370 4** and the **bellows pressure "unladen" = 0.2 bar** in position **(F)** are marked off. When these points are connected by a straight line up to **subsidiary line "2"**, we have position **(H)**.

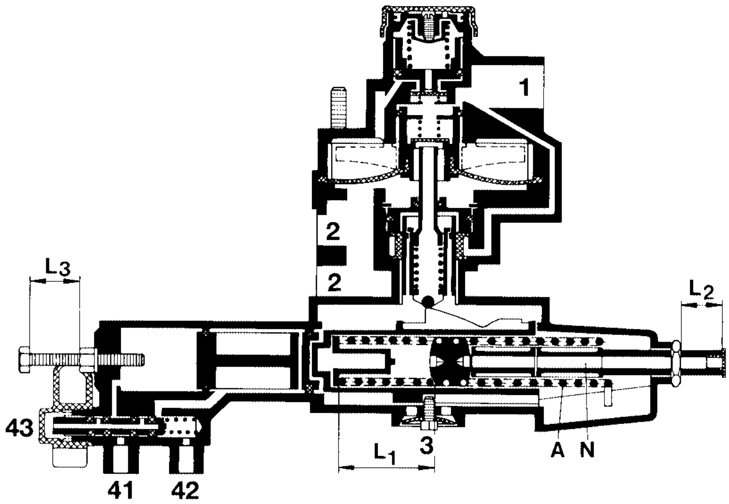
By connecting intersecting points **(G)** and **(H)** we have the adjusting length of screw **"L_2"** at intersecting point **(J)** and the number of separators **(N)**.

Evaluation

Setting of "L_2" = 10 mm with 2 separators
Setting of "L_3" (unladen stop screw) = 16.4 mm

Setting the Values on the Test Rig

1. Before the load-sensing valve is installed, the effective spring length “L_1” is set on the selected spring by means of the clamp (K).
2. Set the unladen stop screw to “L_3” as determined from Nomograph II.
3. Fit the spring in the load-sensing valve, and put on housing cover.
4. Set adjusting screw “L_2” to the value from Nomograph II.



Settings on the Test Bench

1. At a bellows pressure of 0.0 bar at port 43 and an input pressure pin as stipulated on the reference plate (port 1), the output pressure at port 2 must be the unladen braking pressure p_{out} ± 0.1 bar. Any adjustments are made by turning adjusting screw “L_3”:

