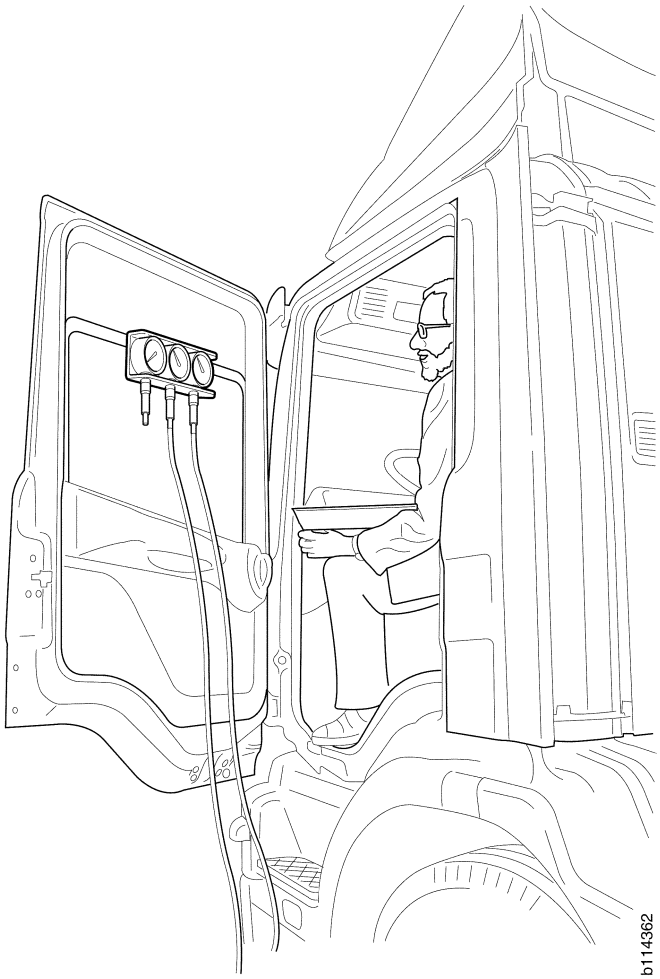
SCANIA

10:03-01

Issue 3 **en**

Testing brake system

Applies to vehicles <u>without</u> EBS



1 585 418

Contents

Brake testing

General Information

The test programme is intended for use during brake system troubleshooting and inspection. For the relevant test stages for the various levels of inspection, see main group 0, Inspection instructions.

The programme is structured so that the whole system can be tested by circuit or individual components.

The test programme assumes access to appropriate test equipment, see the "Equipment" section.

During the test, readings must be recorded in a report. See Testing the brake system, Report, Vehicles without EBS.

IMPORTANT! Before conducting the brake test, apply the brake heavily 5 - 10 times.

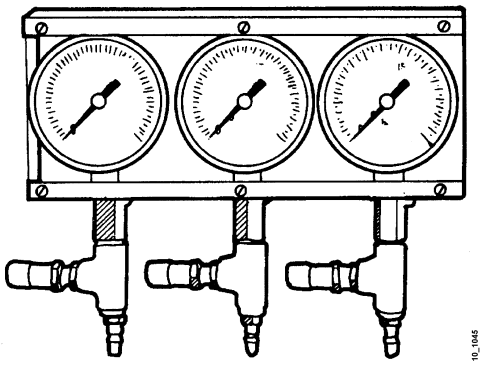
Make sure the pressure gauges being used are checked and calibrated.

Equipment

1 **Measuring panel 98 600**

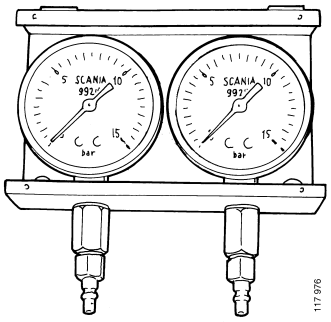
The panel comprises three pressure gauges 0-2.5 bar, permanently fixed in a metal casing.

A Plexiglas disk permanently screwed to the metal casing protects the pressure gauges from the front. The connection to each pressure gauge contains a damping device and a T-pipe equipped with a 3/8" insert nipple and a safety valve, part no. 293 542, set to 2.5 bar.



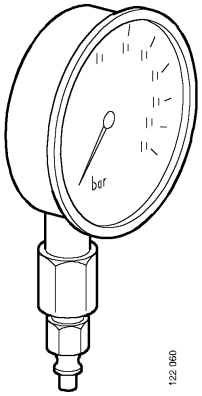
2 **Measuring panel 99 399**

Two built-in pressure gauges, 0-15 bar, without safety valve.



3 **Pressure gauge 99 215**

A loose pressure gauge 0-15 bar, without safety valve.



99 215

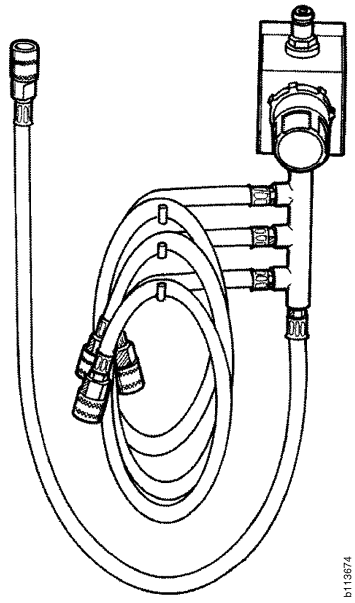
4 **Adapter 99 401**

99 401

122 374

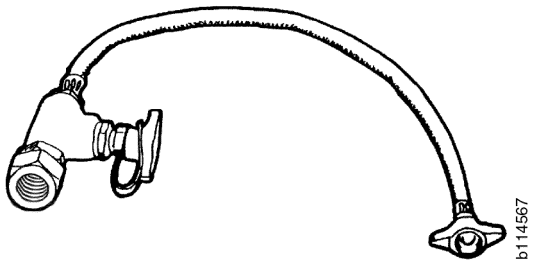
5 **Relief valve 98 703**

The relief valve is designed to control the other pressure gauges.



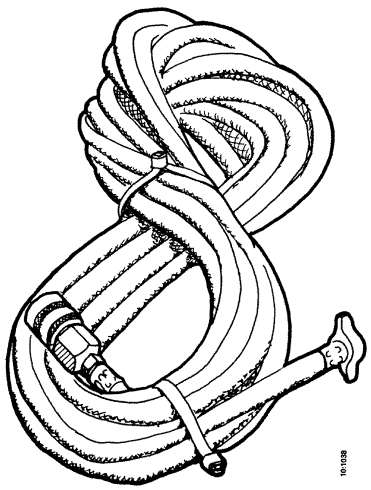
6 **Pressurising hose with connections, 98 243**

The hose is equipped with a cap nut at one end and a threaded adapter connection at the other. It also has a check valve and a test connection. The hose is used when charging the compressed air system of the vehicle with workshop air.



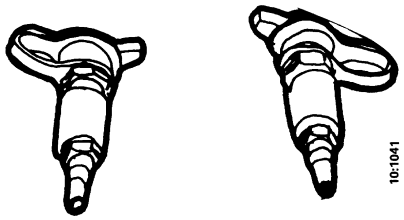
7 **Connecting hose 99 164**

Fabric-reinforced plastic hose with cap nut at one end and quick coupling at the other. The hoses are used to connect the pressure gauges to the test connections. The hoses may be spliced with connector 98 706, e.g. when testing trailer brakes.



8 **Connector for connecting hose 98 706**

The connectors are used to connect the connecting hoses, e.g. when testing trailer brakes.

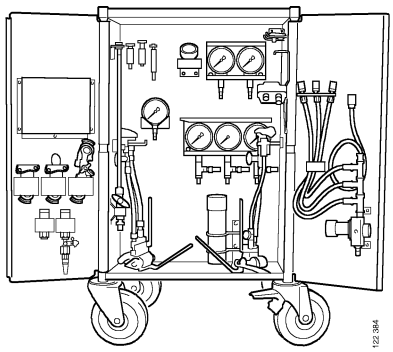


9 **In-house manufactured tools**

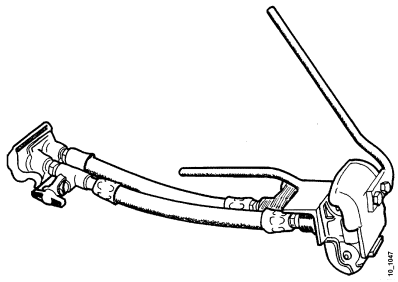
Duo-Matic, ISO and BSI kits can be ordered to brake testing trolley 588 477. See tool sheet 588 477 for component parts.

Due to the various designs of trailer brake couplings, hoses 98 605 are supplied without couplings. Connect the couplings as follows:

- **Duo-Matic coupling:**

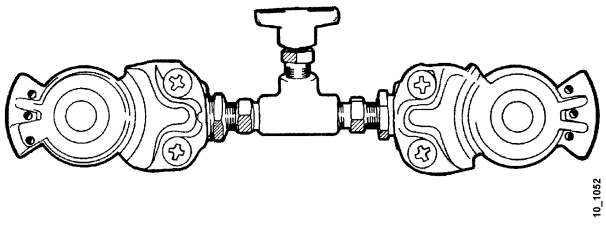


Drill out the rivets holding the plate on the cover using a 5 mm drill. Cut a thread using an M6 tap and attach the handle with an M6x12 mm bolt. Make two versions, one for trucks and one for tractors. Use handle 99 402 for trucks.



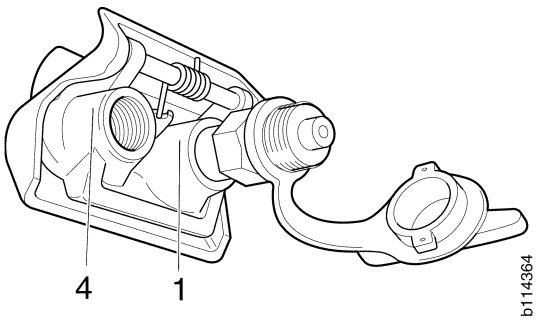
- **ISO coupling:**

Use a T-union WR 1/4" and test connection 215 619.



- **Duo-Matic coupling, trailer section**

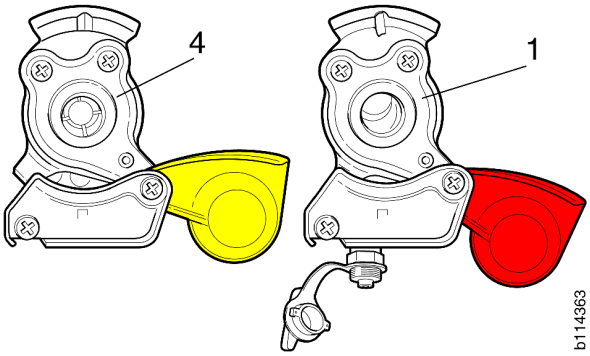
Equipped with a test connection in the feed line connection.



1 Feed line
4 Control line

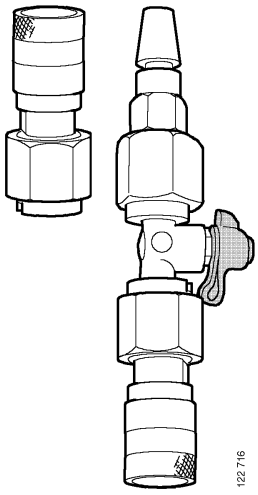
- **ISO coupling, trailer section**

Equipped with a test connection in the feed line connection.

