

AIR BRAKE SYSTEM AGRICULTURE AND FORESTRY

MAINTENANCE, TESTING & FAULT-FINDING



WABCO

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1 General Information

Purpose of the document

This publication applies to employees of workshops for repairing and equipping commercial vehicles.

This document describes the maintenance and testing (including fault-finding) of agricultural and forestry towing vehicles and trailers.

Copyright and trademark notice

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Symbols used

 CAUTION	Specifies a potentially hazardous situation Specifies a possible hazardous situation Not observing the safety instruction can result in minor or moderately severe injuries. – <i>Follow the instructions in this warning note to avoid any injuries.</i>
CAUTION	Specifies possible material damage Not observing the safety instruction can lead to material damage. – <i>Follow the instructions in this warning note to avoid any material damage.</i>

 Important instructions, information, or tips that you should always observe.



Reference to information on the Internet

- Action step
 - ⇒ Consequence of an action
- List

General Information

Technical documents



- Open the WABCO INFORM Online Product Catalogue: <http://inform.wabco-auto.com>
- Search for documents by entering the document number.

The WABCO online product catalogue INFORM provides you with convenient access to the complete technical documentation.

All documents are available in PDF format. Please contact your WABCO partner for printed versions.

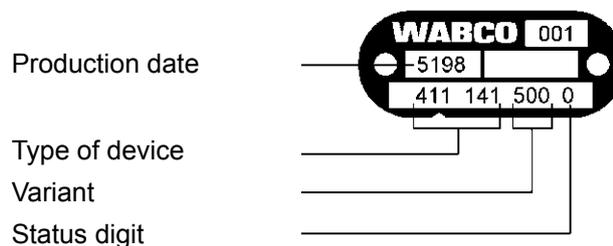
Please note that the publications are not always available in all language versions.

DOCUMENT TITLE	DOCUMENT NUMBER
Air brake devices for trailers (in accordance with 71/320/EEC)	815 XX0 034 3
Coupling Catalogue – Push-In, Standard, Conventional, Accessories	815 010 080 3
Air brake system – agriculture and forestry – product catalogue	815 XX0 082 3
Air brake system – agriculture and forestry – maintenance, testing and fault-finding	815 XX0 083 3
Air brake system – agriculture and forestry – legal requirements	815 XX0 084 3

*Language code XX: 01 = English, 02 = German, 03 = French, 04 = Spanish, 05 = Italian, 06 = Dutch, 07 = Swedish, 08 = Russian, 09 = Polish, 10 = Croatian, 11 = Romanian, 12 = Hungarian, 13 = Portuguese (Portugal), 14 = Turkish, 15 = Czech, 16 = Chinese, 17 = Korean, 18 = Japanese, 19 = Hebrew, 20 = Greek, 21 = Arabic, 24 = Danish, 25 = Lithuanian, 26 = Norwegian, 27 = Slovenian, 28 = Finnish, 29 = Estonian, 30 = Latvian, 31 = Bulgarian, 32 = Slovakian, 34 = Portuguese (Brazil), 35 = Macedonian, 36 = Albanian, 97 = German/English 98 = multilingual, 99 = non-verbal

Structure of the WABCO product number

WABCO product numbers consist of 10 digits.



0 = New device (complete device); 1 = New device (subassembly);
 2 = Repair kit or subassembly; 4 = Component part; 7 = Replacement device;
 R = Reman

Choose genuine WABCO parts

Genuine WABCO parts are made of high quality materials and are rigorously tested before they leave our factories. You also have the assurance that the quality of every WABCO product is supported by a powerful customer service network.

General Information

As a leading supplier to the industry, WABCO collaborates with the world's leading original equipment manufacturers, and disposes of the experience and capacitive capability required to also satisfy the most stringent production standards. The quality of every genuine WABCO part is supported by:

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- Exhaustive end-of-line tests
- Quality standards < 50 PPM

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- Straightforward claims handling
- Plus, of course, the confidence that the Original Equipment Manufacturers' rigorous quality standards are met

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WABCO Service Partners – the network you can rely on. You can access 2000 high quality workshops with more than 6000 specialist mechanics, all trained to WABCO's exacting standards and equipped with our most up-to-the-minute systems diagnostic and support technology.

Your direct contact to WABCO

In addition to our online services, trained members of staff are there to help you at our WABCO Service Partners to directly answer any technical or business-related questions you may have.

Contact us if you need assistance:

- Find the right product
- Diagnosis support
- Training
- System support
- Order management



You can find your WABCO partner here:

<http://www.wabco-auto.com/en/how-to-find-us/contact/>

2 Safety information

Observe all required provisions and instructions:

- Read this publication carefully.
Adhere to all instructions, information and safety information to prevent injury to persons and damage to property.
WABCO will only guarantee the security, reliability and performance of their products and systems if all information in this publication is adhered to.
- Always follow the specifications and instructions of the vehicle manufacturer.
- Observe all accident regulations of the respective company as well as regional and national regulations.

Make provisions for a safe work environment:

- Only trained and qualified technicians may perform work on the vehicle.
- Use personal protective equipment if required (protective goggles, respiratory protection, ear protectors, etc.).

