

SCANIA

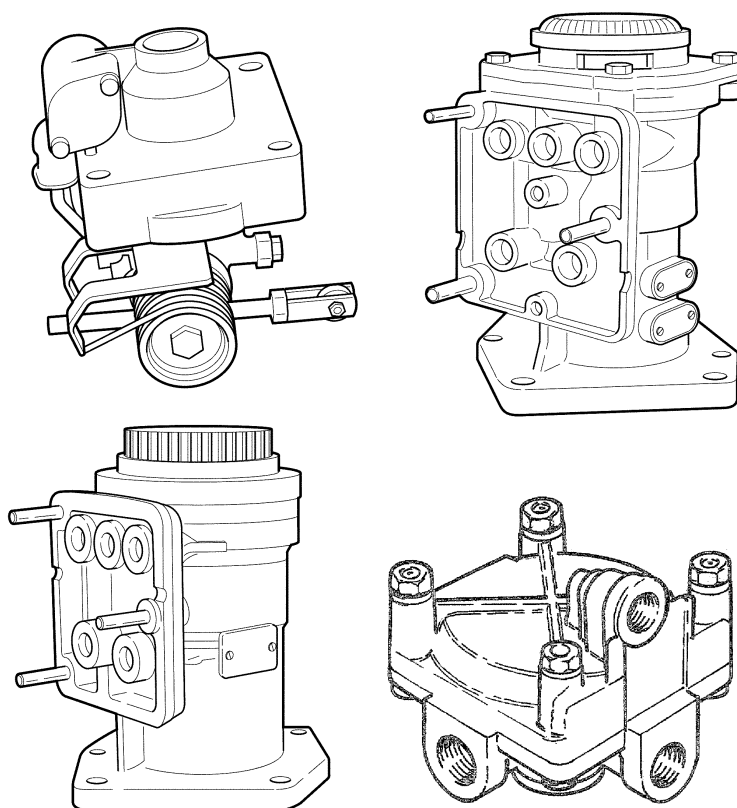
10:02-03

Issue 3 en

Front and rear brake circuits, components

Function and work description

Applies to vehicles without EBS



b113131

Contents

Safety	3
Location of components	4
Function description	
Service brake valve	5
ABS control valve	7
Load-sensing valve	8
Type 1, trucks with leaf spring suspension	9
Type 2, trucks with air suspension	10
Type 3a, trucks with leaf spring suspension	11
Type 3b, trucks with air suspension	12
Brake protection valve	13
Relay valve	15
Pressure sensor/monitor	17
Pressure limiting valve	18
Work description	
Service brake valve	20
Load-sensing valve	23
Leaf spring suspension.....	24
Air suspension.....	30

Safety



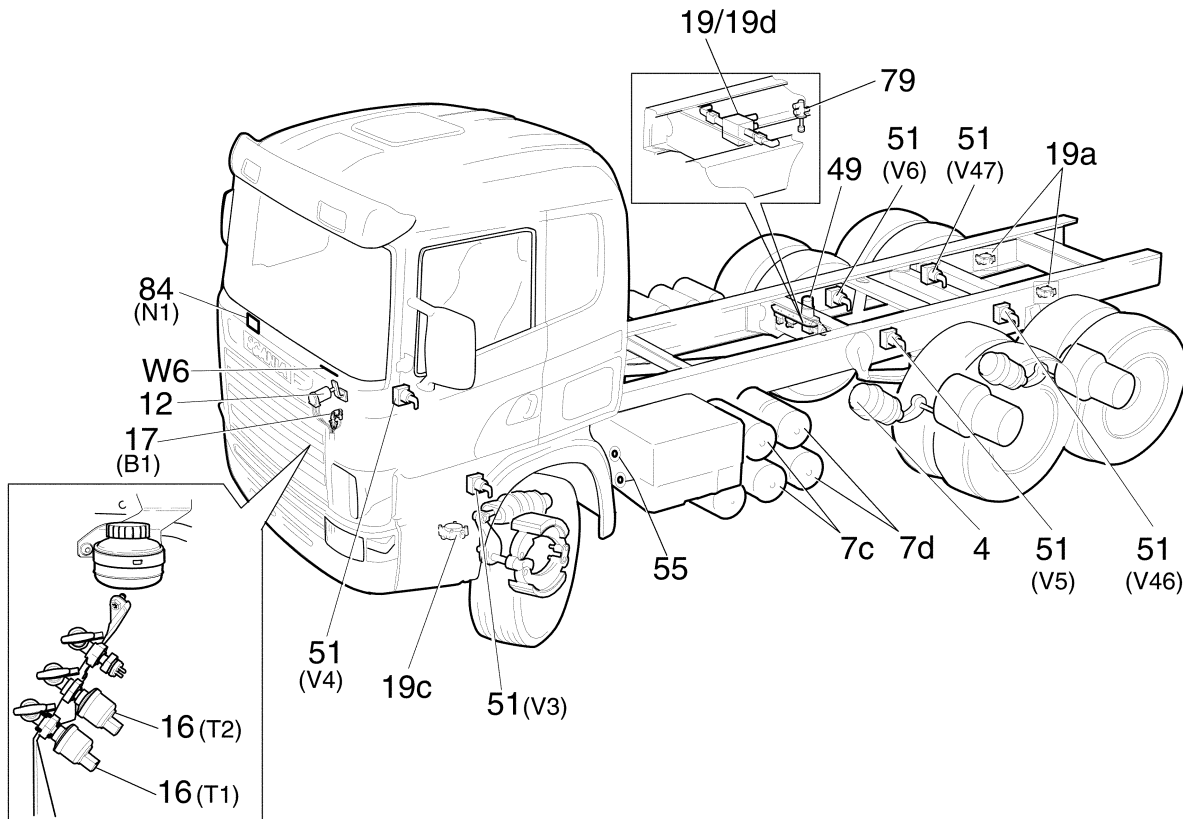
WARNING!

Work on the brake system may only be carried out by personnel with sufficient training and knowledge for the task. If problems arise, contact your nearest supervisor for assistance.

When working on the brake system, it is important to follow the instructions in order to avoid accidents and injury.

It is also important to use the correct components when carrying out work on the brakes. A brake system which fails due to faulty components can have disastrous consequences on the road.

Location of components



b111301

- 4 Brake chamber
- 7c Air tank, front circuit
- 7d Air tank, rear circuit
- 12 Service brake valve
- 16 Pressure sensor with monitor, front circuit T1
- 16 Pressure sensor with monitor, rear circuit T2
- 17 Brake lamp switch B1
- 19 Relay valve, rear circuit
- 19a Relay valve, TC control
- 19c Relay valve, front circuit
- 19d Relay valve, rear circuit with higher opening pressure
- 49 Load-sensing valve
- 51 ABS control valve, V3-V6 and V46-V47
- 55 Test connection
- 79 Brake protection valve
- 84 Buzzer N1
- W6 Warning lamp, low circuit pressure