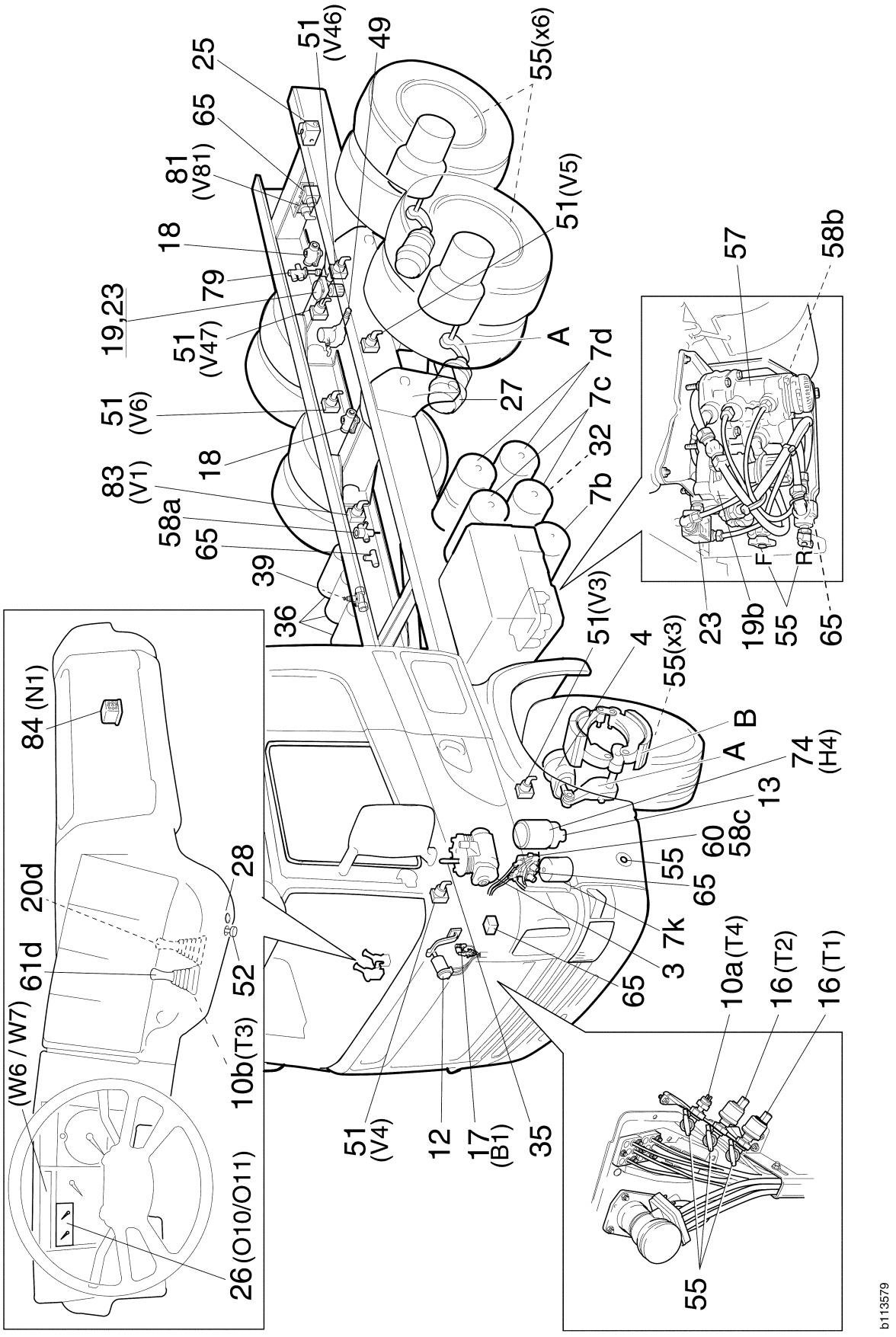


1 Supply cable (red)
4 Control cable (yellow)

- **BSI connection, trailer section**



Location of components



3 Compressor

4 Brake chamber

7b Air tank, parking brake and trailer brake circuit

7c Air tank, front circuit

7d Air tank, rear circuit

7k Air tank, air dryer

10a (T4) Low pressure indicator for supply pressure, parking brake circuit

10b (T3) Low pressure indicator for service pressure, parking brake circuit

12 Service brake valve

13 Safety valve (14.3 bar)

16 (T1) Pressure sensor with monitor, front circuit

16 (T2) Pressure sensor with monitor, rear circuit

17 (B1) Brake light switch

18 Quick release valve

19 Relay valve, rear circuit

19b Relay valve, parking brake circuit

20d Manual control valve, trailer brake circuit

23 Double check valve

25 Trailer brake coupling

26 (O10) Indicating instrument, front circuit pressure

26 (O11) Indicating instrument, rear circuit pressure

27 Spring brake chamber

28 Filler nipple, parking brake circuit

32 Drain valve

35 Safety valve (19 bar)

36 Air tanks, air suspension

39 Overflow valve

49 Load-sensing valve

51 (V3-6, V46-47) Control valve ABS

52 Interlock valve

55 Test connection / filler nipple

57 Trailer relay valve

58a Pressure limiting valve (6.5 bar for exhaust brake, 7.3 bar for others)

58b Pressure limiting valve (8 bar), parking brake and trailer brake circuit (7.3 bar for US-adapted brake systems)

58c Two-stage pressure limiting valve (9.3 bar) for 12.2 bar systems

60 Four-circuit protection valve

61d Manual control valve, parking brake circuit

65 Manifold fitting

74 (H4) Air dryer with integrated pressure regulator

79 Brake protection valve

81 V81) TC Solenoid valve

83 (V1) Exhaust brake solenoid valve

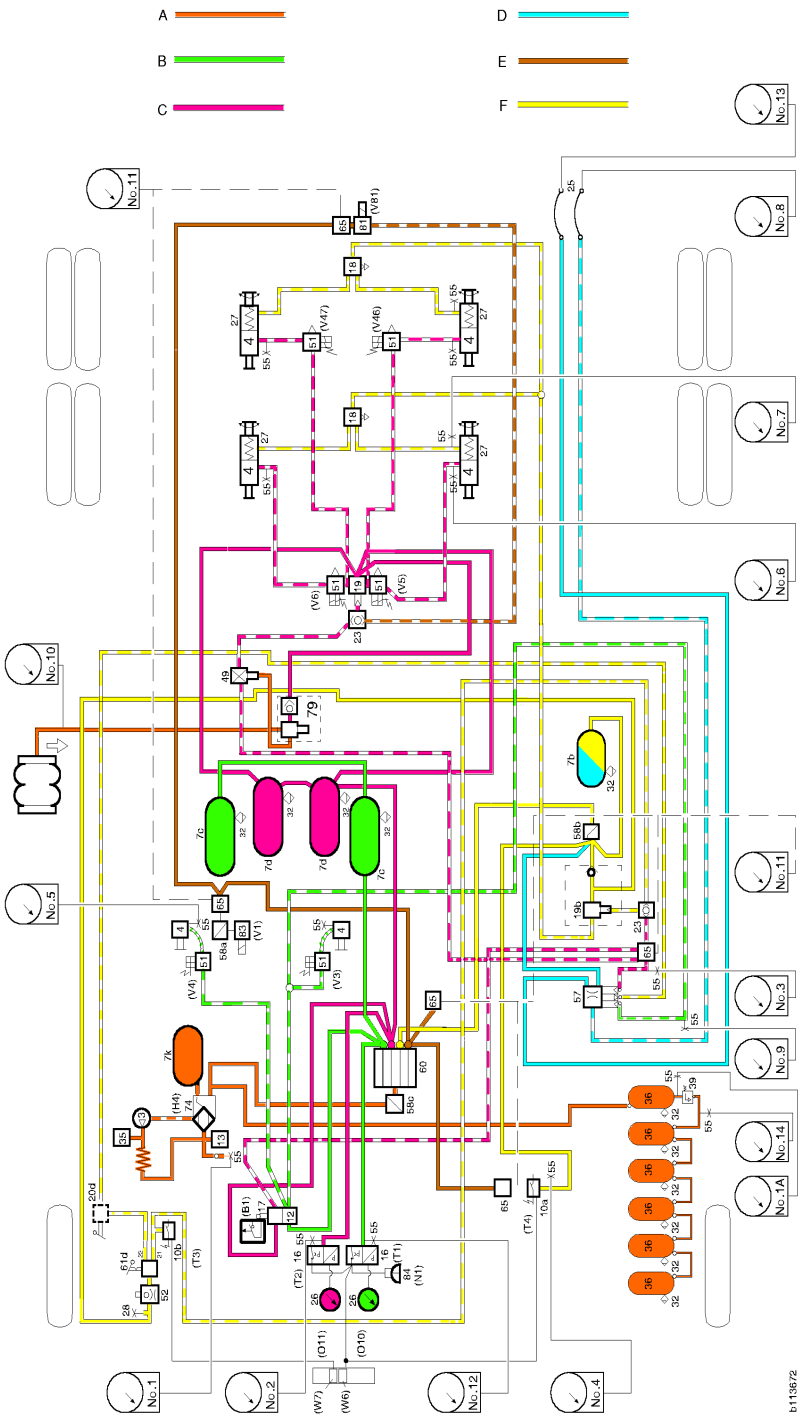
84 (N1) Buzzer

W6 Warning lamp, low circuit pressure

W7 Warning lamp, parking brake

Test connection

A colour-coded brake circuit diagram is available in the electronic version of this booklet as well as in main group 10, Testing brake system, Test connection.



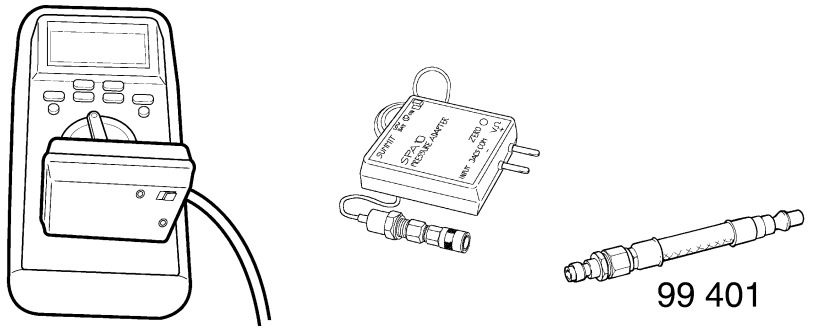
A Supply circuit
B Front circuit
C Rear circuit
D Trailer brake circuit
E Accessory circuit
F Parking brake circuit

Socket No.	Circuit of feature to be tested	Location
1	Charging with workshop air	In left-hand step
1A	Measuring supply circuit pressure (on vehicles with 12.2 bar system) **Must not be used for charging with workshop air**	On the air suspension air tank, in front of the overflow valve
2	Rear circuit, supply pressure	Adjacent to service brake valve
3	Rear circuit, service pressure	In centre valve assembly, bottom connection (R)
4	Parking and trailer brake circuit supply pressure	Adjacent to service brake valve
5	Front circuit, brake pressure	On right-hand front wheel brake chamber, on vehicles with ABS on both sides
6	Rear circuit, brake pressure	On the rear brake chambers
7	Parking brake, service pressure	On the rear spring brake chambers
8	Trailer brake, service pressure	For test connections connected to trailer brake coupling, see In-house manufactured tools
9	Front circuit service pressure	In centre valve assembly, top connection (F)
10	Rear circuit load-sensing valve bellows pressure	Beside solenoid valve block for air suspension
11	Four-circuit protection valve, accessory circuit	One of the outputs on coupling 65, select one of the couplings. **Note:** Fit a test connection on the appropriate coupling
12	Front circuit, supply pressure	Adjacent to service brake valve
13	Trailer brake, supply pressure	For test connections connected to trailer brake coupling, see In-house manufactured tools
14	Supply circuit, check valve in overflow valve 39	On the air suspension air tank, behind the overflow valve

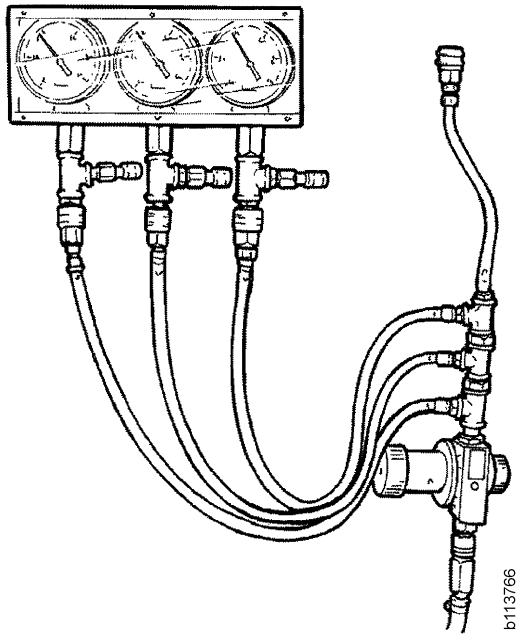
Checking pressure gauges

IMPORTANT! The pressure gauges must be used in a suspended position, in the same way as when they are set to zero.