Observe the following safety instructions when working on the air brake systems to avoid personal injury or damage to components:

- Any adjustments on the braking system must be made by an authorised workshop.
- When disconnecting the trailer, always disconnect the coupling head (supply) first. This way you make sure that the trailer cannot move away.
- When you have a trailer hitched to the tractor, do not move off before the pressure gauge in the driver's cab indicates a pressure of 5.0 bar.
- When driving without a trailer, seal the coupling head caps on the towing vehicle.
- Seal the coupling head caps on the parked trailer or attach them to the unused coupling heads.
- Prior to coupling the trailer, make sure that the sealing washers of the coupling heads are in perfect condition. The seals must be clean and undamaged.
- Before moving off with one or more trailers, move the lever of the trailer's Load Sensing Valve brake force controller to the position that corresponds to the load status (Unladen, 1/2 load, Laden).
- Regularly check the tension of the compressor's drive belt. Observe the respective specifications of the vehicle manufacturer!
- Trailers designed for speeds of more than 25 km/h are subject to the tests as defined in the applicable statutory provision, see section "Technical documents" on page 3.
- Before putting a new tractor with a permissible top speed above 40 km/h (up to 60 km/h) into service, the fleet of trailers with permitted top speeds of only 25 km/h should be checked for optimal brake settings by an authorised workshop. A test run with laden and unladen trailers is recommended.
- The maximum permissible weight of the trailer must never be exceeded.
- The speed of the tractor-trailer combination must not exceed the permissible top speed of the slowest part of that combination.

3 Notes on installing the pipes

CAUTION	Possible damage to the vehicle and the braking system Vehicle components and the braking system can be damaged due to incorrect drilling and welding. <ul style="list-style-type: none">– <i>No drilling or welding is permitted on the drawbar.</i>– <i>Any welding work on the axles must only be carried out in accordance with the axle manufacturer's welding instructions.</i>– <i>When doing welding work, make sure that the brake lines (plastic pipes and hoses) are not damaged.</i>
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Prior to installation

- Before installing plastic pipes, make sure that the insert sleeves are in place.
- Blow clean air through the pipes to prevent contaminating the devices.

Assembly

- Lay the pipes in accordance with the WABCO diagram.
- Colour mark the pipes for clarity.
- Fasten the pipes and lines to the corresponding points using cable fasteners, clips or chassis clamps.

CAUTION	Damage to lines Lines can be damaged if they are loose or routed too tightly. <ul style="list-style-type: none">– <i>Route the lines so that they do not rub within their supports or are squeezed by other components. Water sacks must not form.</i>
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- The lowest point in any air brake system should be the drain valve.
- For the trailers, select the lengths of hoses from the drawbar to the towing vehicle (or the first trailer) to allow for 75° drawbar movement in either direction.
- The hoses leading to the brake chambers must be connected in such a way that the control line is not lower than the cylinder body (avoiding contact with the ground).
- For drawbar trailers, a hose connection should be used from the centre of the live ring to the cylinder(s). Make sure the lines are long enough for the drawbar to turn 75° in either direction without twisting the hoses.

! Steel piping should be used on the drawbar wherever possible to help prevent the hose being damaged in this area.

- After installation, check all pipes and hose connections to make sure they are firmly in place and do not chafe. Eliminate any leaks.

4 Maintenance Instructions

4.1 Tractor

General

- After a short running in period (around 1-2 hours), check the V-belt tension of the compressor drive and re-tension it as required.



Installation and maintenance recommendations for compressors

In this respect, pay particular attention to the installation and maintenance recommendations for compressors (see brochure 826 001 099 3). You will find the brochure in our online product catalogue INFORM at <http://inform.wabco-auto.com>

- Check that screws on the compressor console are properly tightened at regular intervals.

Daily maintenance work

- Daily drain the air reservoir by operating the drain valves.

Quarterly maintenance work

- Clean the outer air reservoir, remove any corrosion. Replace the air reservoir if it is damaged.
- Check the intake line of the compressor.
- Check the intake filter (motor filter) and clean it as required.
- Check if all threaded couplings of the hydraulic tractor braking system and air brake system are tight.
- Check the pipes and hoses for damage.
- Immediately remedy leaks, chafe points and damage.
- Check the function of the brake light switch.
- Check the pressure indicator on the dashboard.
- Check the fill level in the compensating reservoir of the hydraulic wheel brakes and replace the fluid in accordance with the tractor manufacturer's instructions as required.

4.2 Trailers

Daily maintenance work

- Daily drain the air reservoir by operating the drain valves.

Quarterly maintenance work

- Clean or replace the pipe filters.
- Readjust the brake if the brake cylinder strokes in the trailer attain 2/3 of the overall stroke.

- Make sure that the brake lever and linkage move smoothly and re-lubricate as required.
- Check if the folding and protection bellows fit correctly and are in good condition.
- Check the pipe and hose routing, immediately remedy any leaks and damage.
- Check the pressures at the cylinders according to the test instructions (see chapter "5 Test Instructions" on page 8).

5 Test Instructions

 WARNING	<p>Rolling away of the vehicle Unsecured vehicles may roll away during the repair. This might lead to severe injuries or even death.</p> <ul style="list-style-type: none"> – <i>Turn off ignition before starting any repair work.</i> – <i>Secure the vehicle against rolling away.</i> – <i>Attach a visible note on steering wheel saying that repair work is being performed on vehicle.</i>
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5.1 For tractors used in agriculture and forestry

Recommended measurement tools

Tool	Product number
Calibrated pressure gauge (e.g. 16 bar)	453 004 007 0
Test hose (white)	452 600 004 0
Test hose (blue)	452 600 003 0
2x coupling head (2-line)	452 200 000 0
1x coupling head (1-line)	452 201 010 0
Test box	435 002 011 0

Measure the unloader valve's cut-out pressure.