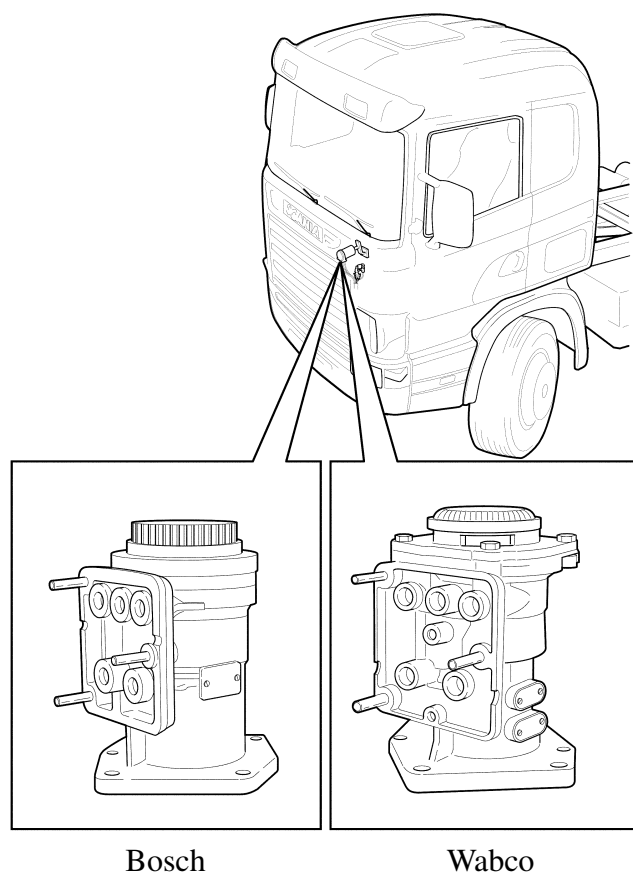
Function description

Service brake valve, Bosch and Wabco

Function

General

The service brake valve performs two separate brake functions in the same housing, one for the rear circuit and one for the front circuit. The rear circuit is activated by depressing the brake pedal. Then the front circuit is activated via pressure from the rear circuit. The service brake valve is designed so that if brake pressure in one circuit is lost, the second circuit's brakes still work.



Bosch

Wabco

5112236

Balancing position

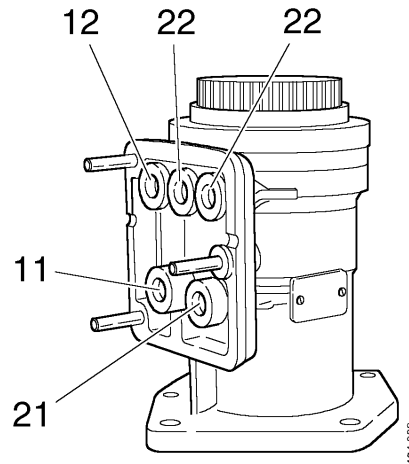
When the brake pressure is balanced in the front and rear circuits the intake valves are closed. The service brake valve is then in equilibrium until either brake pedal position is changed or pressure drops in any of the circuits.

Pressure drop in front circuit

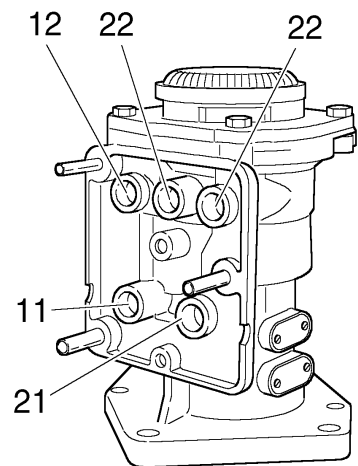
If there is a leak in the front circuit, the rear circuit will continue to operate normally as the valve part of the rear circuit is actuated directly by the brake pedal.

Pressure drop in rear circuit

If there is a leak in the rear circuit, this has a purely mechanical effect on the operation of the front circuit. Normally the front circuit operation is actuated by means of the rear circuit operating air (relay function). This now takes place purely mechanically via the pedal position. The pedal path will be somewhat longer and the force required to depress the pedal will increase to obtain the same operation in the front circuit.



Bosch



Wabco

12 Intake, front circuit

22 Outlet, front circuit

11 Intake, rear circuit

21 Outlet, rear circuit

ABS control valve

Function

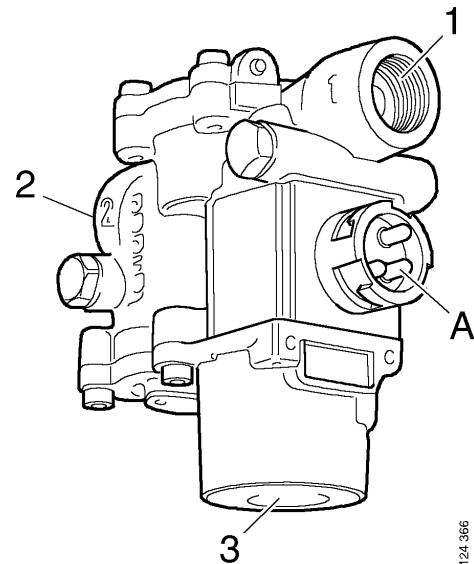
General

The electropneumatic control valve consists of a double solenoid and two diaphragm valves. The control signals can be as short as a few milliseconds in duration.

The ABS control valves have three functions:

- Increasing pressure
- Maintaining pressure
- Pressure reduction

For more information on the ABS control valve function, see main group 10, ABS/TC function description.



- 1 Intake
- 2 Outlet
- 3 Draining air
- A Connector

124.366

Load-sensing valve

Function

General

The load-sensing valve for the rear circuit controls the brake pressure in the rear brake circuit chambers according to the weight of the load. A heavy load results in a higher brake pressure and a light load results in a lower brake pressure.

The load-sensing valve is located on the service line to the rear circuit, in front of the relay valve.

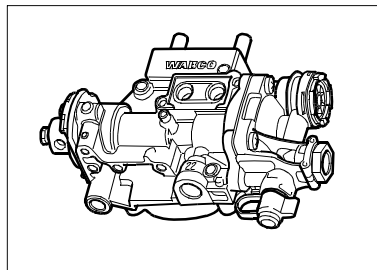
There are four types of load-sensing valve for the rear circuit:

Type 1 is used in vehicles with leaf spring suspension.

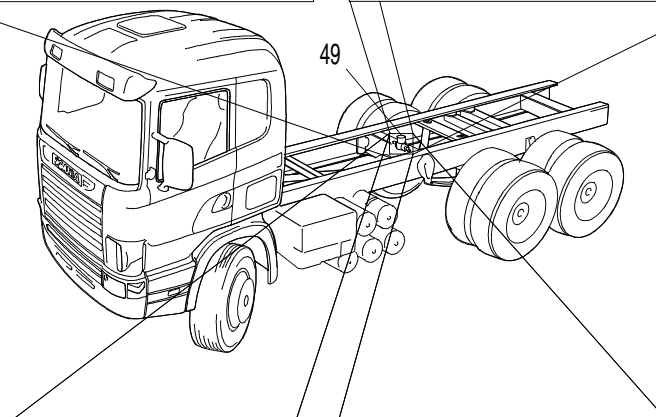
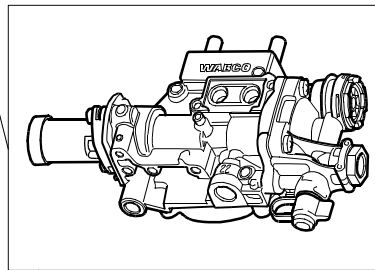
Type 2 is used in vehicles with air suspension.

Type 3 comes in two designs; 3a is used in vehicles with leaf spring suspension. 3b is used in vehicles with air suspension.

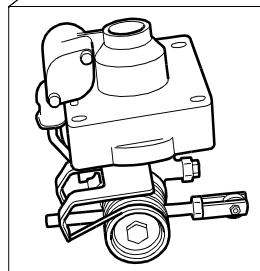
Type 3a



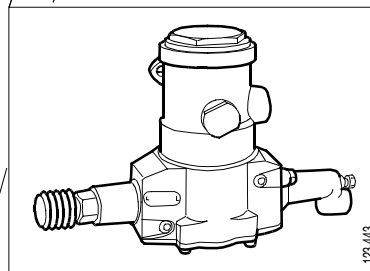
Type 3b



Type 1



Type 2



Type 1, for leaf spring vehicles

The load-sensing valve has a lever which is connected to the rear axle. The position of the lever actuates the valve by variations in suspension, depending on the load in the truck. When axle load is low, the valve reduces brake pressure. At full load on the rear axle, the compressed air passes through the valve without reduction and the brake chambers provide full braking power.