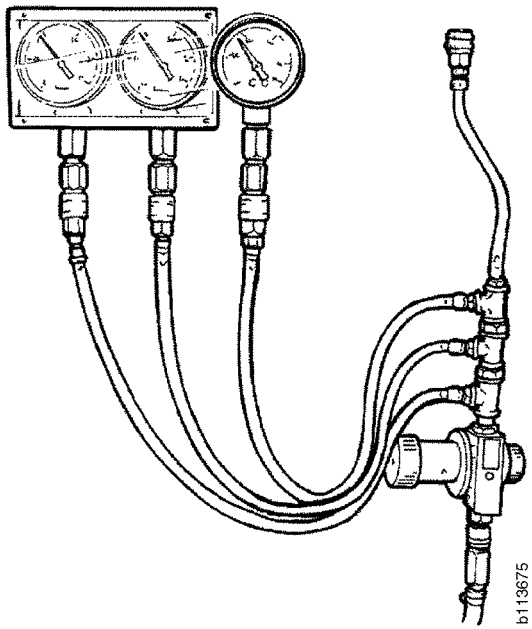
Note: Always check that the cables and connections in the circuits are airtight.



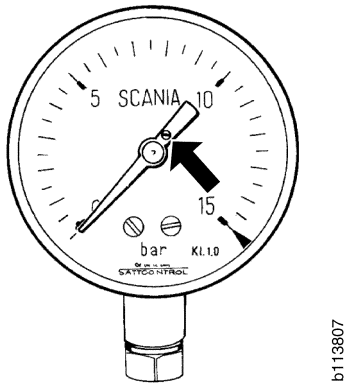
Multimeter with converter from measuring set 99 362 and adapter 99 401



Connection diagram for checking 2.5 bar pressure gauges



Connection diagram for checking 15 bar pressure gauges



Adjusting screw on pressure gauges

Equipment/Pressure gauges

2.5 bar	15 bar
3 off	3 off

Test measures	pressure gauge		Cause of fault / action
	2.5 bar	15 bar	
2.5 bar pressure gauges - Connect adapter 99 401 to the pressure reduction valve. - Connect the adapter to the converter. Then connect the converter to multimeter 588 093. - Set the multimeter to direct current voltage and turn on the converter. - Zero the multimeter by turning the converter set screw marked zero. - Zero the indicators on the pressure gauges. - Turn the knob anticlockwise until the relief valve is closed. - Connect the air hose from the workshop air system to the relief valve. - Connect the three hoses from the relief valve to each pressure gauge. - Turn the relief valve knob clockwise until the pressure gauges and the multimeter show approx. 1.0 bar. The voltage reading shown in the multimeter window corresponds to the pressure in bar. - Check that the pressure gauges show the same.	1.0		Check that the pressure gauge value agrees with the value on the multimeter with a tolerance of +/- 0.025 bar/V. If it does not, return the pressure gauge for calibration.

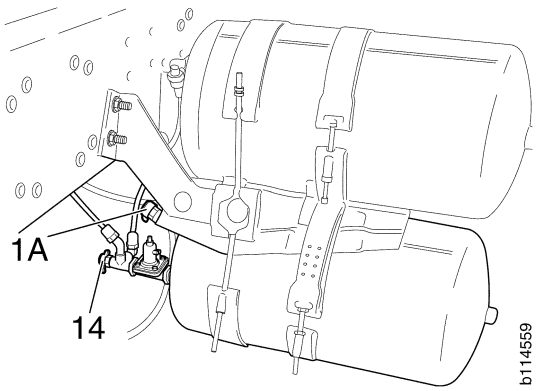
Test measures	pressure gauge		Cause of fault / action
	2.5 bar	15 bar	
- Raise the air pressure using the relief valve to 1.5 and 2.0 bar and check that the pressure gauges and the multimeter correspond.			
- Increase air pressure to 2.5 bar, at which point the safety valves should open.	2.5		The opening pressure is adjusted by turning the adjusting sleeves on the safety valves.
15 bar pressure gauges			
- Set the displays to zero.			
- Connect an air hose to each pressure gauge.			
- Turn the knob clockwise until the pressure gauges show 5 bar.		5.0	
- Check that the pressure gauges correspond.			Check that the pressure gauge value agrees with the value on the multimeter with a tolerance of +/- 0.1 bar/V. If it does not, return the pressure gauge for calibration.
- Raise the air pressure to 6 and 7 bar and check that the pressure gauges correspond.			

1. Testing operating pressure, seal integrity and check valve in overflow valve (39)

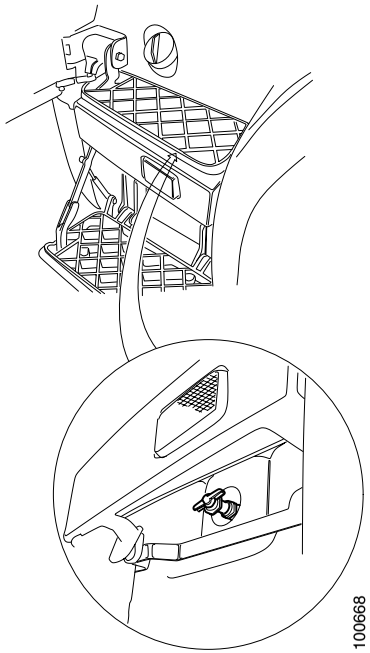
Note the reading in the report accompanying this booklet.

Equipment/Pressure gauges

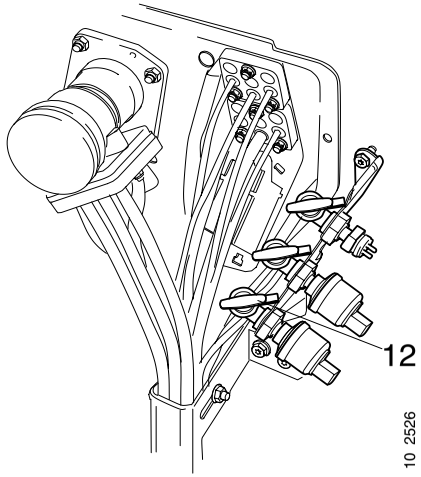
2.5 bar	15 bar
--	3 off



Test connection 1A and 14



Test connection 1



Test connection 12

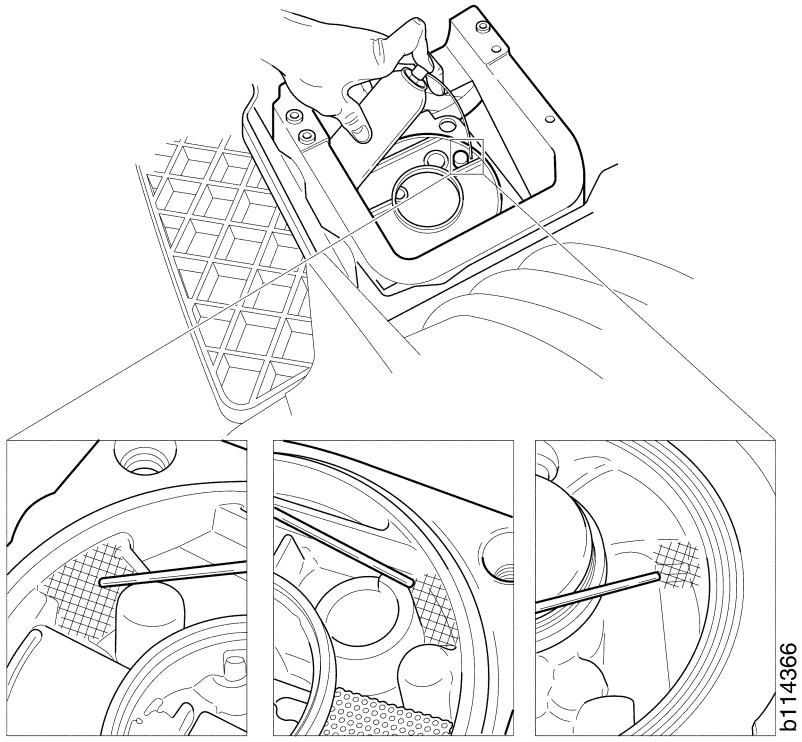
Test measure	Test connection (bar) 12	Test connection (bar) 1A	Cause of fault / action
Vehicles with load handling tanks			
- Connect 15 bar pressure gauge to test connections 12, 1 and 1A.			
- Start the engine and charge the system.			
- Check the relief pressure at test connection 1A by noting when the pressure at test connection 1 drops.			
- Check the pressure limiting valve (58c) at test connection 12.	9.1 - 9.5	12.0 - 12.4	
- Decrease the system pressure by draining the first load handling tank.			
- Note the pressure at test connection 1A when the compressor starts to charge. The compressor starts charging when the pressure rises at test connection 1. Calculate the pressure difference to obtain the operating range of the compressor.		10.4 - 11.5	
Checking the check valve in the overflow valve (39)			
- Move the pressure gauge from test connection 1A to test connection 14.			
- Drain the first load handling tank.			
- The pressure at test connection 14 must not drop.			If the pressure at test connection 14 drops, the overflow valve (39) must be replaced.
Vehicles without load handling tanks			
- Connect 15 bar pressure gauges to test connections 12 and 1.			
- Start the engine and charge the system.			
- Check the relief pressure at test connection 12 by noting when the pressure at test connection 1 drops.	9.1 - 9.5		
- Decrease the system pressure by repeatedly depressing the brake pedal.			
- Note the pressure at test connection 12 when the compressor starts to charge. The compressor starts charging when the pressure rises at test connection 1. Calculate the pressure difference to obtain the operating range of the compressor.	7.9 - 8.9		

Test measure	Test connection (bar)		Cause of fault / action
	12	1A	
Seal integrity - Fill the system to operating pressure. - Fully depress the brake pedal. Wait 30 seconds. Read and record the pressure. - Keep the pedal depressed a further 1 minute. - Read and record the pressure.	< 0.2 bar drop		If pressure drop is greater, the leak must be repaired before continuing the test.

2. Checking anti-freeze unit

WARNING!