Action	Nominal value (expected result)
<ul style="list-style-type: none"> – Connect a pressure gauge to the coupling head "supply red". – In the case of high pressure systems > 8.5 bar: Connect a pressure gauge to the reservoir. 	
<ul style="list-style-type: none"> – Fill the air brake system up until the cut-out pressure of the pressure valve is reached. 	In accordance with the unloader valve variant (7.0 to 8.1 ^{+0.2} bar)

Test Instructions

Check tightness

Action	Nominal value (expected result)
– Connect a pressure gauge to the coupling head "supply red".	
– Fill the air brake system up until the cut-out pressure of the pressure valve is reached. – Switch off the engine.	<ul style="list-style-type: none"> ■ The air brake system is considered to be tight if the pressure drop over a period of 5 minutes is no more than 0.2 bar. ■ While the brakes are actuated (park brake is on) no significant drop in pressure must occur.

Measure the filling time

Requirement: pressureless system

Action	Nominal value (expected result)
– Start the engine and leave it running at nominal rotational speed until the cut-out pressure of the unloader valve is reached. Stop the time when doing this.	<p>Example:</p> <p>With a compressor of 159 cm³, a reservoir of 20 litres and a nominal speed of e.g. 2800min⁻¹, a filling time of 3 minutes should not be exceeded (or the manufacturer's information applies).</p>

Check reservoir pressure and pressure gauge

Action	Nominal value (expected result)
– Connect a pressure gauge to the reservoir.	
– Compare the pressure in the reservoir with the pressure gauge indication in the driver's cabin.	Pressure in the reservoir and the pressure indication on the pressure gauge are identical.

Check the single line braking system

Action	Nominal value (expected result)
– Fill the air brake system up until the cut-out pressure is reached.	
– Release the parking brake.	
– Connect a pressure gauge to the coupling head "single line black".	4.8 to 5.6 bar
– Evenly actuate the foot brake. The pressure must be reduced to 0 bar with continuous, sensitive braking.	<ul style="list-style-type: none"> ■ With full braking 0 bar (at coupling head "single line black"), ■ With partial braking of 1.0 bar (coupling head "brake yellow") at coupling head "single line black" a pressure drop of 0.5 to 2.5 bar (depending on the trailer control valve variant).

Test Instructions

Action	Nominal value (expected result)
– Release the foot brake.	
– Actuate the parking brake.	0 bar (at coupling head "single line black")

Check the dual line air brake system

Action	Nominal value (expected result)
– Fill the air brake system up until the cut-out pressure of the pressure valve is reached.	
– Release the parking brake.	
– Connect a pressure gauge to the coupling head "brake yellow".	0 bar
– Slowly and evenly actuate the foot brake down to the stop position. Pressure must rise gradually and sensitively.	In accordance with the supply pressure (7.0 to 8.1 ^{+0.2} bar)
– While smoothly and gradually increasing the pressure on the foot brake, make sure that the pressure also rises gradually and evenly up to full braking.	
– Release the foot brake.	
– Actuate the parking brake.	7.0 to 8.1 ^{+0.2} bar

Check the pressure limiting valve (only with high pressure systems)

Action	Nominal value (expected result)
– Connect a pressure gauge to the coupling head "supply red".	
– Fill the system up until the cut-out pressure of the pressure valve is reached.	
– Switch off the engine.	
– Check the pressure at the coupling head „supply red“.	7.0 to 8.1 ^{+0.2} bar

Check the response behaviour of a dual line braking system

Action	Nominal value (expected result)
– Connect a pressure gauge to the coupling head "brake yellow".	
– Fill the air brake system up until the cut-out pressure of the pressure valve is reached.	
– Actuate the brake pedals during a test drive in locked state until the brake starts to take effect.	Depending on the variant of trailer control valve used, a rise in pressure must be noted on the pressure gauge.

Action	Nominal value (expected result)
– Carry out a time measurement (must only be carried out by an authorised specialist company!).	

After functional testing, the newly installed air brake system must be presented to the relevant technical supervision authorities for inspection and approval.

5.2 For agricultural and forestry trailers

Check tightness

General

- Check all connections, pipe connections and hose connections as well as couplings for tightness.
- Eliminate any leaks.
- Eliminate situations where pipes and hoses rub against other components.
- Replace porous or defective hoses.

The system is considered to have no leaks if the pressure does not drop by more than 0.2 bar within 5 minutes.

Check pressure in supply reservoir (in the case of dual line air brake systems)

Action	Nominal value (expected result)
– Connect a pressure gauge to the supply reservoir's test port (if test port is provided).	6.0 to 8.1 ^{+0.2} bar

Check brake cylinder pressure (in case of dual line air brake systems)

Action	Nominal value (expected result)
– Connect a gauge to the brake cylinder test port.	<ul style="list-style-type: none"> ■ with brake not applied: 0 bar ■ in full-load position of the manual control device*: 6.0 to 8.1 bar ■ in half-load position of the manual control device*: 3.6 to 4.2 bar ■ in no-load position of the manual control device*: 2.0 to 2.3 bar

* Guideline values: Pressure is set in accordance with the vehicle manufacturer's specifications. If a load-sensing valve has been fitted, these values should be checked following the vehicle manufacturer's instructions (LSV controller plate on the trailer).

Checking the Stroke of the Brake Cylinders.

Action	Nominal value (expected result)
– In the event of full braking	Brake cylinder only moves out 1/2 to 2/3 of the total possible stroke.
– Re-adjust the brake with greater stroke.	

Test Instructions

Visual inspection of brake cylinder

Action	Nominal value (expected result)
– Check the dust sleeves or folding bellows for damage.	
– Replace any damaged parts.	