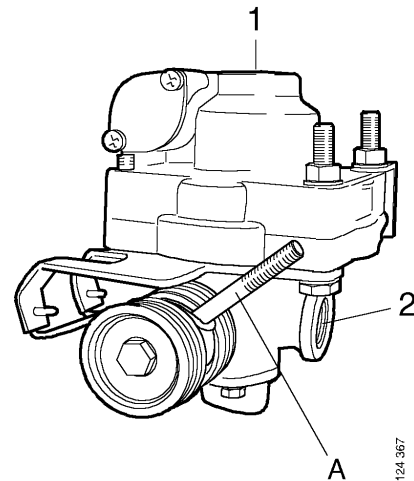
In the pressure range up to 0.5 bar, there is no reduction. Input and output pressure are always the same irrespective of load size.

Linkage

The load-sensing valve has various linkages depending on the design of the rear axle and bogie. See the section Work description.

Changing pressure reduction

The greater the load, the further arm A will move counterclockwise. The pressure difference between the intake and outlet reduces when the weight on the load increases. When arm A is in the maximum load position, there is no pressure difference between the intake and outlet.



- 1 Intake
- 2 Outlet
- A Arm

Type 2, for trucks with air suspension

The type 2 load-sensing valve senses the weight of the load pneumatically. The pressure in the air suspension bellows is measured, which is proportional to the rear axle load.

Air path through valve

The valve senses the pressure in the bellows via inlet 4. The rear circuit service pressure comes in through intake 1. The adapted pressure exits via connection 2 to the rear circuit relay valve.

Brake pressure

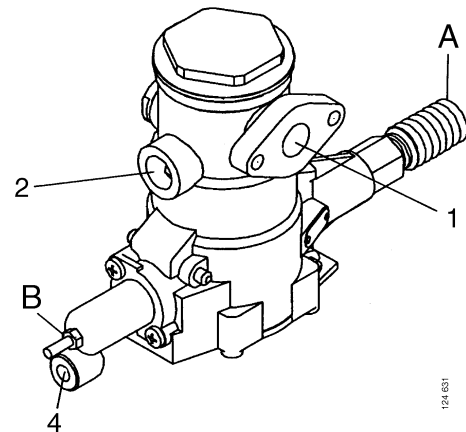
The output brake pressure on the valve is determined by the spring force, which can be adjusted with adjusting screw A.

Maximum reduction of valve

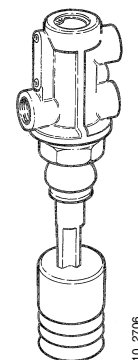
The maximum reduction of the valve is determined by the spring force, which can be adjusted with adjusting screw B.

Defective air bellows

If an air bellows breaks, the chassis will drop and the pressure in intake 4 will fall. In order for the valve to react as if the load is high, despite the fact that it may be low, brake protection valve 79 reverses so that the rear circuit obtains full brake pressure. Brake protection valve 79 conveys tank pressure instead of bellows pressure to the load-sensing valve. The pressure at the outlet is not reduced.



- 1 Intake
- 2 Outlet
- 4 Intake from air suspension
- A Brake pressure adjusting screw
- B Adjusting screw for maximum reduction

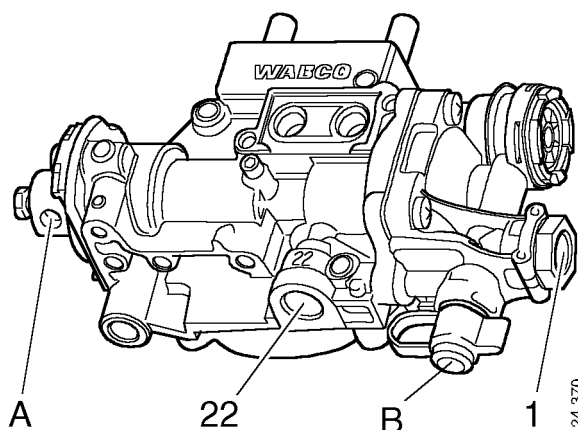


Brake protection valve 79

Type 3a, for trucks with leaf spring suspension

The load-sensing valve has a lever which is connected to the rear axle. The position of the lever actuates the valve by variations in suspension, depending on the load in the truck. When axle load is low, the valve reduces brake pressure. At full load on the rear axle, the compressed air passes through the valve without reduction.

In the pressure range up to 0.5 bar, there is no reduction. Input and output pressure are always the same irrespective of load weight.



Linkage

The load-sensing valve has various linkages depending on the design of the rear axle and bogie. See the section Work description.

Changing pressure reduction

The greater the load, the further arm A will move counterclockwise. The pressure difference between the intake and outlet reduces when the weight on the load increases. When arm A is in the maximum load position, there is no pressure difference between the intake and outlet.

- 1* Operating air intake
- 22* Controlled operating air outlet
- A* Arm attachment
- B* Test connection arm

Type 3b, for trucks with air suspension

The weight of the load is sensed via the pressure in the air suspension bellows, which is proportional to rear axle load.

The valve senses the pressure in the bellows via inlet 41. The rear circuit service pressure comes in through intake 1. The adapted pressure exits via connection 22 to the rear circuit relay valve.

Brake pressure

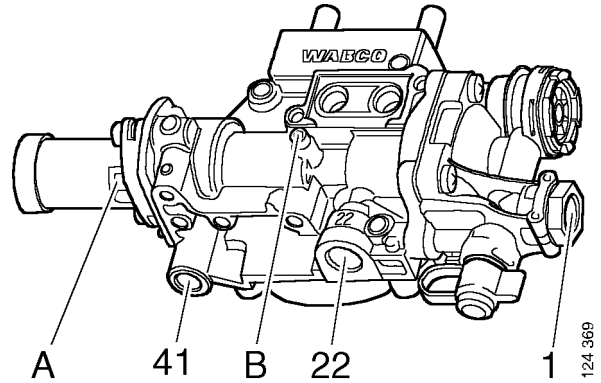
The output brake pressure on the valve is determined by the spring force, which can be adjusted with adjusting screw A.

Maximum reduction of valve

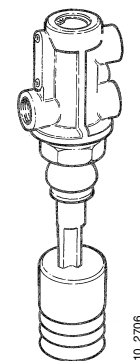
The maximum reduction of the valve is determined by the spring force, which can be adjusted with adjusting screw B.

Defective air bellows

If an air bellows breaks, the chassis will drop and the pressure in intake 4 will fall. In order for the valve to react as if the load is high, despite the fact that it may be low, brake protection valve 79 reverses so that the rear circuit obtains full brake pressure. Brake protection valve 79 conveys tank pressure instead of bellows pressure to the load-sensing valve. The pressure at the outlet is not reduced.