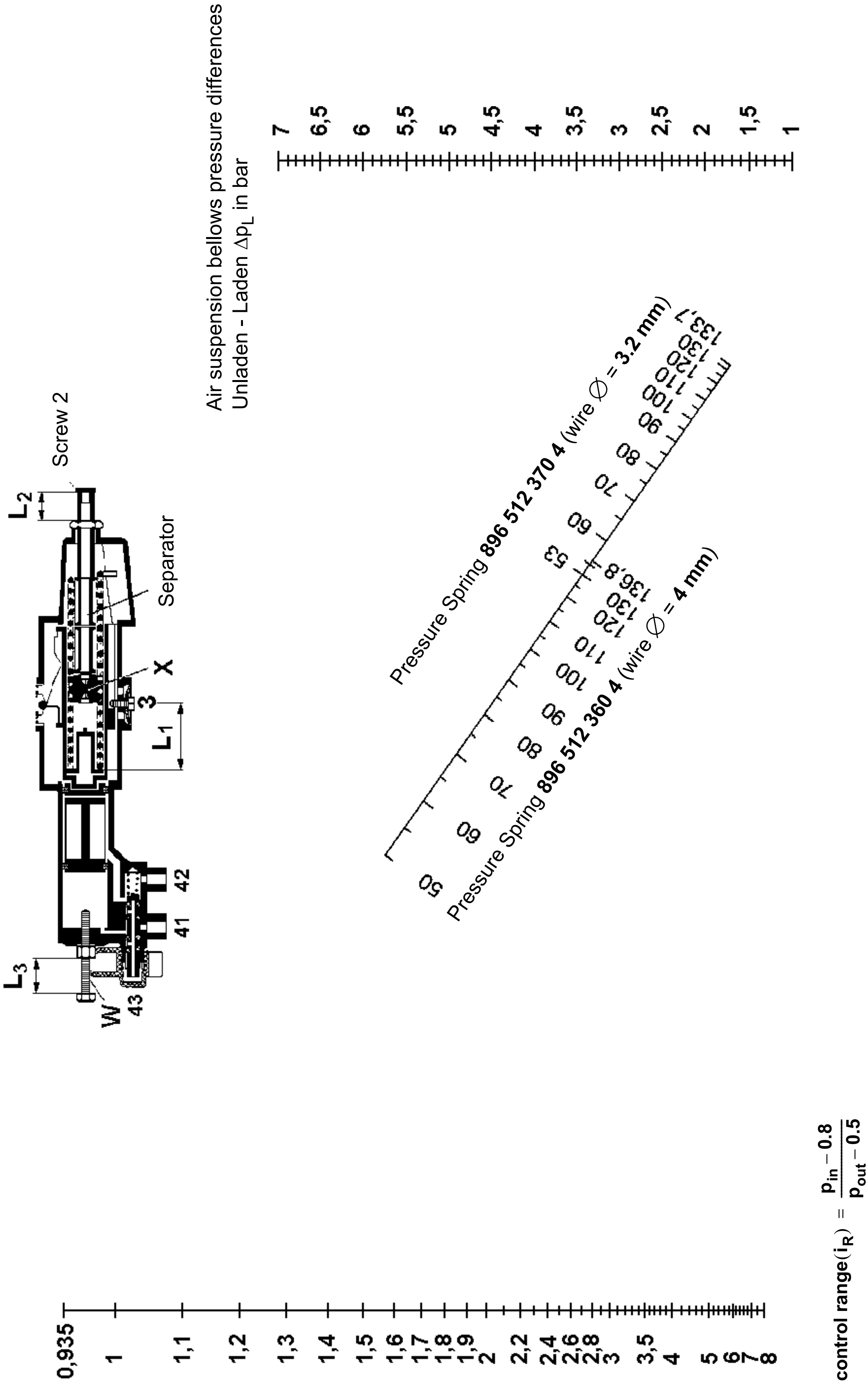
   turning anti-clockwise = pressure falls
   turning clockwise = pressure rises