Release the air from the system before removing the desiccant container



Haldex design 1 Haldex design 2 Wabco

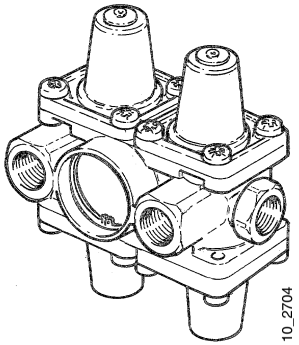
Air dryer	Resistance
Haldex and Wabco	5.0 - 7.5 ohm at temp < + 7 °C

Test measure	Cause of fault / action
Air dryer - Note the function check in the brake test report. - Check that the drain valve in the bottom of the dryer does not leak when the compressor is charging.	When the compressor is relieving load, the drain valve should open. The air in the dryer should then be evacuated. Evacuation takes up to 40 seconds.
Checking the heater element - Start the engine and check whether there is a supply voltage in the connector to the air dryer heater element, 24 - 28.8 volts	
Air dryer temperature below +7 ° - Start the engine and feel to see if the underside of the dryer heats up within a minute. The temperature should rise to 20 °C, which is the switch-off temperature of the thermostat.	Rectify the air dryer if it is not operating in accordance with the test stages, see main group 10 in the Service Manual, Supply circuit components.
Air dryer temperature above +7 ° - Remove the P2/H contact in the central electric unit. - Connect a multimeter set for measuring resistance between ground and the green wire marked 61C on pin 12 in the H contact. - Place the multimeter on top of the instrument panel with its display window facing the windscreen. - Tilt the cab or drop down the bonnet. Remove the cover over the air dryer. - Remove the desiccant container. - Cool down the air dryer as illustrated using e.g. cooling spray until it is below + 7 °C, which is the opening temperature of the thermostat. Spray at intervals to allow time for the cold to propagate through the material. - Measure the resistance at the contact.	

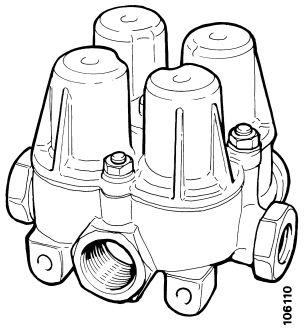
3a. Testing four-circuit protection valve type 1 and type 3

Equipment/Pressure gauges

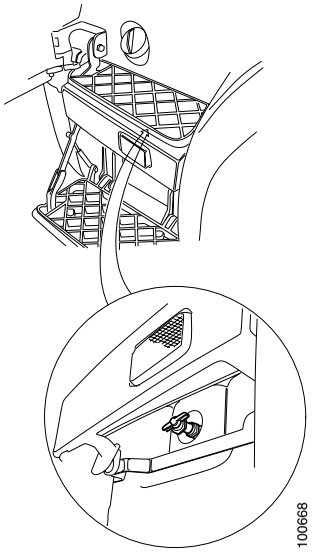
2.5 bar	15 bar
--	3 off



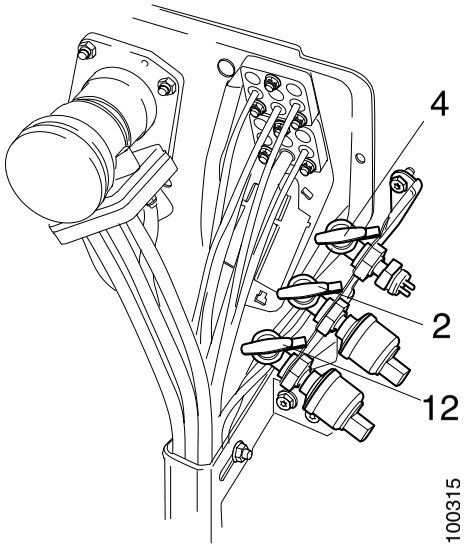
Type 1 Wabco



Type 3 Knorr



Test connection 1



Test connections 2, 4 and 12

Test measure	Test connection (bar)					Cause of fault / action
	1	2	4	11	12	
Checking the opening pressure The only circuit that needs to be tested is the parking brake circuit, since legal provisions state that it must not be charged before the service brake circuits have reached emergency brake pressure. - Evacuate the system. - Connect 15 bar pressure gauges to test connection 2. 4 and 12. - Charge the system and check that the pressure in the front and rear circuit is at least 5 bar before the parking brake circuit clearly opens.		> 5.0			> 5.0	If the value is incorrect, replace the valve.
Checking closing pressure **Front circuit and rear circuit** - Charge the system to at least 7.5 bar and make sure the compressor is in charging mode. - Connect 15 bar pressure gauges to the rear circuit test connection 2, the front circuit test connection 12 and test connection, filler nipple 1. - Drain the accessory circuit. - Check that the pressure in the rear circuit and the front circuit is not below 4 bar. and the test connection, filler nipple drops to zero.	0.0	> 4.0			> 4.0	If the value is incorrect, replace the valve.

Test measure	Test connection (bar)					Cause of fault / action
	1	2	4	11	12	
Parking brake circuit and accessory circuit - Charge the system to at least 7.5 bar and make sure the compressor is in charging mode. - Connect 15 bar pressure gauges to the parking brake circuit test connection 4, the accessory circuit test connection 11 and test connection, filler nipple 1. - Drain the rear circuit by fitting a pressurising hose to test connection 2. - Check that the pressure in the parking brake circuit and the accessory circuit is not below 4 bar. and the test connection, filler nipple drops to zero. The pressure in the parking brake circuit will continue to drop because it does not have a check valve.	0.0		> 4.0	> 4.0		If the value is incorrect, replace the valve.

3b. Testing four-circuit protection valve type 2, 4 and 5

Equipment/Pressure gauges

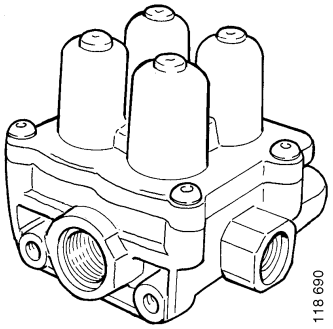
2.5 bar	15 bar
--	3 off

Types 2, 4 and 5 are similar. The difference between them is that there is a bypass function in types 4 and 5 that drains the parking brake circuit if the rear circuit is empty. Type 5 has increased opening pressure and is found on T-vehicles with disc brakes.

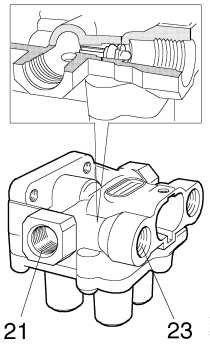
Type 4 is present as from chassis number:

Scania Södertälje 1 261 040
Scania Nederland
Scania Angers

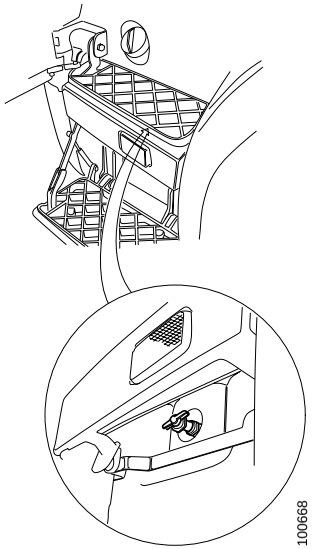
Type 5 is present from 2001-09, T-vehicles with disc brakes.



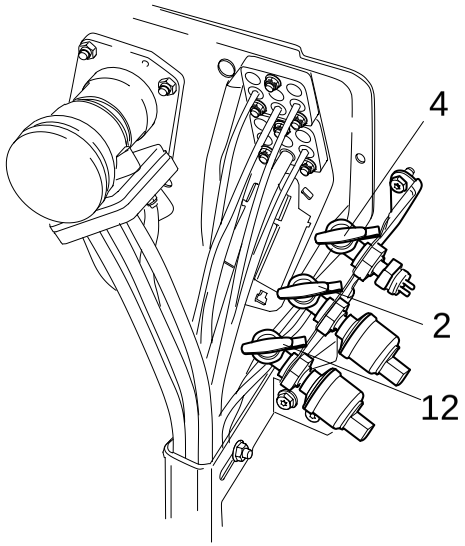
Types 2, 4, 5 Wabco



Types 4 and 5 Wabco



Test connection 1



Test connections 2, 4 and 12

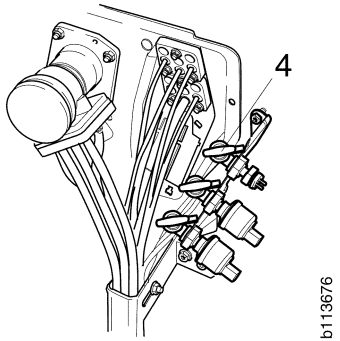
Test measure	Test connection (bar)					Cause of fault / action
	1	2	4	11	12	
Checking the opening pressure						
The only circuit that needs to be tested is the parking brake circuit, since legal provisions state that it must not be charged before the service brake circuits have reached emergency brake pressure.						
- Evacuate the system.						
- Connect 15 bar pressure gauges to test connections 2, 4 and 12.						
- Charge the system and check that the pressure in the front and rear circuit is at least 5 bars before the parking brake circuit clearly opens.		> 5.0			> 5.0	If the value is incorrect, replace the valve.
Checking closing pressure						
Front circuit						
- Connect a 15 bar pressure gauge to the test connection, filler nipple 1.						
- Charge the system to at least 8.5 bar and make sure the compressor is in charging mode. Drain the front circuit and read off the pressure gauge.	> 4.0					If the value is incorrect, replace the valve.
Rear circuit						
- Charge the system to at least 8.5 bar and make sure the compressor is in charging mode. Drain the rear circuit and read off the pressure gauge.	> 4.0					If the value is incorrect, replace the valve.
Parking brake circuit						
- Charge the system to at least 8.5 bar and make sure the compressor is in charging mode. Drain the parking brake circuit and read off the pressure gauge.	> 4.0					If the value is incorrect, replace the valve.
Accessory circuit						
- Charge the system to at least 8.5 bar and make sure the compressor is in charging mode. Drain the accessory circuit and read off the pressure gauge.	> 4.0					If the value is incorrect, replace the valve.

Test measure	Test connection (bar)					Cause of fault / action
	1	2	4	11	12	
Bypass function, types 4 and 5 only. - Apply the parking brake. - Charge system to relief pressure. - Connect 15 bar pressure gauges to parking brake circuit test connection 4 and rear circuit test connection 2. - Drain the rear circuit. - Check that the pressure in the parking brake circuit does not exceed the specified value and that the rear circuit drops to 0.		0.0	< 5.0			If the value is incorrect, replace the valve.