- 1 Operating air intake from service brake valve
- 22 Controlled operating air outlet
- 41 Bellows pressure intake
- A Brake pressure adjusting screw
- B Adjusting screw for maximum reduction



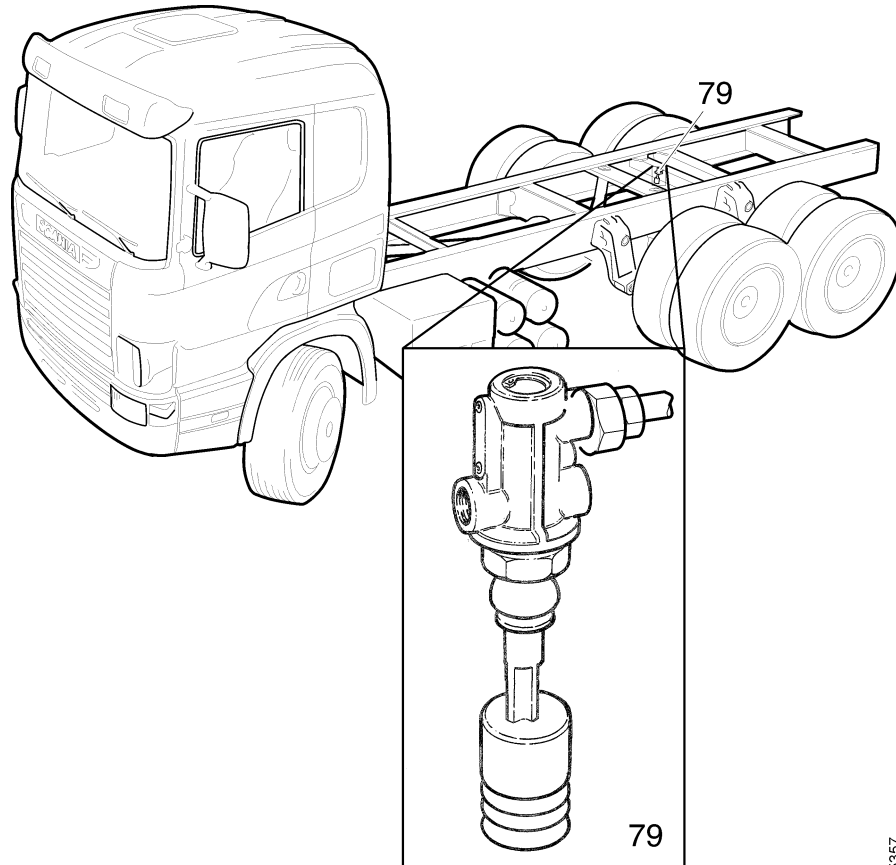
Brake protection valve 79

Brake protection valve

Function

General

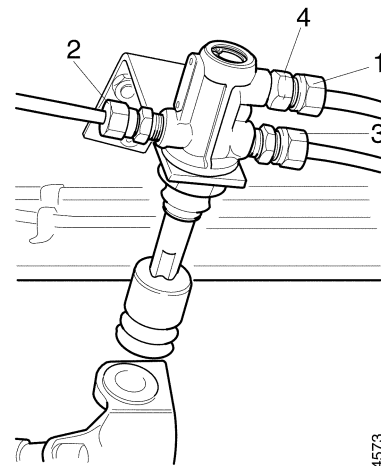
Brake protection valves are used on vehicles with air suspension that are equipped with a load-sensing valve. The brake protection valve ensures that the rear circuit receives full brake pressure in the event of a reduction in pressure in the air suspension system, e.g. bellows explosion.



115357

Function with chassis completely lowered

When a chassis is completely lowered, e.g. because the bellows have burst, the brake protection valve makes sure that the rear circuit obtains full brake pressure. Tank pressure rather than bellows pressure is conveyed to the load-sensing valve. The brake protection valve is positioned so that it can be mechanically manipulated if the chassis is completely lowered.



- 1 Intake from air bellows
- 2 Intake from rear air tank circuit
- 3 Outlet to load-sensing valve
- 4 Check valve

Relay valve

Function

General

The relay valve (19/19d) is used for a more rapid application of the rear wheel brakes. The relay valve is located beside the rear axle and receives its supply air from the compressed air tanks and service air from the service brake valve.

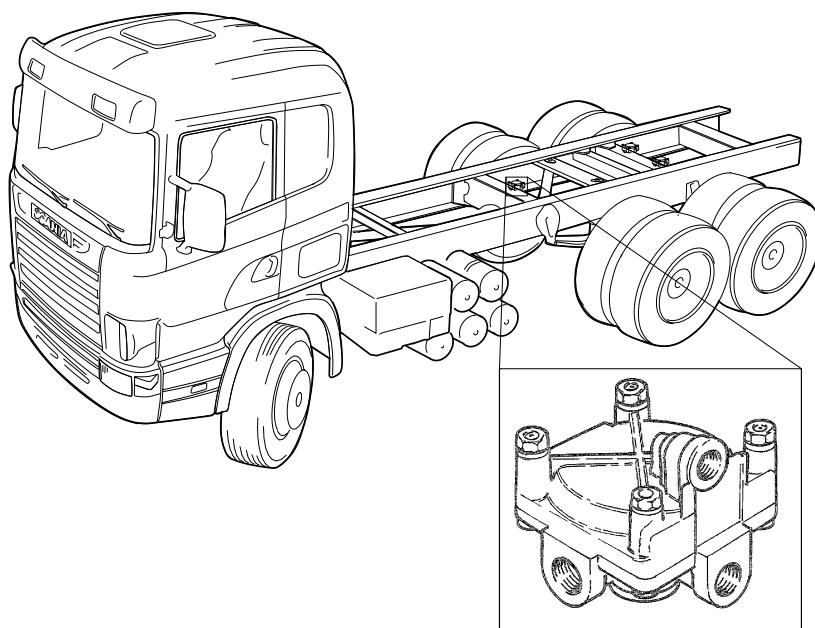
The task of the relay valve is to reduce the brake chamber release and application times. This result is obtained because the operating air path between the relay valve and brake chambers is shorter than it would have been if the operating air went directly from the service brake valve to the brake chambers.

Relay valve 19a is used on tag axle and triple bogie vehicles to disconnect tag axle brake chambers during TC control.

Vehicles fitted with double front axles and front circuit relay valve 19c are also fitted with rear circuit relay valve 19d from chassis numbers SSS1236236, SAN9009215 and SNL4386215 onwards. Relay valve 19d is also fitted to vehicles with a braking system for the US market. 19d has an increased opening pressure.

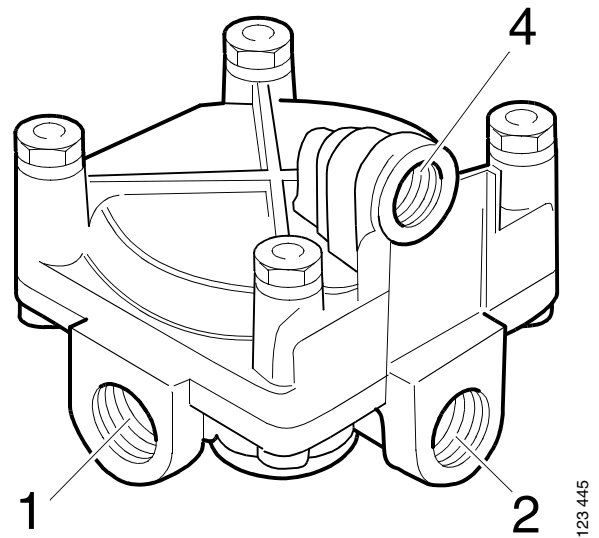
Relay valves 19/19a/19c come in two different designs, Wabco and Knorr, and feature either a separate silencer or an integrated silencer. Relay valve 19d is only available in the Wabco design. Knorr has been withdrawn from January 2001 and is replaced by Wabco.