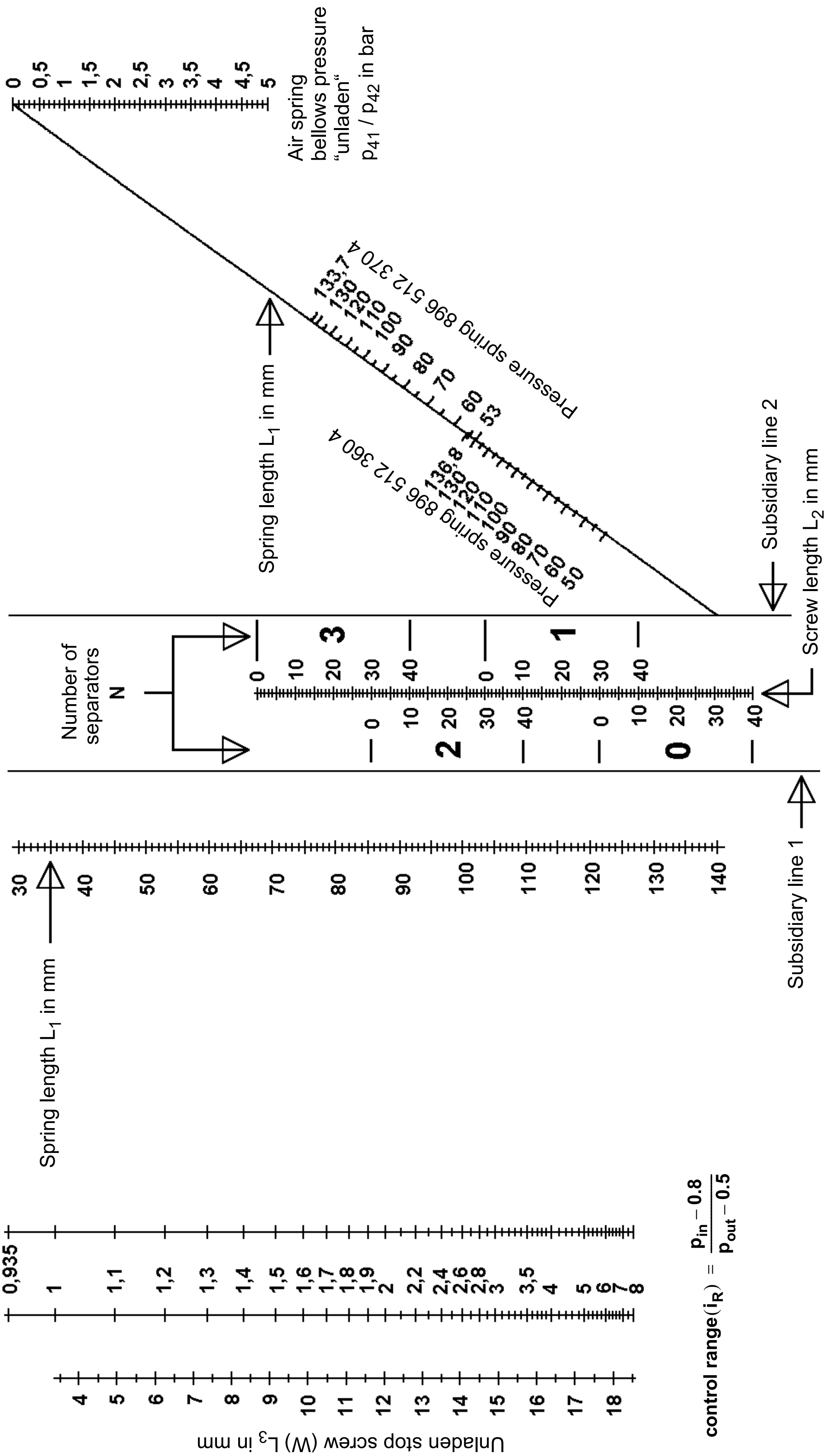
2. Reduce bellows pressure to 0.0 bar. then apply bellows pressure “unladen” + 0.3 bar at port 43. If the input pressure p_{in} is now input at port 1, the output pressure at port 2 must be between 0.1 and 0.2 bar higher than the unladen braking pressure. If the pressure is too high, adjusting screw “L_2” must be turned clockwise a little further. If the pressure is too low, screw “L_2” must be turned anti-clockwise slightly.
3. Input “laden” bellows pressure – 0.3 bar (port 43). If the input pressure pin is now input at port 1, the output pressure at port 2 must be between 0.3 ± 0.2 bar lower than p_{in}. Any adjustments are made from outside on the clamp to adjust the spring length “L_1”, and on adjusting screw “L_1”.

   turning anti-clockwise = pressure rises
   turning clockwise = pressure falls

4. Repeat test as described under “2”.

Nomograph I for Load Sensing Valve 475 714 500 0




Air spring bellows pressure "unladen" p_{41} / p_{42} in bar
0 0,5 1 1,5 2 2,5 3 3,5 4 4,5 5
Pressure spring 896 512 370 4
133,7 130 120 110 100 90 80 70 60 53
Pressure spring 896 512 360 4
136,8 130 120 110 100 90 80 70 60 50
Spring length L_1 in mm
Subsidiary line 2
Screw length L_2 in mm
Number of separators N
3 2 1 0
0 10 20 30 40
Spring length L_1 in mm
30 40 50 60 70 80 90 100 110 120 130 140
Subsidiary line 1
0,935 1 1,1 1,2 1,3 1,4 1,5 1,6 1,7 1,8 1,9 2 2,2 2,4 2,6 2,8 3 3,5 4 5 6 7 8
control range $(i_R) = \frac{p_{in} - 0.8}{p_{out} - 0.5}$
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Unladen stop screw (W) L_3 in mm

Adjustment of Automatic Brake Pressure Control 475 714 509 0

Introduction

As mentioned under “Types”, 475 714 509 0 is a universal load-sensing valve in terms of its settings.

In difference to 475 714 500 0 this device has an inbuild pressure spring ∅ **3.6 mm** and a **30 mm longer screw** on the the side of the spring **(L_2)**.