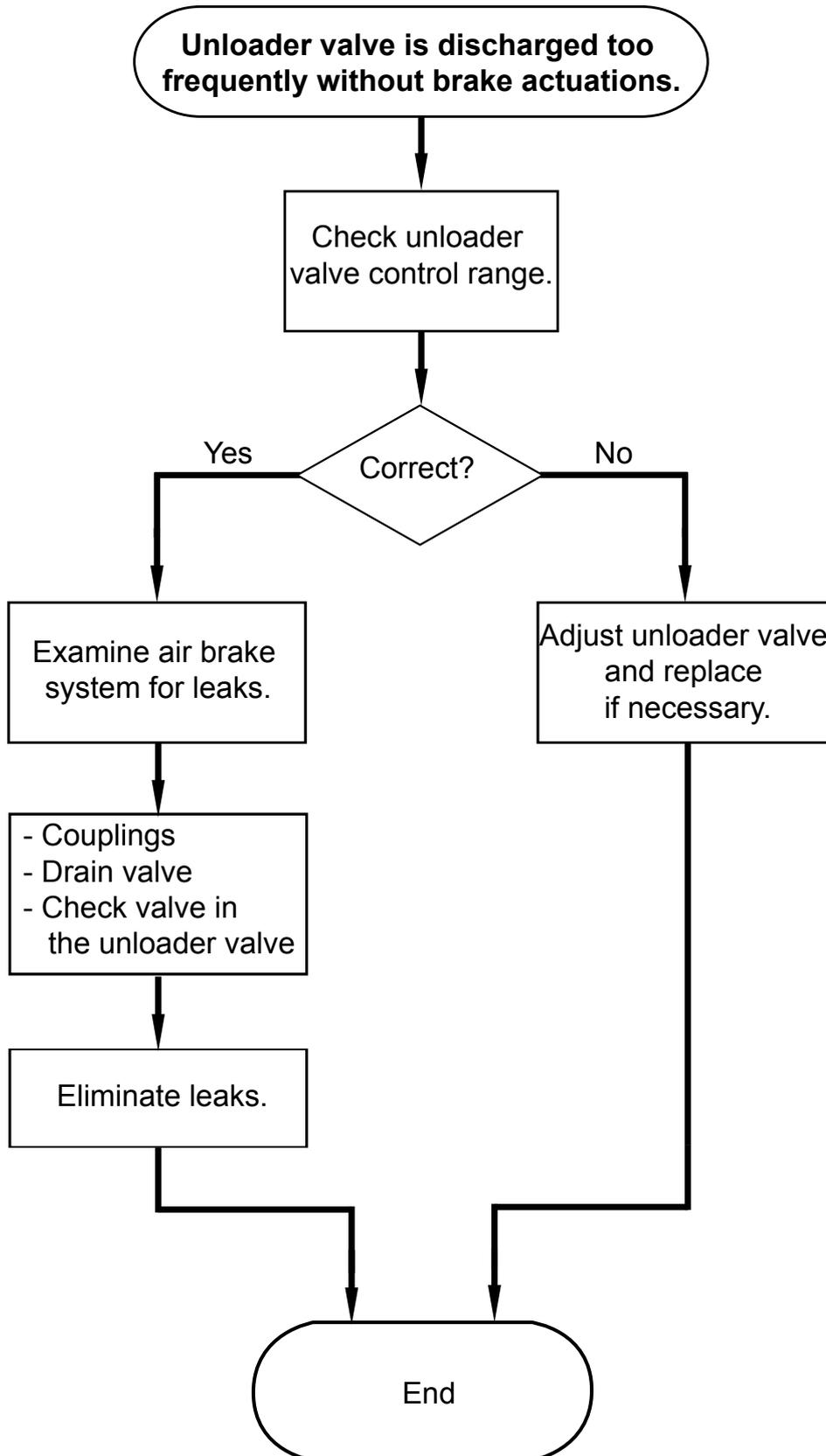


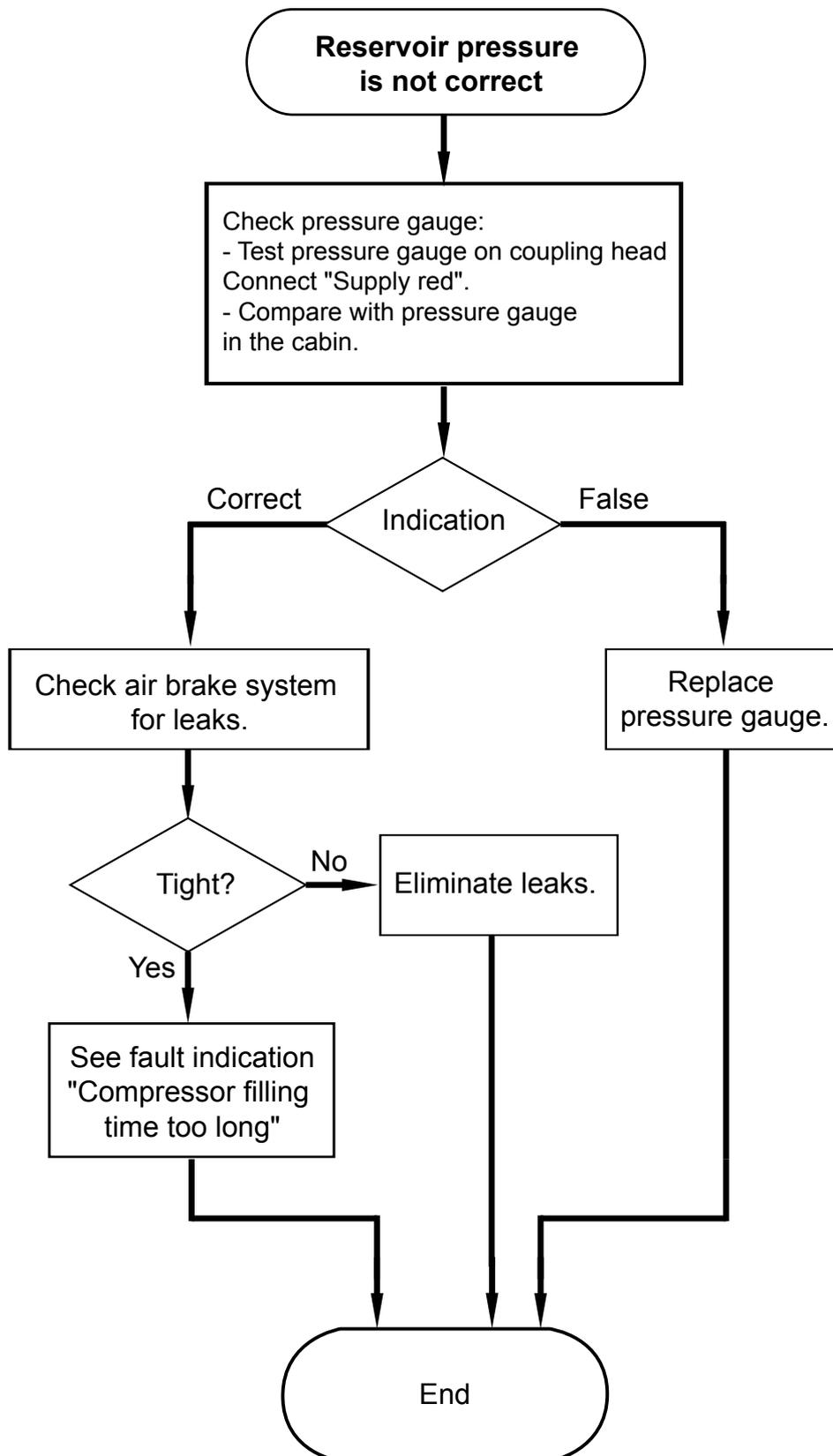
Repair kits and reconditioned units are available for many types of equipment. Ask your dealer about these or find out about them in our product catalogue at <http://inform.wabco-auto.com>.