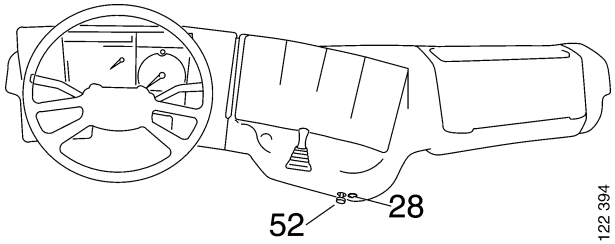
4. Testing parking brake / emergency brake and function of pressure limiting valve (58b) and relay check valve

Equipment/Pressure gauges

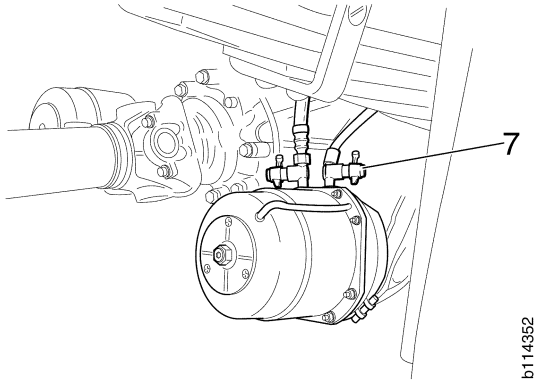
2.5 bar	15 bar
--	3 off



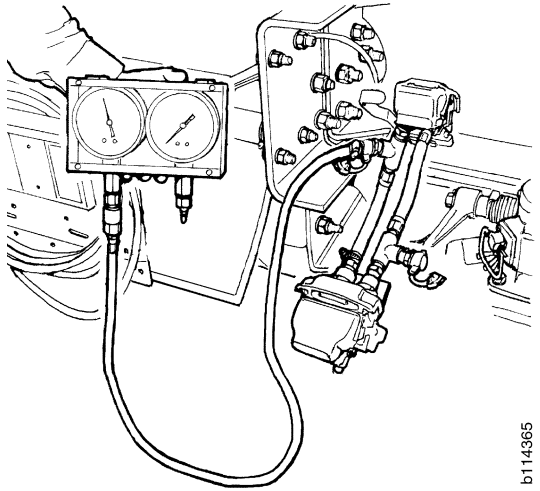
Test connection 4



Filler nipple 28
Interlock valve 52



Test connection 7



Test connection 8

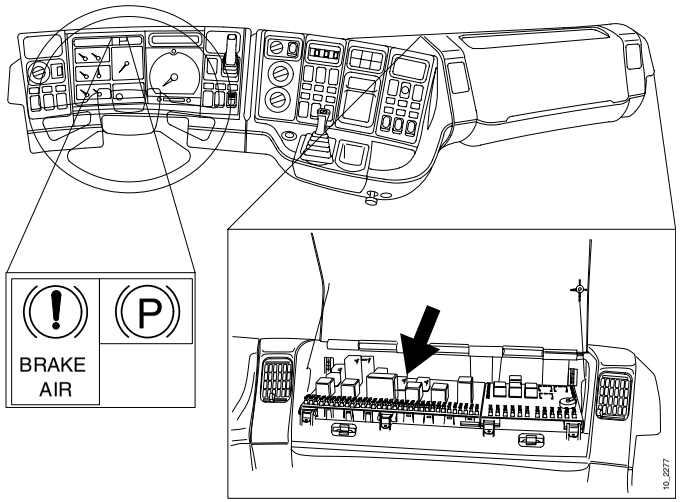
Test measure	Test connection (bar)			Cause of fault / action
	7	8	4	
Pressure limiting valve (58B)				
- Charge the system. Close the air supply.				
- Read the pressure gauge at test connection 4.			7.7 - 8.3 (7.0 - 7.6)	Incorrectly adjusted pressure limiting valve.
Parking brake-emergency brake				
- Place chocks in front of and behind at least two wheels.				
- Connect 15 bar pressure gauges to test connections 4, 7 and 8. If the vehicle does not have a trailer relay valve (57), only one pressure gauge should be connected to test connection 7.				
- Charge system to relief pressure. Close the air supply.				
1 Parking brake in **drive position**. (The values in brackets only apply to vehicles with US-adapted brake systems.)	7.4 - 8.2 (6.7 - 7.5)	0.0		Test connection 7: Incorrectly adjusted pressure limiting valve (58b) or faulty parking brake valve (61d).
2 Lever to **full emergency brake position**.	0.0	6.6 - 7.6 (6.0 - 7.0)		Test connection 8: Incorrectly adjusted pressure limiting valve (58b) or faulty parking brake valve (61d) or trailer relay valve (57).
3 Lever in **parking position**. (Valve without check position)	0.0	0.0		
Lever to **parking position**. (Valve with check position)	0.0	6.6 - 7.6		
4 Lever to **test position.**	0.0	0.0		

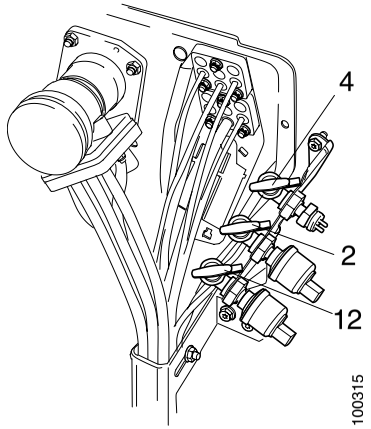
Test measure	Test connection (bar)			Cause of fault / action
	7	8	4	
Check valve in relay valve for parking brake - Apply the parking brake. - Place chocks in front of and behind at least two wheels. - Evacuate air from the parking brake circuit via test connection 4. - Put the parking brake in drive position. - Connect 15 bar pressure gauges to test connections 4 and 7. - Press in the interlock valve 52 if fitted and charge the parking brake circuit to 6-8 bar via filler nipple 28. - Read the pressure gauge at test connection 7. **The pressure must not drop more than 1 bar in 1 minute.**	6.0 - 8.0		0.0	Pressure rise at test connection 4 indicates defective check valve in parking brake relay valve. A large pressure drop at test connection 7 indicates a leak in the control circuit or brake chambers.

5. Checking warning lamps and sensors

Equipment/Pressure gauges

2.5 bar	15 bar
--	1 off





Test connections 2, 4 and 12

Test measures	Test connection (bar)			Cause of fault / action
	12	2	4	
Front circuit - Charge the system with air. - Check that the displays in the cab show full system pressure. - Connect the pressure gauge to test connection 12. - Disconnect the sensors from test connections 2 and 4. - Drain the front circuit tank (7c) until the warning lamp comes on and the buzzer sounds. - Check that the display in the cab shows the correct pressure.	4.5 - 5.5			Fault in the sensor, lamp or buzzer.

Test measures	Test connection (bar)			Cause of fault / action
	12	2	4	
Rear circuit				
- Charge the system with air.				
- Connect the pressure gauge to test connection 2.				
- Disconnect the sensors from test connections 4 and 12.				
- Drain the rear circuit tank (7d) until the warning lamp comes on and the buzzer sounds.		4.5 - 5.5		Fault in the sensor, lamp or buzzer.
- Check that the display in the cab shows the correct pressure.				
Parking brake circuit (feed)				
- Charge the system with air.				
- Connect the pressure gauge to test connection 4.				
- Disconnect the sensors from test connections 2 and 12.				
- Drain the parking tank (7b) until the warning lamp comes on and the buzzer sounds.			4.5 - 5.5	Fault in the sensor, lamp or buzzer.
Parking brake circuit (control)				
- Charge the system.				
- Apply the parking brake.				
- Check that the parking brake lamp comes on.				Fault in the sensor or lamp.

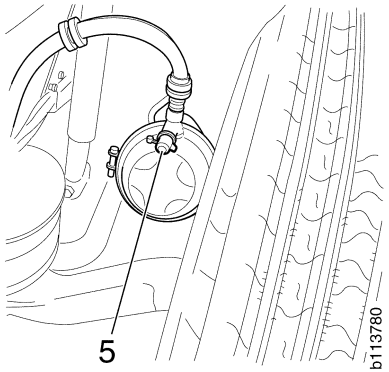
6. Testing front and rear brake circuit

Note: When measuring **increasing pressure** you may only **depress the brake pedal or keep it still**. If the brake pedal is released when measuring increasing pressure, the test result will be incorrect.

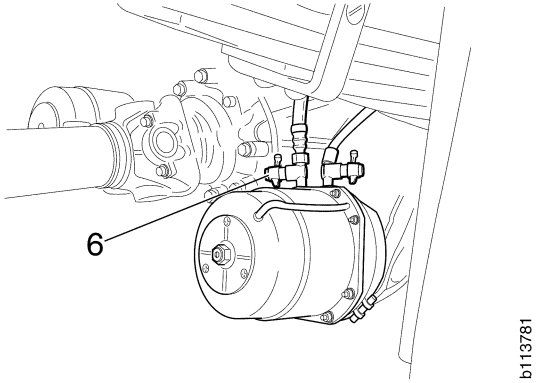
When measuring **falling pressure** you may **only release the brake pedal or keep it still**. If the brake pedal is depressed when measuring falling pressure, the test result will be incorrect.

Equipment/Pressure gauges

2.5 bar	15 bar
2 off	--



Test connection 5



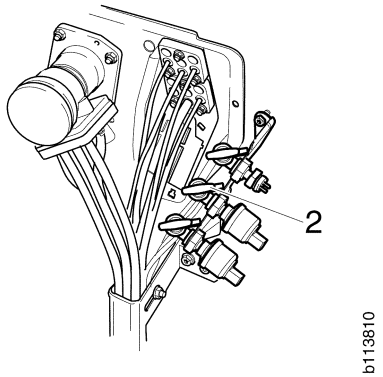
Test connection 6

Test measure	Test connection (bar)		Cause of fault / action
	5	6	
- Connect the pressure gauges to test connections 5 and 6. If the vehicle has a rear load-sensing valve, it must be set to fully open. On vehicles with leaf suspension this is done by releasing the springs on the load-sensing valve. On vehicles with air suspension, the rear air suspension is evacuated.			
- Measure the difference between the front and rear circuits. Note this down.	Maximum permitted deviation between front and rear circuits is 0.3 bar.		If the value is incorrect, check the brake protection valve (79). If pressure rises or drops in steps, one or more of the valves could soon cause problems.

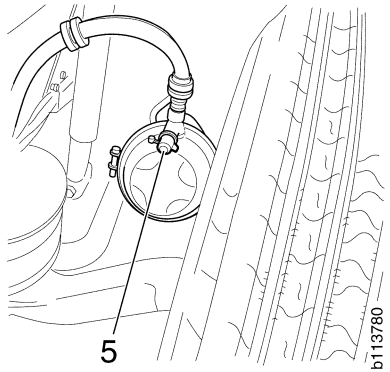
7. Testing maximum service pressure

Equipment/Pressure gauges

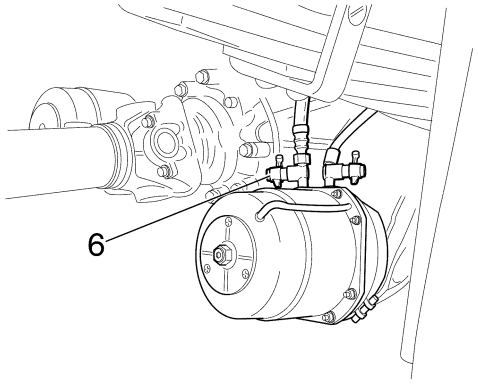
2.5 bar	15 bar
--	3 off



Test connection 2

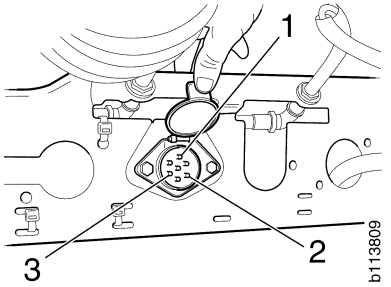


Test connection 5



Test connection 6

Applies to tractors with front circuit pressure limitation



1 Earth
2 Left indicator
3 Right indicator

Test measure	Test connection (bar)		Cause of fault / action
	5	6	
- Connect the pressure gauges to test connections 5 and 6 for the front and rear circuits and test connection 2. If the vehicle has a rear load-sensing valve, it must be set to fully open. On vehicles with leaf suspension this is done by releasing the springs on the load-sensing valve. On vehicles with air suspension, the rear air suspension is evacuated. **Note:** If the vehicle has brake reduction in the front circuit, disconnect the reduction. Do this by connecting the trailer to the tractor.			Tip! With a trailer connected to the vehicle, it means that the electrical connection between the vehicle and trailer is connected or that a 21 W lamp is connected to the right-hand or left-hand indicator circuits on the trailer.
- Place chocks in front of and behind at least two wheels. - Release the parking brake. - Start the engine and charge the system to relief pressure. - Fully depress the brake pedal.			
- Read the pressure gauges. Note this down. The recorded pressure must not deviate more than 1 bar from the supply pressure at test connection 2. - Note the values for the front and rear circuits (test connections 5 and 6). The difference between the circuits must be no more than 0.5 bar.			If the service pressure deviates more than 1 bar, the load-sensing valve, relay valve, service brake valve and brake protection valve must be checked.