In 1999, two extra relay valves with an opening pressure of 0.2 bar in the front circuit were introduced for leaf spring vehicles with ABS, double front axles, tyre size 12R24 or greater. These two valves will reduce the time required for bleeding the brake chambers on the first axle.



Application, Knorr and Wabco

During braking, operating air from the service brake valve actuates the valve so that the relay valve is opened. When the relay valve is open, supply air can flow from the intake to the outlet and on to the brake chambers.



- 1 *Supply air intake*
- 2 *Service pressure outlet to the brake chambers*
- 4 *Controlled operating air intake from service brake valve*

Pressure sensor or pressure monitor

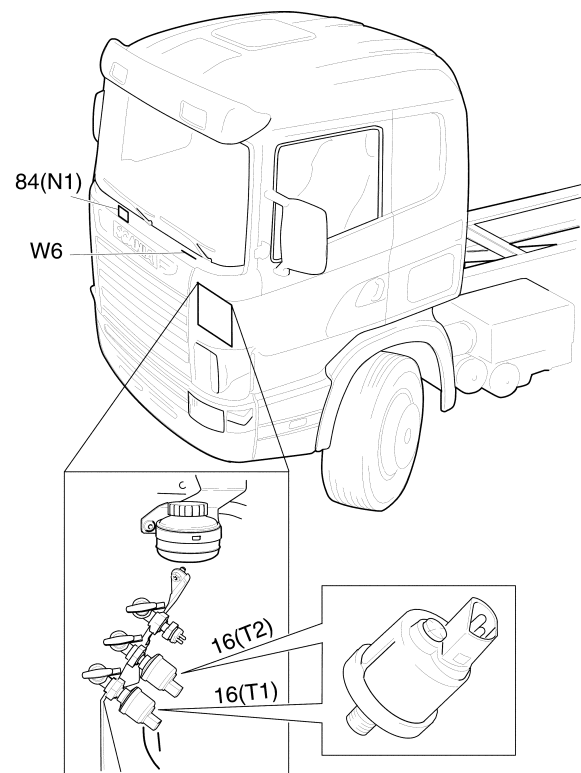
Function

General

There are pressure sensors or monitors on the front and rear circuit supply lines at the service brake valve. The sensor part is connected to the circuit pressure gauge and the monitor is connected to a warning lamp and buzzer.

The monitor flow circuit is closed at a circuit pressure of up to 5 bar, which means that the buzzer will sound and the warning lamp on the instrument panel will flash.

The pressure sensor or monitor has the task of warning that the front and rear circuit supply pressure is not high enough for the brakes to work.



- 16 Pressure sensor with monitor, front circuit T1
- 16 Pressure sensor with monitor, rear circuit T2
- W6 Warning lamp, low circuit pressure
- 84 Buzzer N1

Pressure limiting valve

Function

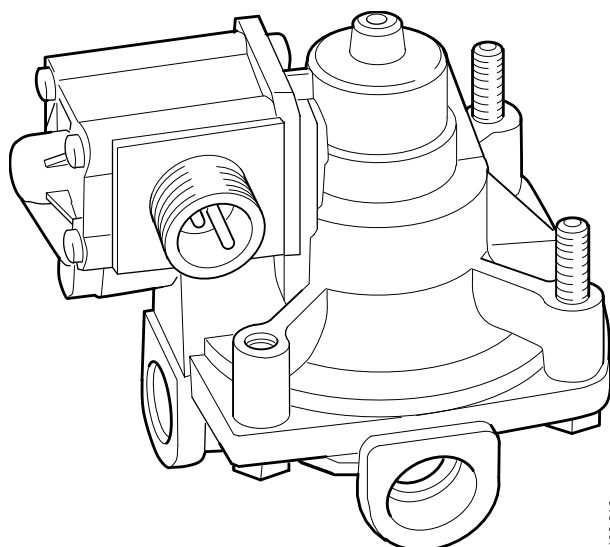
General

P and R vehicles with a semi-trailer (4x2, 4x4) with an axle distance of less than 3.7 m are equipped with a pressure limiting valve for brake pressure in the front circuit. The pressure limitation only takes effect when driving without a trailer. The pressure limiting valve ensures that the vehicle maintains the axle weight on the rear axle during heavy braking.

The limitation level is determined by the size of the front axle brake chambers.

- With 16" brake chambers - no pressure limitation.
- With 20" brake chambers - pressure limited to max 6 bar.
- With 24" or 30" brake chambers - pressure limited to max 5 bar.

Note: T vehicles or vehicles fitted with an EBS system are not affected.



The 5 bar pressure limiting valve was introduced in vehicles from chassis numbers SSS1240180, SAN9032532, SNL4393275 and SLA3503387 onwards. 6 bar pressure limiting valve from chassis numbers SSS1241108, SAN9033438 and SNL4395112 onwards.

Description of pressure limiting valve

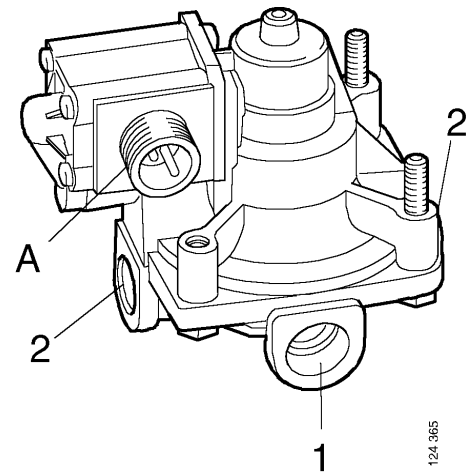
Pressure limiting valve 66a (V73) is an electrically controlled air valve. It has two positions, one for 'not activated' and one for 'activated' solenoid valve. When the solenoid valve is activated, there is a reduction in supply pressure.

Non activated position

If a trailer is connected, the valve is open. The solenoid valve is not supplied with voltage.

Activated position

If the trailer is disconnected, the solenoid valve is supplied with voltage. Equilibrium is reached between the adjusted spring power and the air pressure in the valve. In this equilibrium position, the valve closes and thereby limits outgoing supply pressure to the service brake valve.



- 1 Supply pressure intake
- 2 Supply pressure outlet
- A Connector

For more information on brake pressure reduction, see main group 10, Reduction of brake pressure in the front circuit.

Work description

Service brake valve



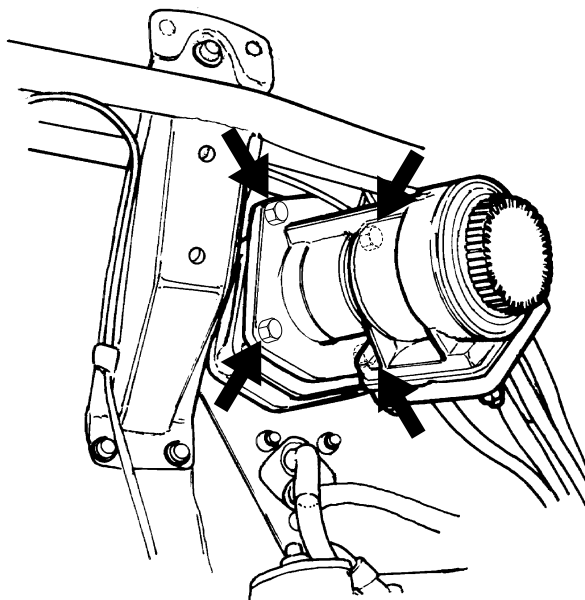
WARNING!

Always place stands under the chassis when working on vehicles with air suspension!

Removal

- 1 Bleed air from the braking system.
- 2 Remove the block coupling.
- 3 Remove the service brake valve. This is secured with four nuts.