5.3 Testing Table

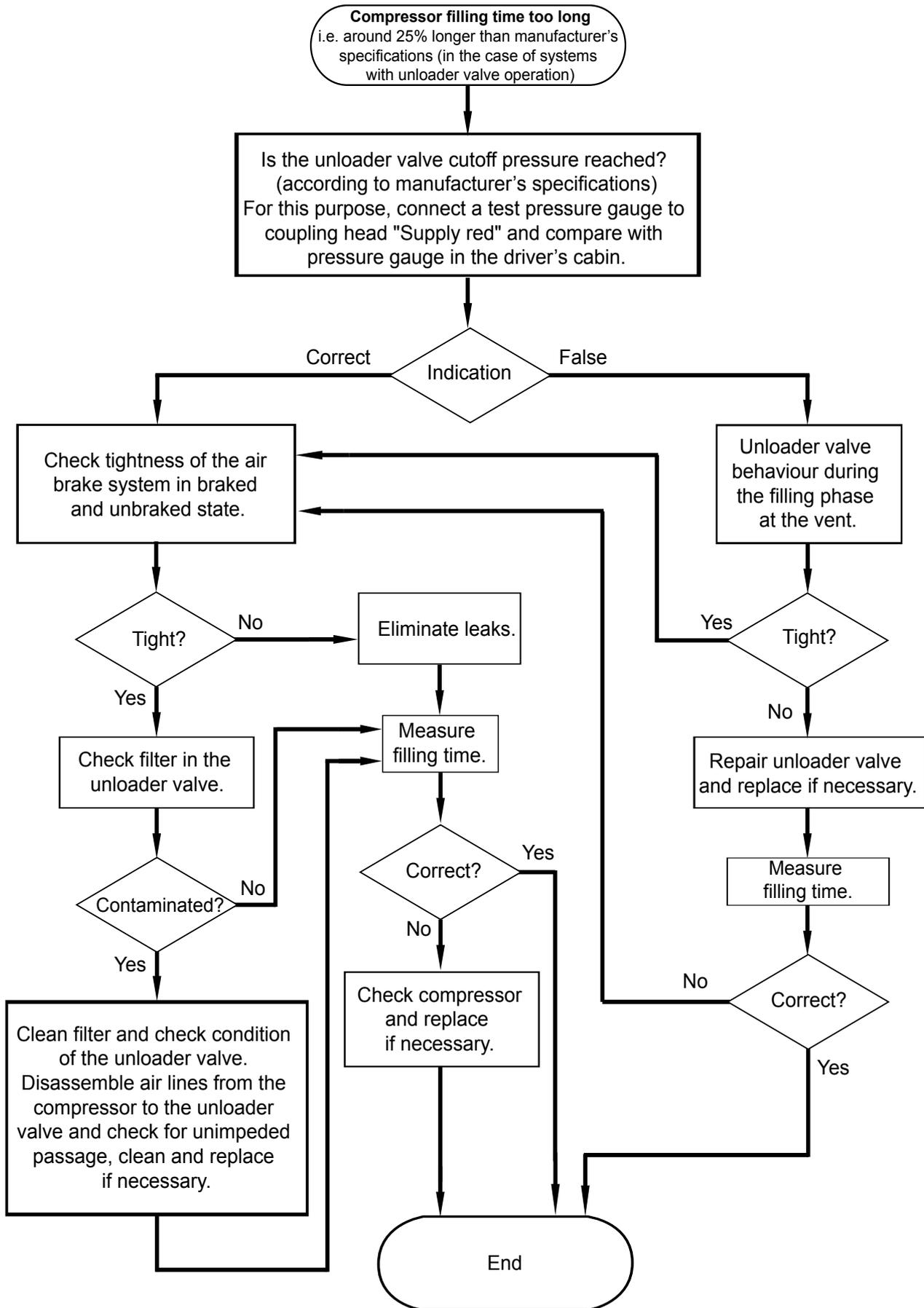
			Towing vehicle		Trailer			
Brake	Status	Measurement point (coupling head)	Pressure at the coupling head (bar)		Pressure at the supply reservoir (bar)		Pressure at the brake cylinder (bar) (with manual control device set to "full load")	
			Nominal value	Actual value	Nominal value	Actual value	Nominal value	Actual value
Single line								
Foot brake	not actuated	Single line "black"	4.8 to 5.6		4.8 to 5.6		0.0	
	fully actuated	Single line "black"	0.0		4.8 to 5.6		4.8 to 5.6	
Park brake	released		4.8 to 5.6		4.8 to 5.6		0.0	
	engaged		0.0		4.8 to 5.6		4.8 to 5.6	
Two-line								
Foot brake	not actuated	Supply "red"	7.0 to 8.1		7.0 to 8.1		0.0	
		Brake "yellow"	0.0					
	fully actuated	Supply "red"	7.0 to 8.1		7.0 to 8.1		7.0 to 8.1	
		Brake "yellow"	7.0 to 8.1					
Park brake	released	Supply "red"	7.0 to 8.1		7.0 to 8.1		0.0	
		Brake "yellow"	0.0					
	engaged	Supply "red"	7.0 to 8.1		7.0 to 8.1		7.0 to 8.1	
		Brake "yellow"	7.0 to 8.1					