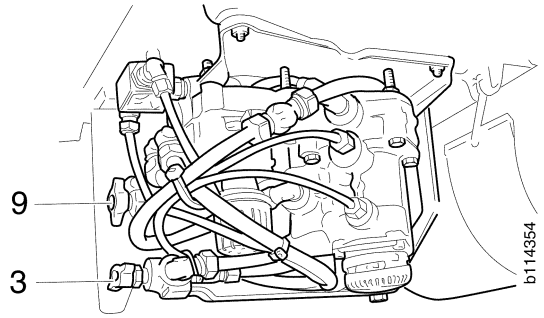
8. Testing service brake valve

Note: When measuring **increasing pressure** you may **only depress the brake pedal or keep it still**. If the brake pedal is released when measuring increasing pressure, the test result will be incorrect.

When measuring **falling pressure** you may **only release the brake pedal or keep it still**. If the brake pedal is depressed when measuring falling pressure, the test result will be incorrect.

Equipment/Pressure gauges

2.5 bar	15 bar
2 off	--



Test connections 3 and 9

Test measure	Test connection (bar) 3	9	Cause of fault / action
- Connect the pressure gauges to test connections 3 and 9. - Brake in 5 steps according to point 6 on the report. - Measure the difference between the front and rear circuits. Make a note in the report.	See the readings in Testing the brake system, Report, main group 10.		If pressure rises or drops in steps, the service brake valve is sticking and could soon cause problems.

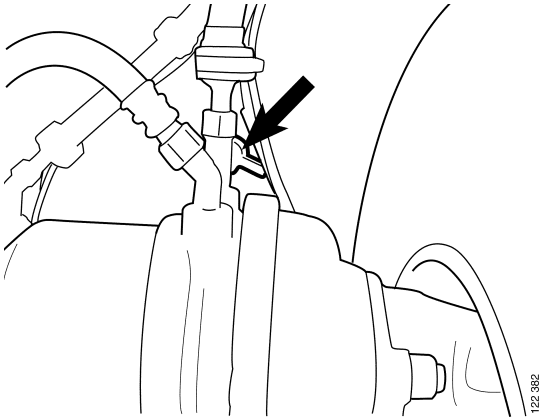
9a. Testing brake starting pressure, disc brake

Specifications

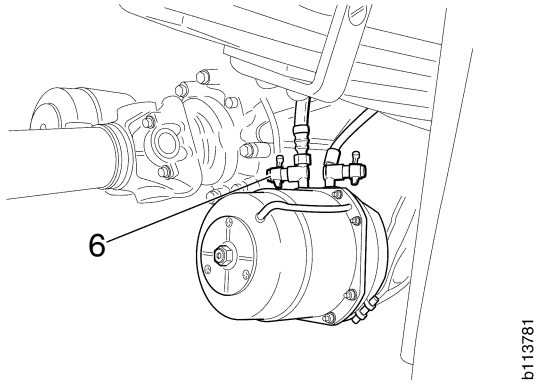
Brake starting pressure	
Brake starting pressure	0.3 -0.5 bar
Maximum difference right-left per axle	0.2 bar

Equipment/Pressure gauges

2.5 bar	15 bar
1 off	--



Test connection 5



Test connection 6

Test measure	Test connection (bar)		Cause of fault / action
	5	6	
- Connect the pressure gauge to the test connections, 5 on the front axle and 6 on the rear axle. - Jack up the vehicle so that the wheel to be measured spins freely. - Rotate the wheel. - Ask a colleague to slowly depress the brake pedal. - Read the manometer when the brakes begin to apply. - Measure on all wheels.	0.3 - 0.5	0.3 - 0.5	Note the readings in the brake test report, point 9. The maximum brake starting pressure must lie between 0.3 - 0.5 bar, regardless of chamber size. Rectify the brakes if the starting pressure or the difference between the axles is higher than specification, as this indicates binding brake calipers. See main group 10 in the Service Manual, Disc Brakes.

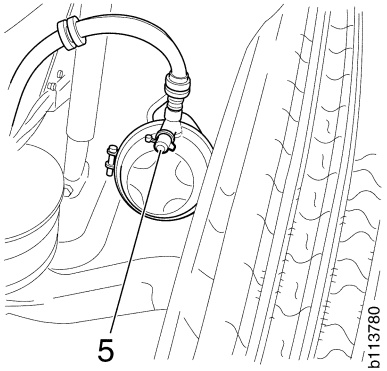
9b. Testing brake starting pressure, drum brake

Specifications

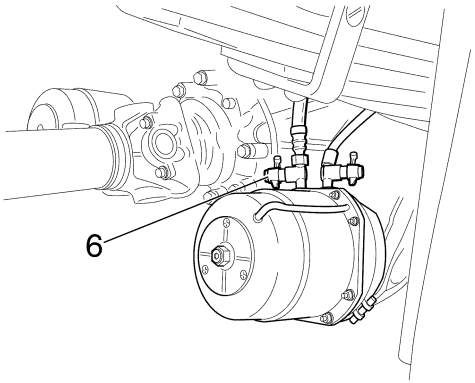
Brake starting pressure	
Brake starting pressure, with vibration damper	0.4 - 0.6 bar
Brake starting pressure, without vibration damper	0.2 - 0.4 bar
Maximum difference right-left per axle	0.2 bar

Equipment/Pressure gauges

2.5 bar	15 bar
1 off	--



Test connection 5



Test connection 6

Test measure	Test connection (bar)		Cause of fault / action
	5	6	
- Connect the pressure gauge to the test connections, 5 on the front axle and 6 on the rear axle. - Jack up the vehicle so that the wheel to be measured spins freely. - Rotate the wheel. - Ask a colleague to slowly depress the brake pedal. - Read the manometer when the brakes begin to apply. With vibration damper, regardless of chamber size. Without vibration damper, regardless of chamber size. - Measure on all wheels.	0.4 - 0.6 0.2 - 0.4	0.4 - 0.6 0.2 - 0.4	Note the readings in the brake test report, point 9. Rectify the brakes if the starting pressure or the difference between the axles is higher than specification. See main group 10 in the Service Manual, Wheel brake components for drum brakes.

10. Testing rear circuit relay valve

Test stage 10a, see Testing the brake system, Report in main group 10, applies to vehicles with relay valve 0.2 bar opening pressure.

Test stage 10b, see Testing the brake system, Report in main group 10, applies to vehicles with relay valve 0.4 bar opening pressure.

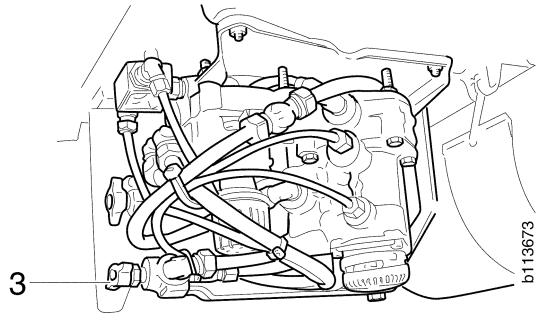
Vehicles with double front axles, US-adapted brake systems or 4x2s, 6x4s without load-sensing valve and with 8" rear brake drums have relay valves with 0.42 bar opening pressure. For more information and introduction times, see main group 10 Front and rear circuit components.

Note: When measuring **increasing pressure** you may **only depress the brake pedal or keep it still**. If the brake pedal is released when measuring increasing pressure, the test result will be incorrect.

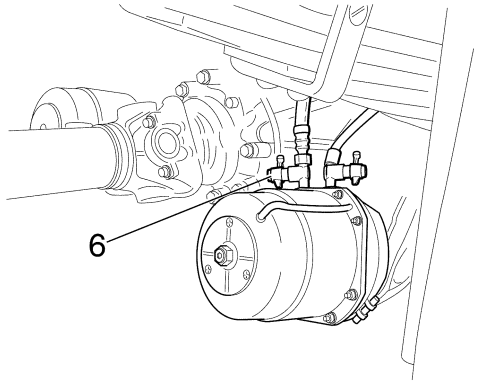
When measuring **falling pressure** you may **only release the brake pedal or keep it still**. If the brake pedal is depressed when measuring falling pressure, the test result will be incorrect.

Equipment/Pressure gauges

2.5 bar	15 bar
2 off	--



Test connection 3



Test connection 6

Test measure	Test connection (bar)		Cause of fault / action
	3	6	
- Connect the pressure gauges to test connections 3 and 6. If the vehicle has a rear load-sensing valve, it must be set to fully open. On vehicles with leaf suspension this is done by releasing the springs on the load-sensing valve. On vehicles with air suspension, the rear air suspension is evacuated.			
- Measure the difference between the pressure in front of and behind the relay valve.	See the readings in Testing the brake system, Report, main group 10.		If the values are incorrect, check the brake protection valve (79). If pressure at test connection 6 rises or drops in steps, the relay valve may soon cause problems.

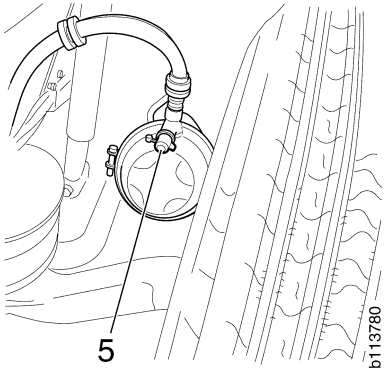
11. Testing front circuit relay valve

Note: When measuring **increasing pressure** you may **only depress the brake pedal or keep it still**. If the brake pedal is released when measuring increasing pressure, the test result will be incorrect.

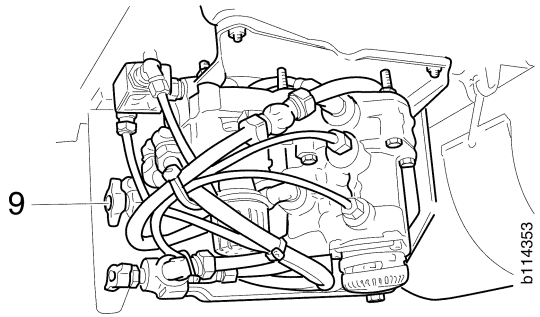
When measuring **falling pressure** you may **only release the brake pedal or keep it still**. If the brake pedal is depressed when measuring falling pressure, the test result will be incorrect.

Equipment/Pressure gauges

2.5 bar	15 bar
2 off	--



Test connection 5



Test connection 9

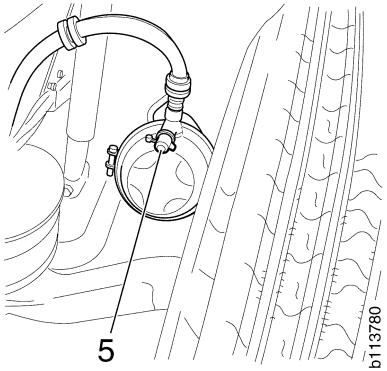
Test measure	Test connection (bar)		Cause of fault / action
	5	9	
- Connect the pressure gauges to test connections 5 and 9. - Measure the difference between the pressure before and after the relay valve (19c).	See the readings in Testing the brake system, Report, main group 10.		If pressure at test connection 5 rises or drops in steps, the relay valve (19c) may soon cause problems.

12. Testing front circuit pressure limitation

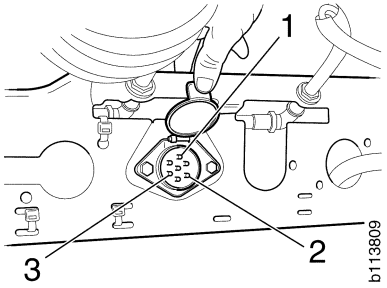
This test stage is only used for short tractors P/R 4x2 and 4x4 with axle distance 3.7 m and shorter, from chassis number SS1240180 and SN4393275 onwards, which have pressure limiting valve 66a in the front circuit. The pressure limiting valve reduces the brake pressure in the front circuit when driving without a trailer. For more information see main group 10 in the Workshop manual, Reducing brake pressure in the front circuit.