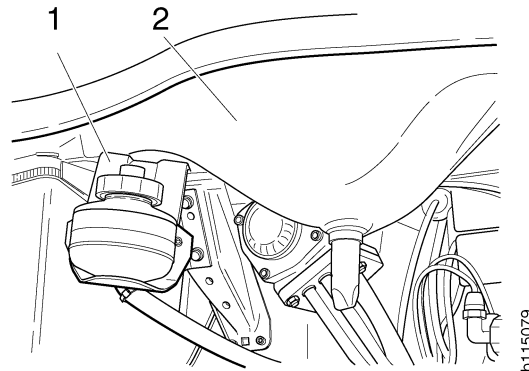
If the vehicle is fitted with a Scania retarder, remove the two bolts and undo the service brake valve from the retarder potentiometer.



On T vehicles

- 1 Remove the fluid reservoir 1.
- 2 Remove cover 2.
- 3 Bleed air from the braking system.
- 4 Remove the block coupling.
- 5 Remove the service brake valve. The valve is fitted with four nuts.

If the vehicle is fitted with a retarder, remove the two bolts and undo the service brake valve from the retarder potentiometer.



Fitting

Specifications

Clearance

Brake pedal clearance	3 - 5 mm
-----------------------	----------

- 1 Fit the service brake valve. Use new lock nuts. Ensure that the push rod and return spring are in the correct position.
- 2 Check brake pedal clearance. There should be 3-5 mm play in the pedal plate. If the pedal clearance is incorrect, it may be adjusted after removing the cover beneath the steering wheel.

Note: Checking brake pedal clearance is especially important in vehicles with EBS or retarder.

- 3 Fit the block coupling to the service brake valve Use new lock nuts.
- 4 Applies to T vehicles: fit cover and fluid reservoir.
- 5 Test service brake valve function as described in main group 10 "Testing the Braking System".

Load-sensing valve

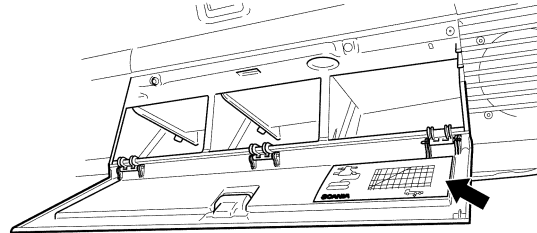
General

Vehicles equipped with a load-sensing valve for the braking system have a diagram (nomogram) glued to the inside of the lower storage compartment lid on the passenger side.

The diagram is used to set the load-sensing valve.

You can order a diagram from the parts department.

There are two different diagrams, one for vehicles with leaf spring suspension and another one for vehicles with air suspension.



b112560

Leaf spring suspension

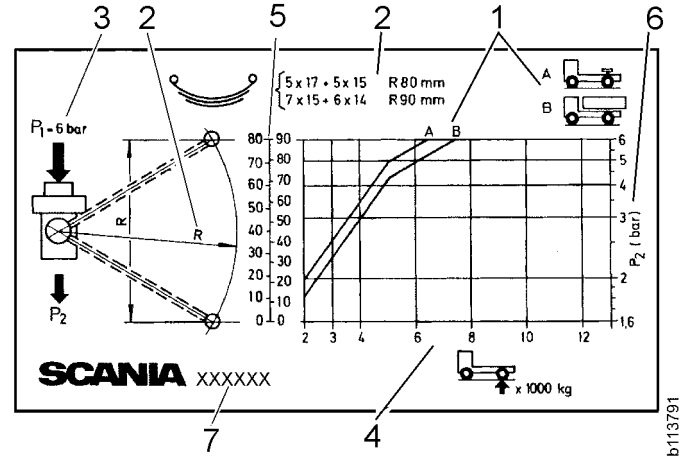
The differing design of the rear axle and bogie and the maximum loads affect the adjustment of the load-sensing valve.

The diagram is used to check that the settings on the load-sensing valve are correct or to correct incorrect settings.

Reading the diagram

- 1 Determine which line should be read (vehicle type dependent). The A line for tractors, the B line for trucks.
- 2 Determine arm length R (spring configuration dependent).
- 3 Incoming pressure P1 from the service brake valve must be 6.0 bar.
- 4 Determine rear axle or bogie load. If necessary, load the vehicle in order to come within the diagram range.
- 5 The top figure in each column specifies arm length and determines which column should be read. For a given rear axle/bogie load, the A or B line and arm length, the position of the arm above the zero position and pressure at the outlet P2 are obtained.

Note: The zero position is not the lower mechanical stop of the valve but is R mm below the uppermost position of the arm.



- 1 The vehicle type determines which line should be read.
- 2 Arm length R is determined by the spring configuration.
- 3 P1 Inlet pressure from the service brake valve.
- 4 Rear axle or bogie load x 1000 kg.
- 5 The top figure in each column specifies arm length and determines which column should be read.
- 6 Outlet pressure P2.
- 7 Diagram part number.

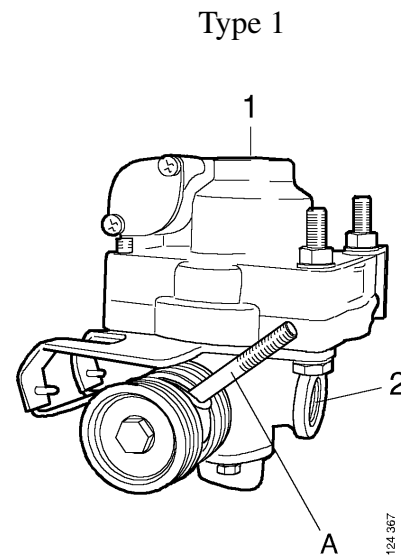
Example of reading the diagram

- A 4x2 truck with maximum rear axle load 11,200 kg has a rear axle load of 4,000 kg at the time of setting.
- The vehicle has the spring combination 7 x 15 + 6 x 14 and arm length R= 90 mm. According to line B in the diagram, the lever should be positioned 50 mm above the zero position and P2 should be 2.9 bar.

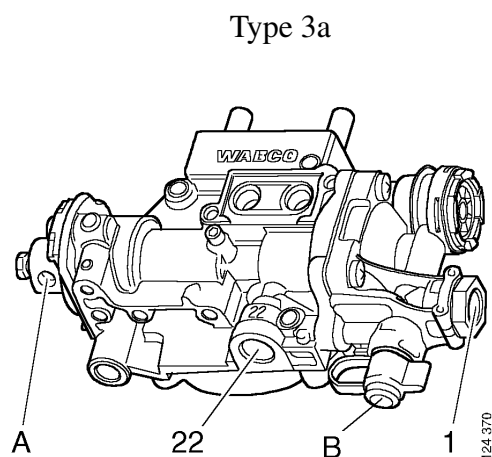
Checking load-sensing valve type 1 and type 3a

- 1 Check the arm length as shown on the diagram.
- 2 If necessary, load the vehicle in order to come within the diagram range.
- 3 Check outlet pressure P2 at an inlet pressure of 6.0 bar and a given load. Read the diagram.
- 4 If the pressure at the outlet does not correspond to the diagram, adjust the load-sensing valve.

For more information about testing, see section 10 "Testing the braking system".