5.4 Fault finding

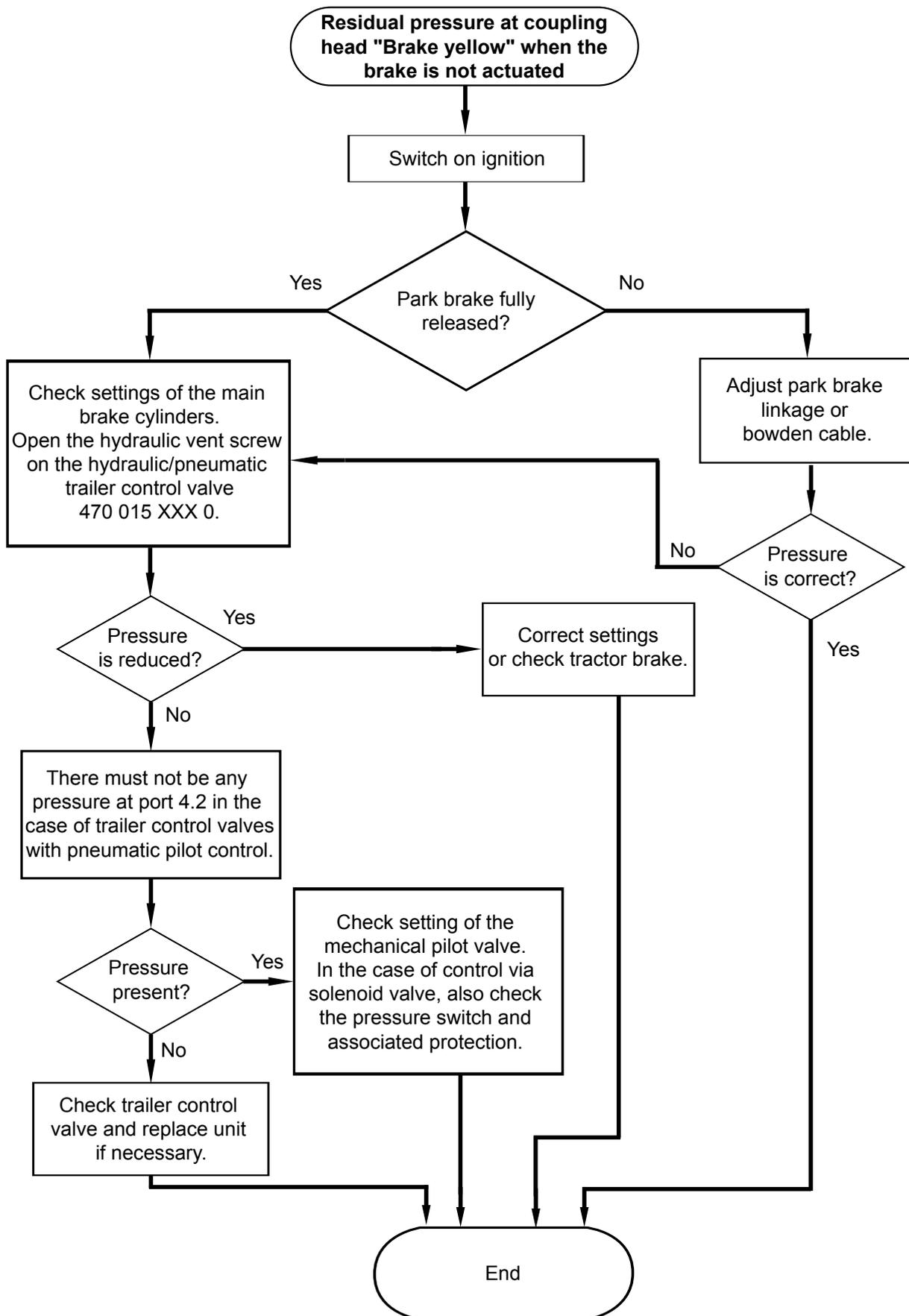