Basic Settings with Load Sensing Valve Program

The settings can be determined with the WABCO-Load Sensing Valve-Program. The specification follows as number of rotation for clamp and screw L_2.

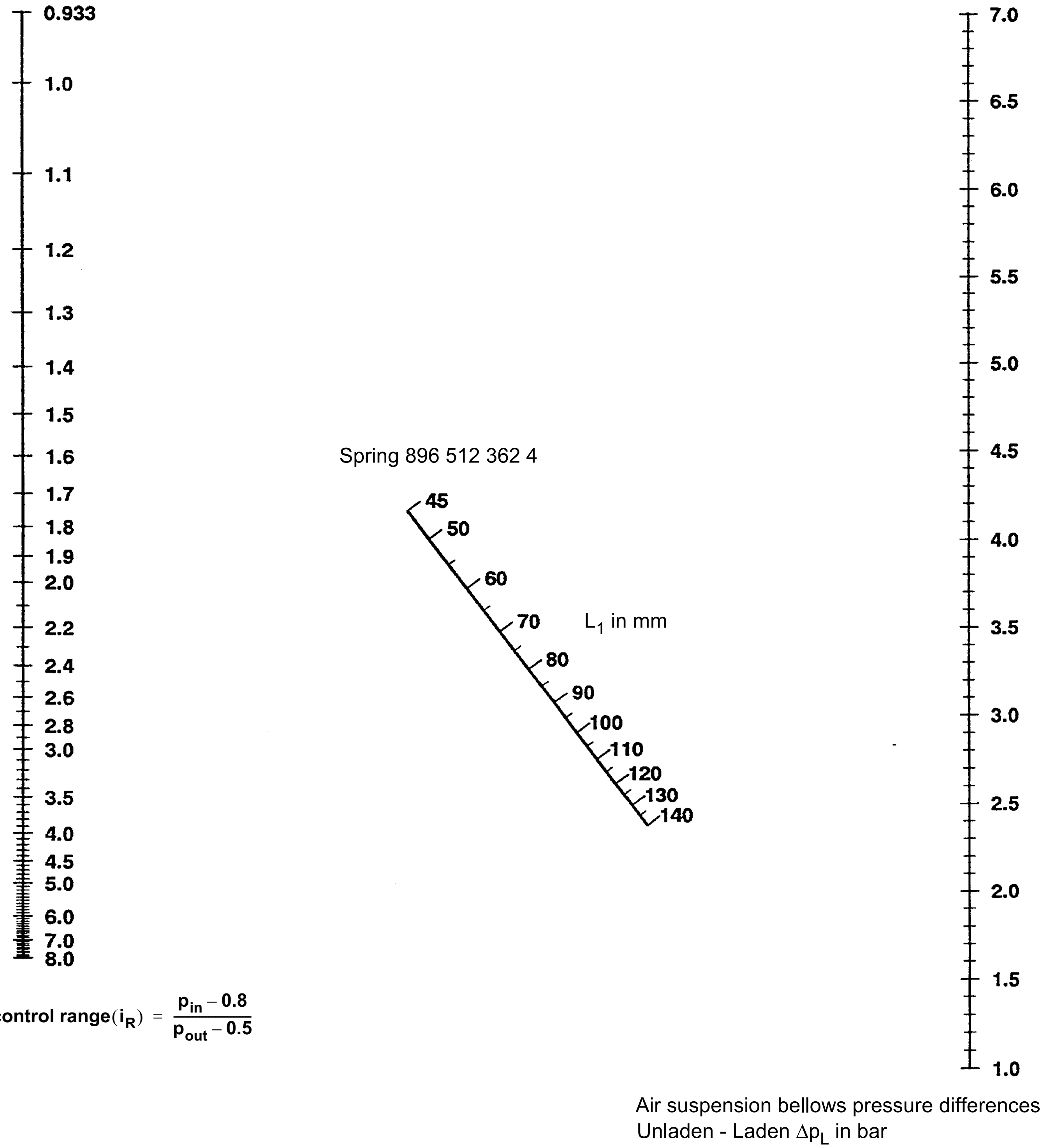
Thus, looking at the manufacturer setting, the transfer of settings **without opening the load sensing valve** can be done at the device.