Equipment/Pressure gauges

2.5 bar	15 bar
--	1 off



Test connection 5



1 Earth
2 Left indicator
3 Right indicator

Test measure	Test connection (bar) 5	Cause of fault / action
- Connect the pressure gauge to test connection 5. - Charge system to relief pressure. Without trailer connected to the vehicle - Fully depress brake pedal. - Read pressure gauge at test connection 5.		
Vehicle with 20" front brake chamber.	5.8 - 6.2	If the pressure gauge at test connection 5 shows 8.0 - 9.0 bar, pressure is not limited. The valve does not activate. Check the valve and wiring.
Vehicle with 24" or 30" front brake chamber.	4.8 - 5.2	If the values deviate from the default value, adjust the pressure limiting valve.
With trailer connected to vehicle - Fully depress brake pedal. - Read pressure gauge at test connection 5. - Test both right-hand and left-hand indicator circuits.	8.0 - 9.0	**Tip!** With a trailer connected to the vehicle, it means that the electrical connection between the vehicle and trailer is connected or that a 21 W lamp is connected to the right-hand or left-hand indicator circuits on the trailer.

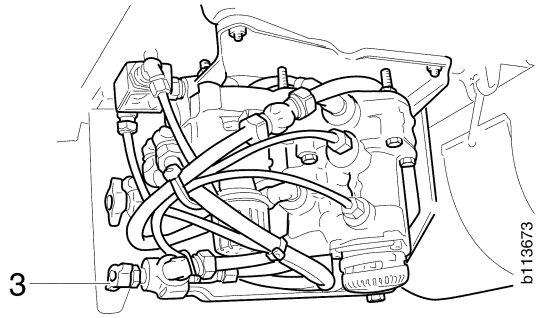
13. Testing trailer relay valve

Note: When measuring **increasing pressure** you may **only depress the brake pedal or keep it still**. If the brake pedal is released when measuring increasing pressure, the test result will be incorrect.

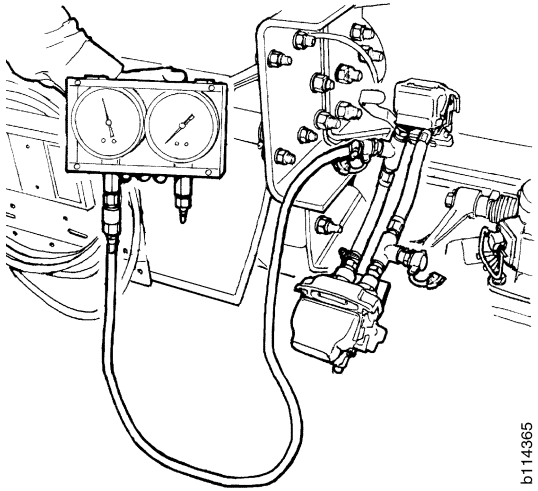
When measuring **falling pressure** you may **only release the brake pedal or keep it still**. If the brake pedal is depressed when measuring falling pressure, the test result will be incorrect.

Equipment/Pressure gauges

2.5 bar	15 bar
2 off	--



Test connection 3



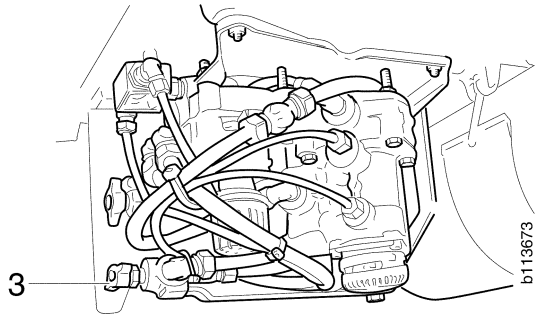
Test connection 8

Test measure	Test connection (bar)		Cause of fault / action
	3	8	
- Connect the pressure gauges to test connections 3 and 8. - Brake in 5 steps according to point 13 on the report. Measure the deviation between test connections 3 and 8. Make a note in the report.	See the readings in Testing the brake system, Report, main group 10.		The pressure level set at the factory at 0.3 bar should normally not be changed. For more information on settings, see main group 10 Trailer brake circuits, Components. If pressure at test connection 8 rises or drops in steps, the trailer relay valve may soon cause problems.

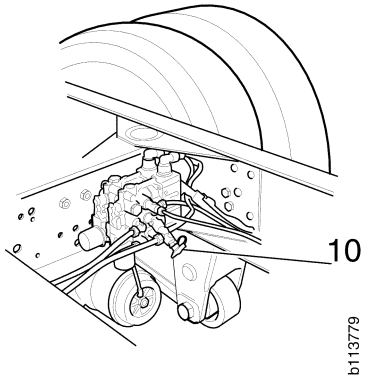
14a. Testing rear circuit load-sensing valve, air suspension

Equipment/Pressure gauges

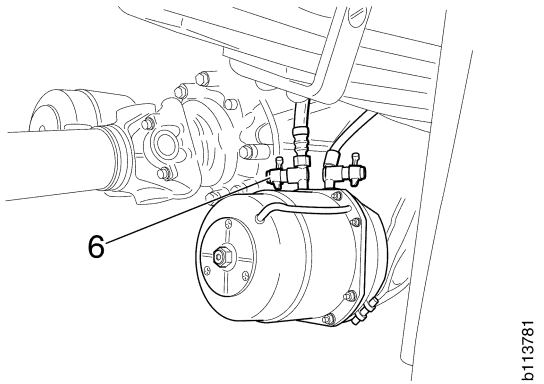
2.5 bar	15 bar
2 off	2 off



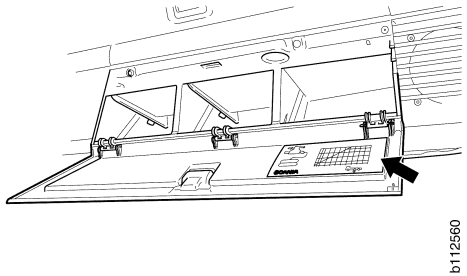
Test connection 3



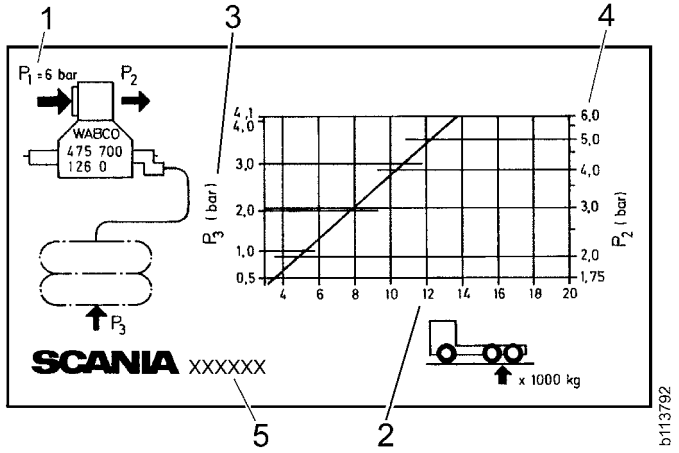
Test connection 10



Test connection 6



Location of alignment chart for load-sensing valve



Example of alignment chart

1 *P1 Incoming pressure must be 6.0 bar.*

2 *Rear axle or bogie load x 1000 kg.*

3 *Air pressure in rear bellows P3.*

4 *Outlet pressure P2.*

5 *Alignment chart part number.*

Outgoing pressure P2 can be read at a particular rear axle/ bogie load 2 and an air pressure value in the rear bellows P3.

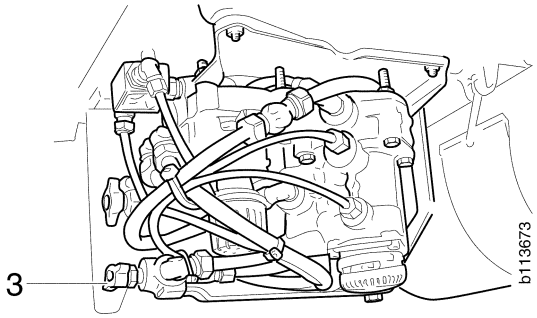
The alignment chart for the load-sensing valve is located on the inside of the door to the compartment above the passenger seat.

Test measure	Test connection (bar)			Cause of fault / action
	3	6	10	
Checking maximum reduction				
- Connect 2.5 bar pressure gauges to test connections 6 and 10, and a 15 bar pressure gauge to test connection 3.				
- Enter the following bellow pressure via the control box. If the bellows pressure increases, disconnect the pressure gauge.				If the bellows pressure cannot be reached in this way, disconnect the link arm to the levelling valve arm and block the arm in drive position during the test.
1.0 bar for 4x2s, 4x4s			1.0	
0.5 bar for others			0.5	
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0			
- Read the pressure gauge at test connection 6. Note this down.		1.6 - 1.9		To adjust load-sensing valve, see main group 10 Front and rear circuits, Components
Checking brake pressure				
- Enter the following bellow pressure via the control box. If the bellows pressure increases, disconnect the pressure gauge.				
min. 1.5 bar for 4x2s, 4x4s			1.5	
min. 0.8 bar for others			0.8	
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0			
- Read the pressure gauge at test connection 6. Check the alignment chart in the vehicle.				To adjust load-sensing valve, see main group 10 Front and rear circuits, Components
Checking the brake protection valve (79)				
- Connect a 15 bar pressure gauge to test connection 6.				
- Evacuate the rear air suspension.				
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0	5.8 - 6.1		Fault in the brake protection valve.

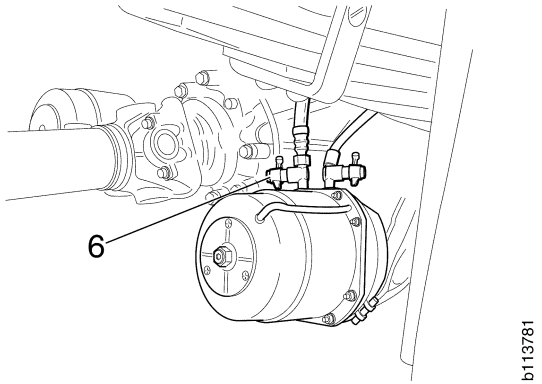
14b. Testing rear circuit load-sensing valve, leaf-spring suspension

Equipment/Pressure gauges

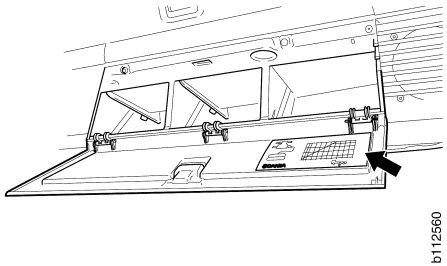
2.5 bar	15 bar
--	2 off



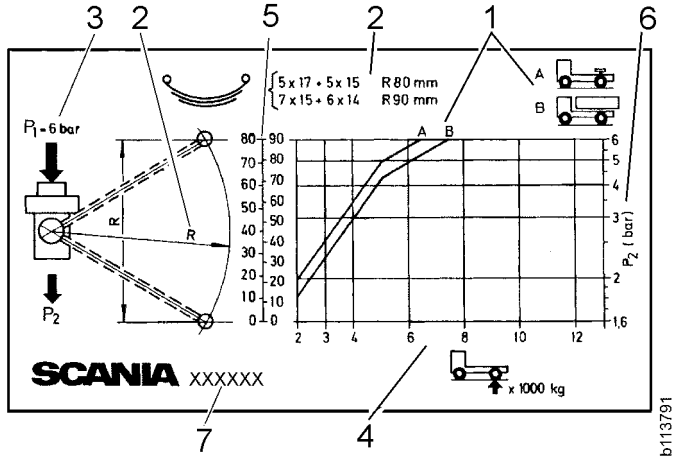
Test connection 3



Test connection 6



Location of alignment chart for load-sensing valve



Example of alignment chart

1. *The vehicle type determines which line should be read. The A line for tractors, the B line for trucks.*
2. *Arm length R is determined by the spring configuration.*
3. *P1 Incoming pressure from the service brake valve must be 6.0 bar.*
4. *Rear axle or bogie load x 1000 kg*
5. *At a particular rear axle / bogie load, A or B line and arm length are obtained from the arm length above the zero position and P2 Outgoing pressure (6). The topmost digit in each column indicates the arm length.*
6. *Outlet pressure P2.*
7. *Alignment chart part number.*