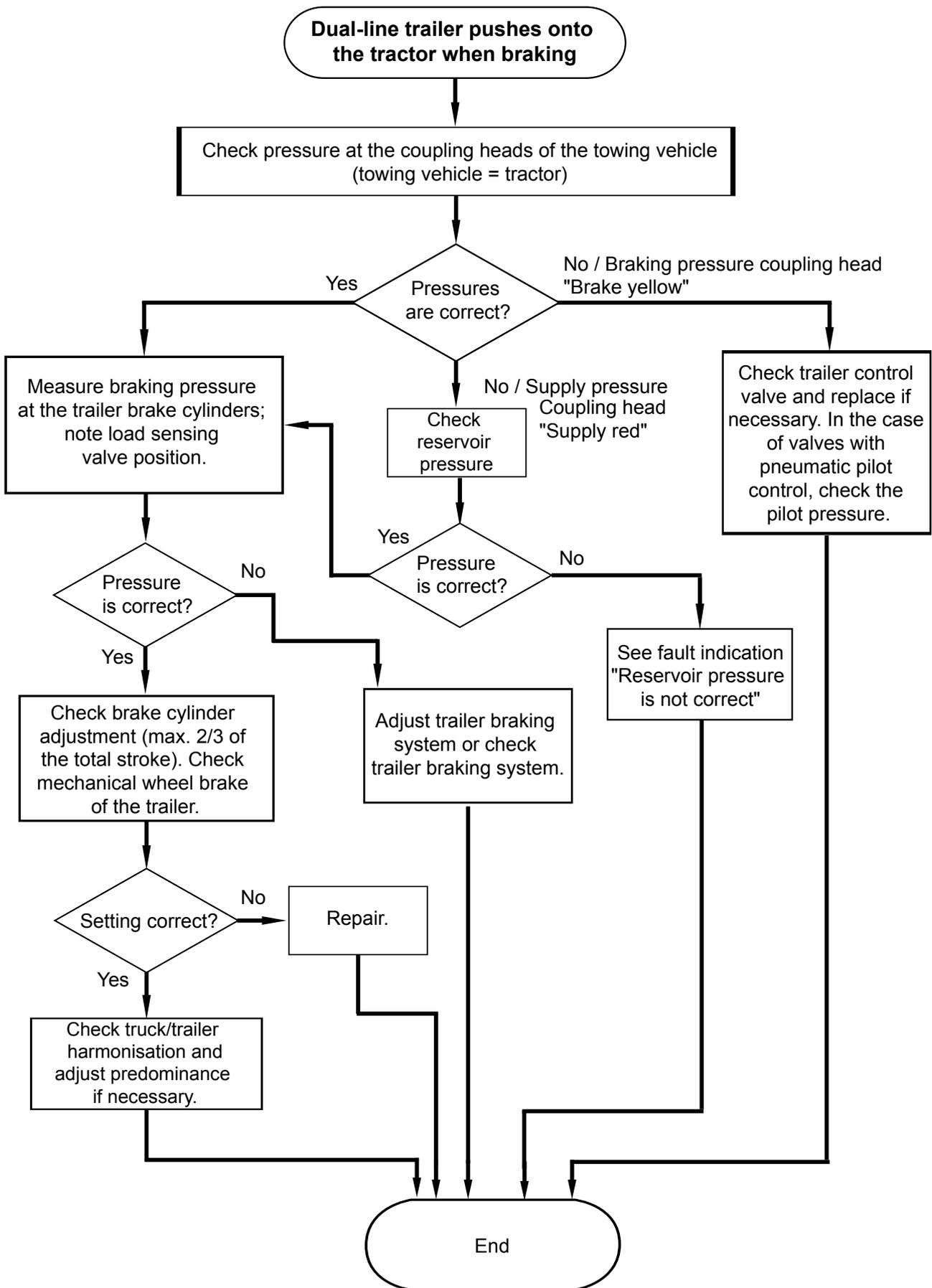
Test Instructions



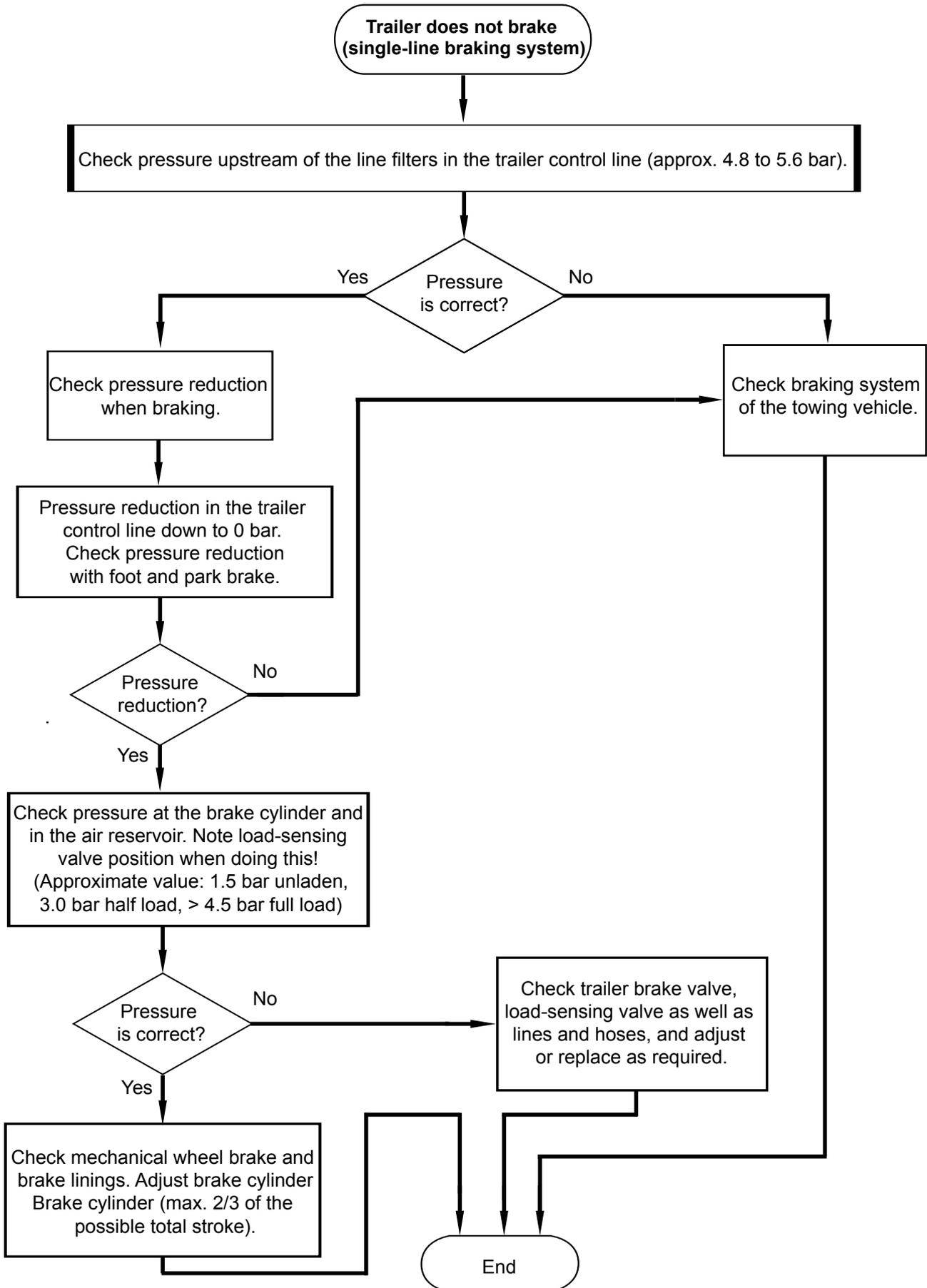