Basic Setting with normographs

If no load sensing valve program is available, the basic settings can analogous to load sensing valve 475 714 500 0 also be used with help of following nomographs for variant 475 714 509 0.

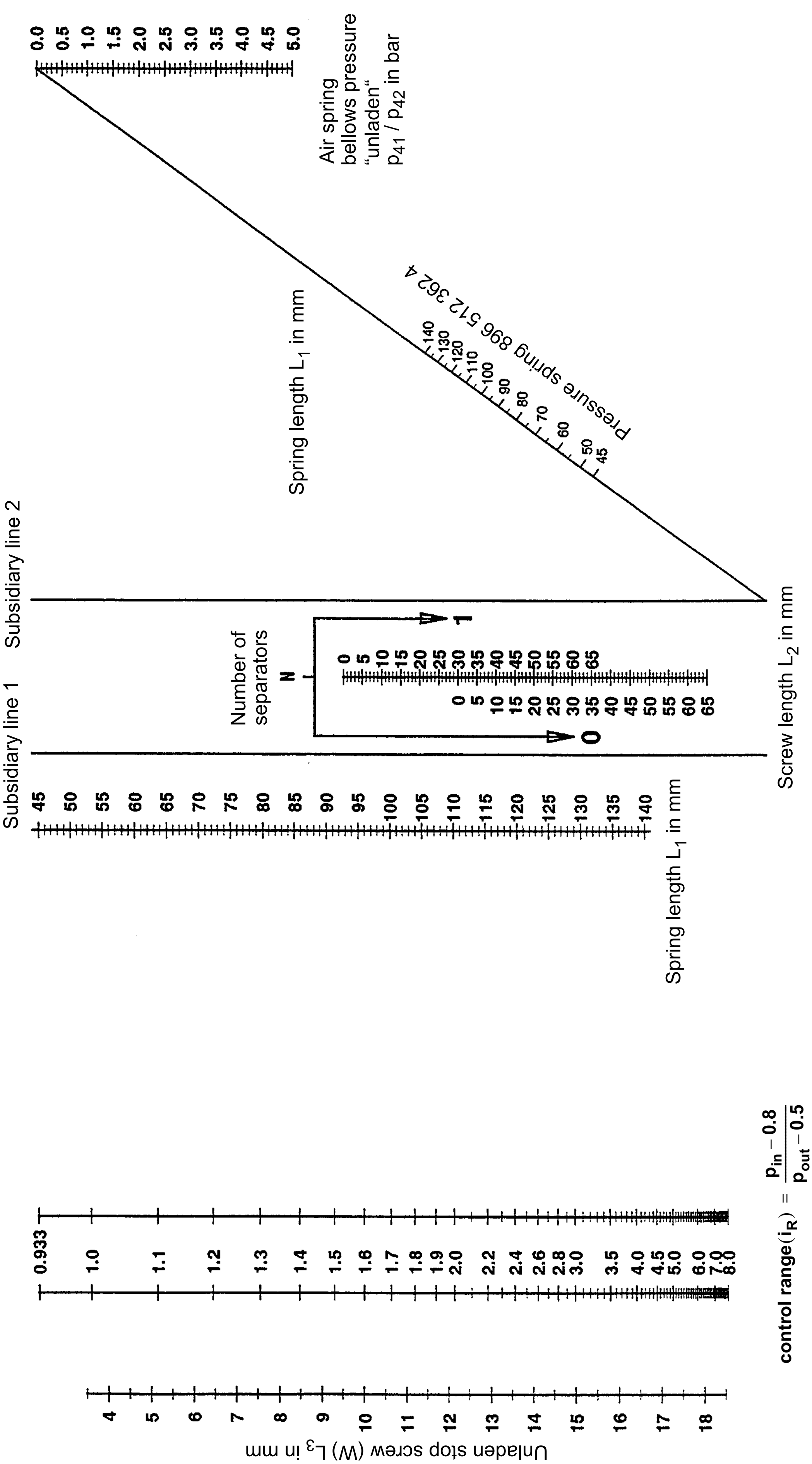
However the device has to be opened as before.