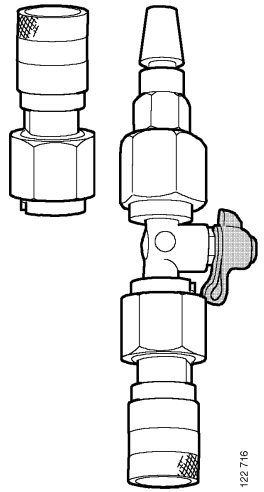
Test measure	Test connection (bar)		Cause of fault / action
	3	6	
Checking the valve			
- Connect 15 bar pressure gauges to test connections 3 and 6.			
- Remove the link to the load-sensing valve arm. The valve then sets itself to maximum position, no reduction.			
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0		
- Read the pressure gauge at test connection 6. Note this down.		5.8 - 6.0	If the pressure gauge at test connection 6 shows less than 5.8 bar, there is a fault in the load-sensing valve.
- Read the arm vertical travel (R) between the maximum and minimum positions on the alignment chart in the cab.			
- Tie up the arm on the half vertical travel (R/2).			
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0		
- Read the pressure gauge at test connection 6. Note this down.		2.7 - 2.9	If the pressure gauge at test connection 6 shows less than 2.7 bar or more than 2.9 bar, there is a fault in the load-sensing valve.
- Tie up the arm on the vertical travel minimum position (maximum position - R), as shown on the alignment chart, **not the minimum position of the valve.**.			
- Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar.	6.0		
- Read the pressure gauge at test connection 6. Note this down.		1.5 - 1.7	If the pressure gauge at test connection 6 shows less than 1.5 bar or more than 1.7 bar, there is a fault in the load-sensing valve.
- Install the link to the load-sensing valve arm.			

Test measure	Test connection (bar)		Cause of fault / action
	3	6	
Checking the setting - Check the arm length as shown on the alignment chart. - In order to read the alignment chart, the vehicle must be loaded until the desired rear axle / bogie load is reached. - Connect the pressure gauges to test connections 3 and 6. - Depress the brake pedal until the pressure gauge at test connection 3 shows 6.0 bar. - Read the pressure gauge at test connection 6. Note this down. Compare the reading with the alignment chart.			If the reading deviates by more than +/-10 % from the alignment chart, the link system between the drive shaft and the valve must be adjusted. To adjust the link system, see main group 10 Front and rear circuits, Components.

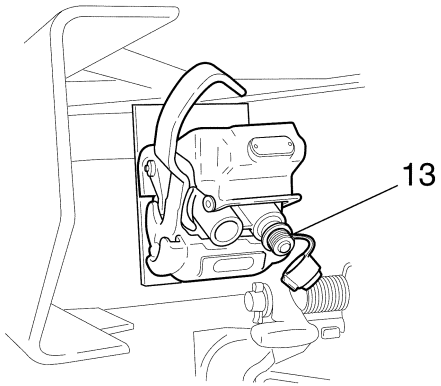
15. Testing trailer relay valve dump feature

Equipment/Pressure gauges

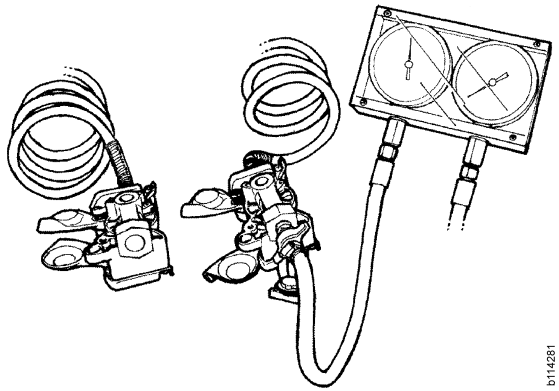
2.5 bar	15 bar
--	1 off



BSI connector



Test connection 13 with in-house manufactured tools for vehicles with Duo-Matic coupling.

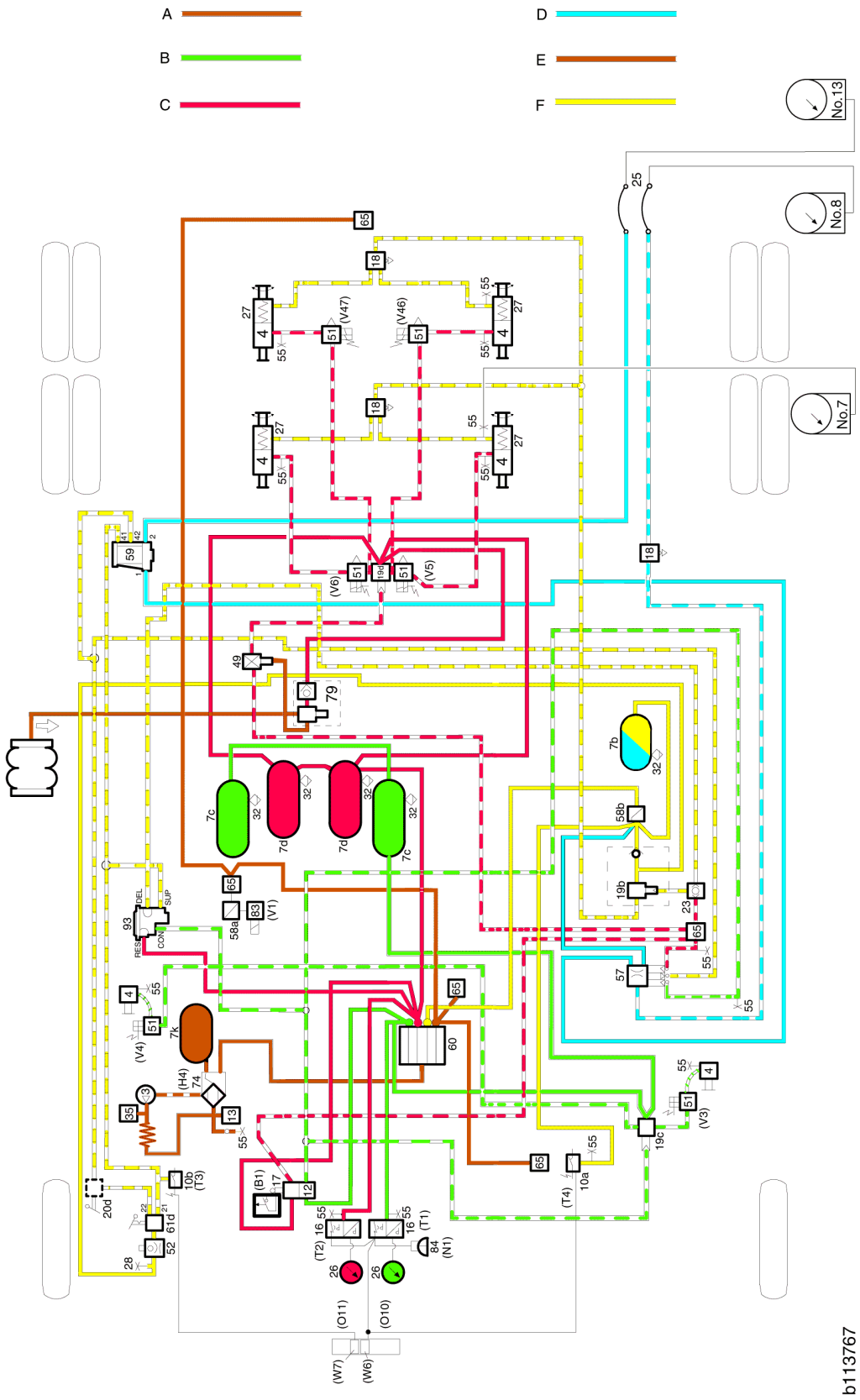


Example of test connection 13 and in-house manufactured tools for vehicles with ISO coupling.

Test measure	Test connection (bar) 13	Cause of fault / action
- Make a tool as described in *In-house manufactured tools.* The outlet of the service connection should not be obstructed. - Place chocks in front of and behind the wheels. - Release the parking brake. - Connect the tool and pressure gauge to test connection 13. - Charge the system with air. The pressure gauge should now show full supply pressure.		
- Quickly depress the brake pedal fully. The supply pressure should drop to less than 1.5 bar in maximum two seconds.	< 1.5	If the value is incorrect, the trailer relay valve must be replaced.

Test connection on 6x4s with US-adapted brake system

A colour-coded brake circuit diagram is available in the electronic version of this booklet as well as in main group 10, Testing brake system, Test connection.



A Supply circuit
B Front circuit
C Rear circuit
D Trailer brake circuit
E Accessory circuit
F Parking brake circuit

16. Testing emergency brake valve (93)

Note: The test stage applies only to vehicles with US-adapted brake systems.

Equipment/Pressure gauges

2.5 bar	15 bar
--	2 off

Test measure	Test connection (bar)		Cause of fault / action
	7	8	
Checking parking brake function			
- Charge system to relief pressure.			
- Connect the pressure gauges to test connections 7 and 8.			
- Place chocks in front of and behind the wheels.			
- Parking brake lever to drive position.	6.7 - 7.5	0.0	
- Parking brake lever to full emergency brake position.	0.0	6.5 - 7.5	
- Parking brake lever to parking position.	0.0	0.0	

Test measure	Test connection (bar)		Cause of fault / action
	7	8	
Checking the emergency brake function - Charge system to relief pressure. - Place chocks in front of and behind the wheels. - Release the parking brake. - Evacuate the rear circuit completely. - Connect the pressure gauge to test connection 7. - Slowly depress the brake pedal fully. - The pressure in the parking brake chamber should slowly drop to 0 bar.			If pressure is greater than 0 bar, check that neither relay valve 19b, the double check valve, nor the emergency brake valve is sticking.

17. Testing supply dump valve (59)

Note: The test stage only applies to vehicles with brake systems adapted to USA, Australia and New Zealand.

Equipment/Pressure gauges

2.5 bar	15 bar
--	1 off

Test measure	Test connection (bar) 13	Cause of fault / action
Checking the venting feature		
- Charge the brake system to relief pressure.		
- Connect the pressure gauge to test connection 13.		
- Place chocks in front of and behind the wheels.		
- Release the parking brake.		
- Check the supply cable to the trailer.		
Parking brake level to drive position.	Pressure	Faulty parking brake valve.
Parking brake lever to full emergency brake position.	Pressure	
Parking brake lever to parking position.	No pressure	The supply dump valve is sticking.
Remove the interlock valve (28)	Pressure	

18. Basic setting and stroke

For Work description and Specifications see Maintenance instructions in Group 0.

19. Checking brake lining thickness, drum brakes

For Work description and Specifications see Maintenance instructions in Group 0.

20. Checking brake discs and brake lining thickness, disc brakes

For Work description and Specifications see Maintenance instructions in Group 0.