- 1 Intake
- 2 Outlet
- A Arm

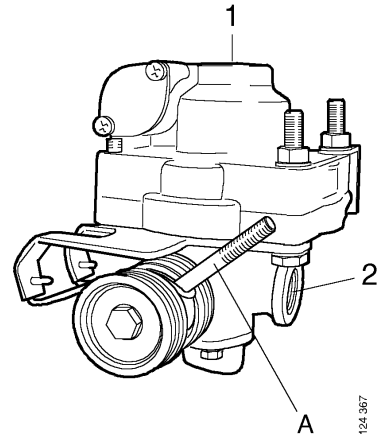


- 1 Operating air intake
- 22 Controlled operating air outlet
- A Arm attachment
- B Service pressure test connection

Adjusting load-sensing valve type 1 and type 3a

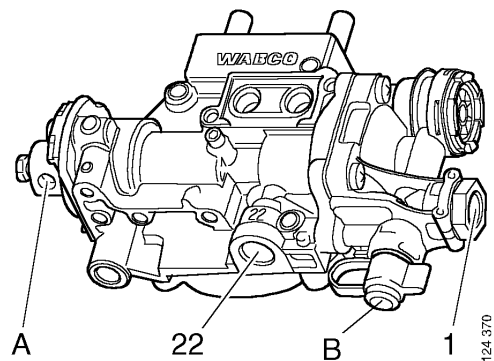
- 1 Follow the instructions for checking a load-sensing valve.
- 2 Release the brake.
- 3 Adjust the linkage to the load-sensing valve. The adjustment is made via the adjusting screw. If the pressure at the outlet is too low, the linkage should be adjusted so that the arm moves upwards. If the pressure at the outlet is too high, the linkage should be adjusted so that the arm moves downwards.
- 4 Check the pressure at the outlet again and, if necessary, repeat the adjustment procedure.

Type 1



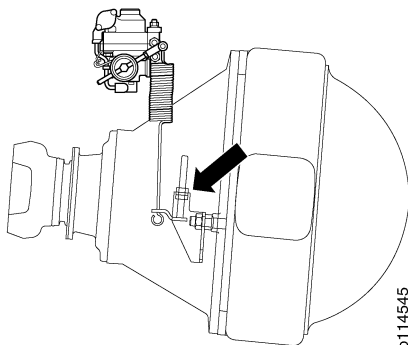
- 1 Intake*
- 2 Outlet*
- A Arm*

Type 3a

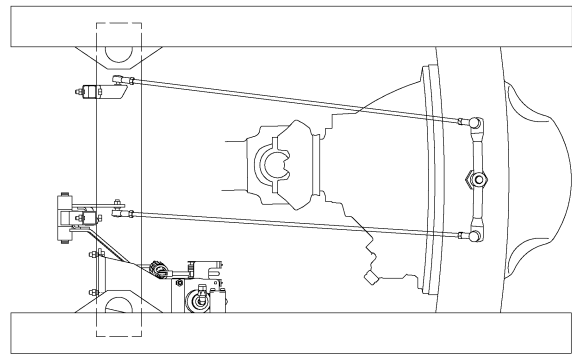
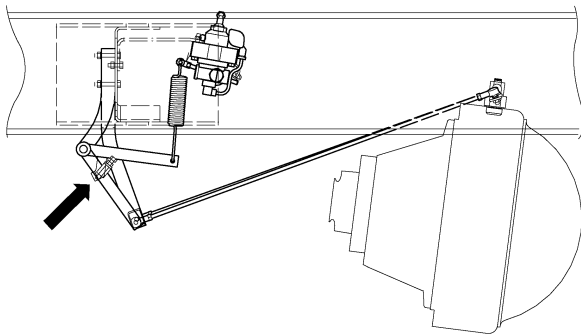


- 1 Operating air intake*
- 22 Controlled operating air outlet*
- A Arm attachment*
- B Service pressure test connection*

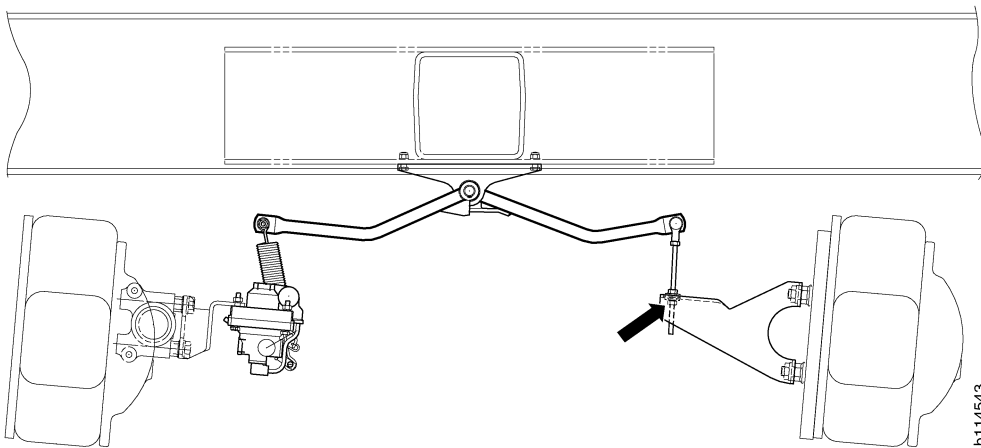
Linkage and adjusting screw for load-sensing valve type 1



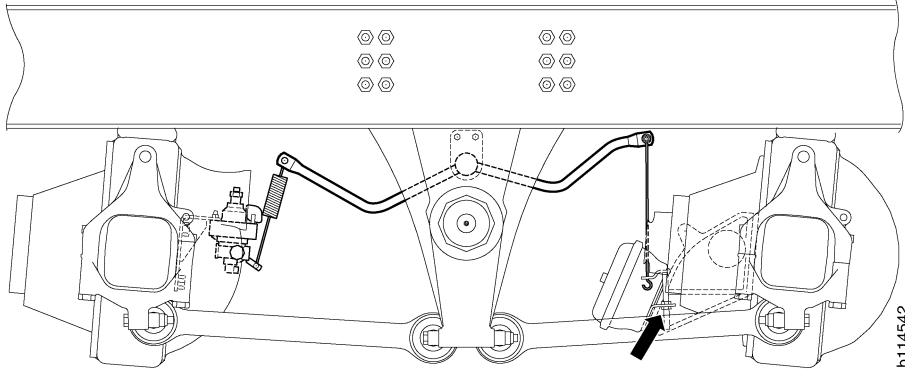
Linkage and adjusting screw on type 1 for 4x2 and 4x4



Linkage and adjusting screw on type 1 for 6x2

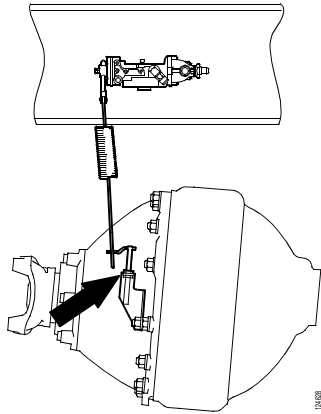


Linkage and adjusting screw on type 1 for 6x4 and 8x4 with AD1100P

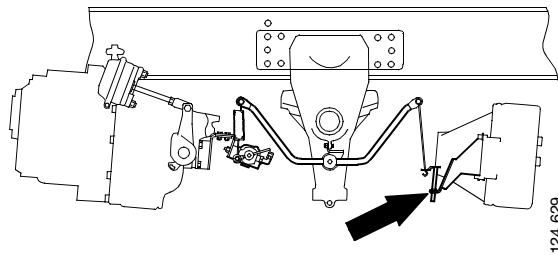


Linkage and adjusting screw on type 1 for 6x4 with AD1300 or AD1500P

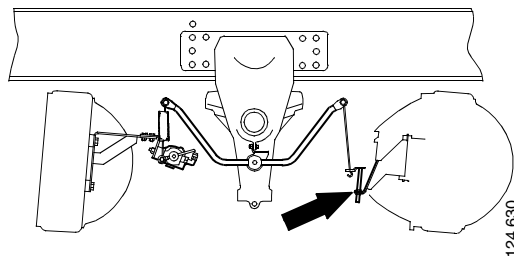
Linkage and adjusting screw for load-sensing valve type 3a