for automatic Load-Sensing Valve 475 714 509 0 (part 1)
Determining spring length L_1 in mm



$$\text{control range}(i_R) = \frac{p_{in} - 0.8}{p_{out} - 0.5}$$

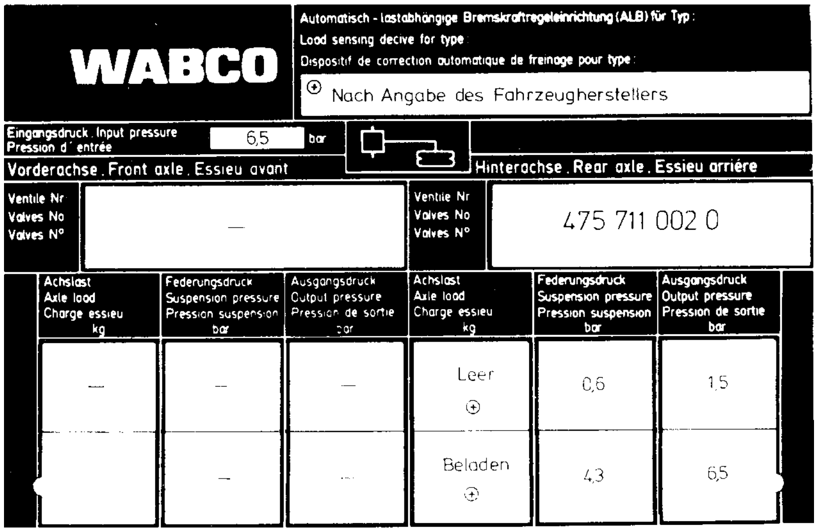
Nomograph II for Load Sensing Valve 475 714 509 0



Testing and Adjustment of Load-Sensing Valve 475 711

Please note

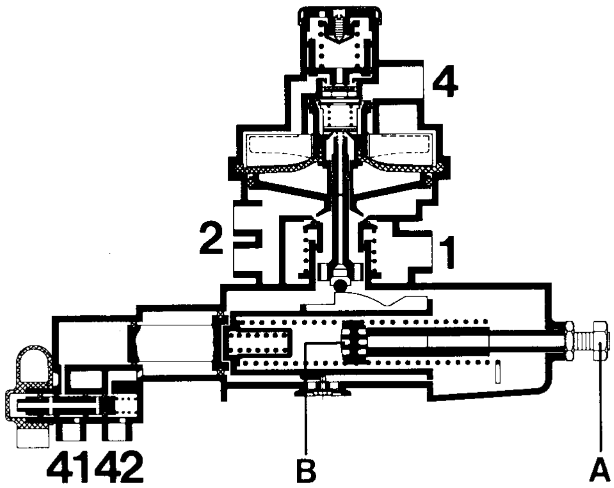
The information on the reference plate for the load-sensing device must be used as a basis when testing the load-sensing valve.



What must be checked is the input pressure $\mathbf{P_{in}}$ and the output pressure $\mathbf{P_{out}}$ in the unladen and laden vehicle as a ratio of the **“unladen”** and **“laden”** suspension pressures.

The reservoir pressure at port **(1)** must correspond to the operating pressure of the system.

If the braking pressures shown on the reference plate are not achieved within a range of ± 0.4 bar, readjustment can be done on the adjusting screw (A) or the clamp (B).



Adjustment “Unladen”

Turning adjusting screw (A) clockwise = pressure reduction; turning it anti-clockwise = pressure increase.

Adjustment “Laden”

If the load-sensing valve does not output the full braking pressure, or if it shows no falling tendency when the bellows pressure is reduced by 0.7 bar, the clamp (B) and the adjusting screw (A) have to be readjusted. The load-sensing valve will react to this as follows: **The pressure will increase when the screw is turned anti-clockwise**, and **it will decrease when the screw is turned clockwise**. After adjusting the **“laden”** pressure, the **“unladen”** braking pressure must be checked once again.

Further Testing

Within the bellows’ **“unladen”** and **“laden”** pressure ranges, the load-sensing valve must achieve grading at a maximum of 0.3 bar.

If the air-suspension system fails (pressure in ports **41** and **42** = 0.0 bar), the load-sensing valve will output approximately half the **“laden”** braking pressure.