Linkage and adjusting screw on type 3a for 4x2 and 4x4



Linkage and adjusting screw on type 3a for 6x4 and 8x4 with AD1100P

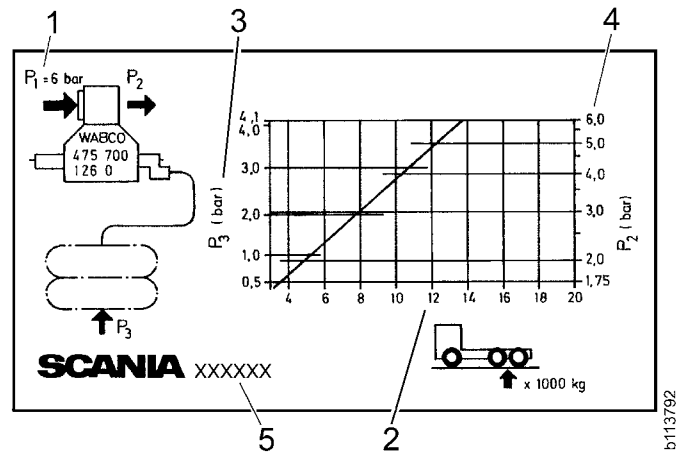


Linkage and adjusting screw on type 3a for 6x4 with AD1300 or AD1500P

Air suspension

The load-sensing valve in a vehicle with air suspension has no linkage system like the one in vehicles with leaf spring suspension.

In this case the load-sensing valve is adjusted by using adjusting screws.



Reading the diagram

- 1 Inlet pressure P1 should be 6.0 bar.
- 2 Determine rear axle or bogie load. If necessary, load the vehicle in order to come within the diagram range.
- 3 Measure the air pressure in the rear air bellows.
- 4 Outlet pressure P2 (4) can be read at a particular rear axle/bogie load 2 and an air pressure value in the rear bellows 3.

- 1 Inlet pressure P1.
- 2 Rear axle or bogie load x 1000 kg.
- 3 P3 Air pressure in the rear air bellows.
- 4 Outlet pressure P2.
- 5 Diagram part number.

Example

- A 6x2 vehicle with a maximum bogie load of 18 000 kg has a bogie load of 8 000 kg at the time of the setting.
- Air pressure P3 in the rear bellows is 2.0 bar. The output brake pressure P2 should be 3.0 bar.

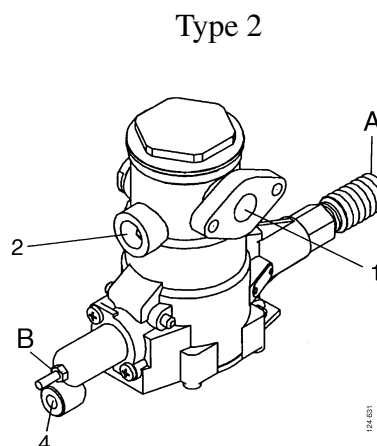
Checking load-sensing valve type 2 and type 3a

- 1 Connect a 2.5 bar manometer (pressure gauge) to the rear brake chamber, brake pressure at the outlet P2. Connect a 2.5 bar manometer to the solenoid valve block for the air suspension, bellows pressure P3. Connect a 15 bar manometer to the central valve cluster, rear circuit service pressure P1.
- 2 Enter the following bellows pressure via the control box.

Note: If the bellows pressure increases, disconnect the manometer.

The manometer which is connected to air suspension P3 should show, see table below.

- | | |
|----------|--|
| <i>1</i> | <i>Intake</i> |
| <i>2</i> | <i>Outlet</i> |
| <i>4</i> | <i>Intake from air suspension</i> |
| <i>A</i> | <i>Brake pressure adjusting screw</i> |
| <i>B</i> | <i>Adjusting screw for maximum reduction</i> |



Bellows pressure for adjusting maximum reduction

Vehicles 4x2, 4x4	1.0 bar
Other wheel configurations	0.5 bar

Bellows pressure when adjusting brake pressure

Vehicles 4x2, 4x4	1.5 bar
Other wheel configurations	0.8 bar

Type 3b

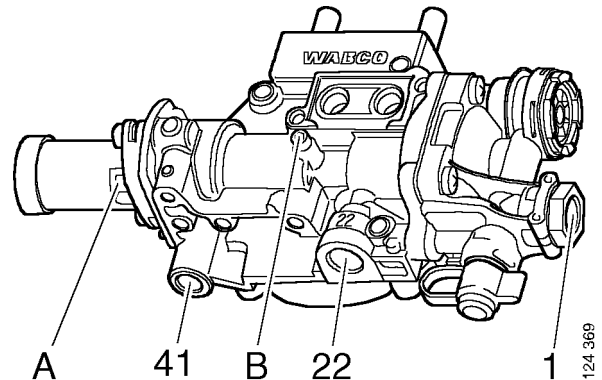
- 3 If the correct bellows pressure cannot be reached using the control box, load the vehicle.
- 4 Depress the brake pedal until the 15 bar manometer displays 6.0 bar. Read the output brake pressure P2 and compare it with the values specified below.

Maximum reduction

Pressure P2 should be checked against the diagram in the vehicle.

Brake pressure

Pressure P2 should be 1.6-1.9 bar.



- 1 *Operating air intake from service brake valve*
- 22 *Controlled operating air outlet*
- 41 *Bellows pressure intake*
- A *Brake pressure adjusting screw*
- B *Adjusting screw for maximum reduction*

For more information about checking, see section 10 “Testing the braking system”.

Adjusting load-sensing valve type 2 and type 3b

Note: Adjusting the brake pressure on load-sensing valve type 3b. The adjustment is carried out on Torx bolt 1 inside the pipe, under the cover. The nut fitted around the Torx bolt operates as a washer and cannot be used when carrying out the adjustment.

- 1 Carry out a check on the load-sensing valve.
- 2 If brake pressure does not match up, adjust the load-sensing valve.

Maximum reduction

Screw the maximum reduction adjusting screw 2 inwards two turns to increase brake pressure or outwards to reduce brake pressure.

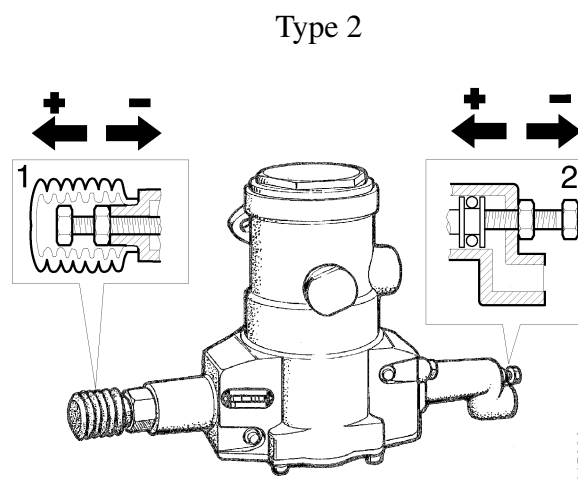
Brake pressure

Screw the adjusting screw 1 one turn inwards to reduce brake pressure or one turn outwards to increase brake pressure.

- 3 Repeat the check.

Checking after adjustment

If the pressure at the outlet cannot be adjusted, the load-sensing valve must be replaced.



- 1 Brake pressure adjustment
- 2 Adjusting maximum reduction