Test Instructions



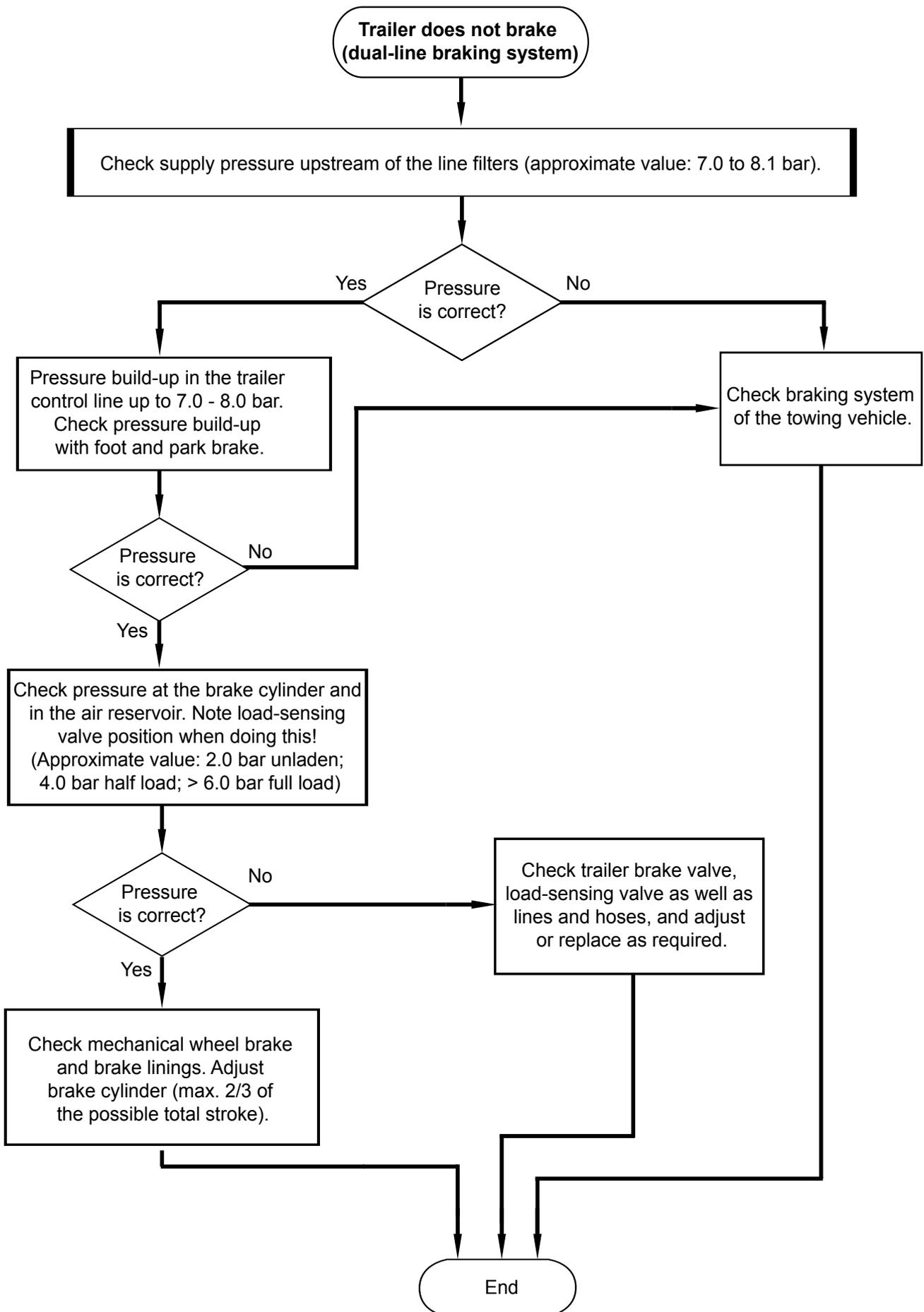
Test Instructions



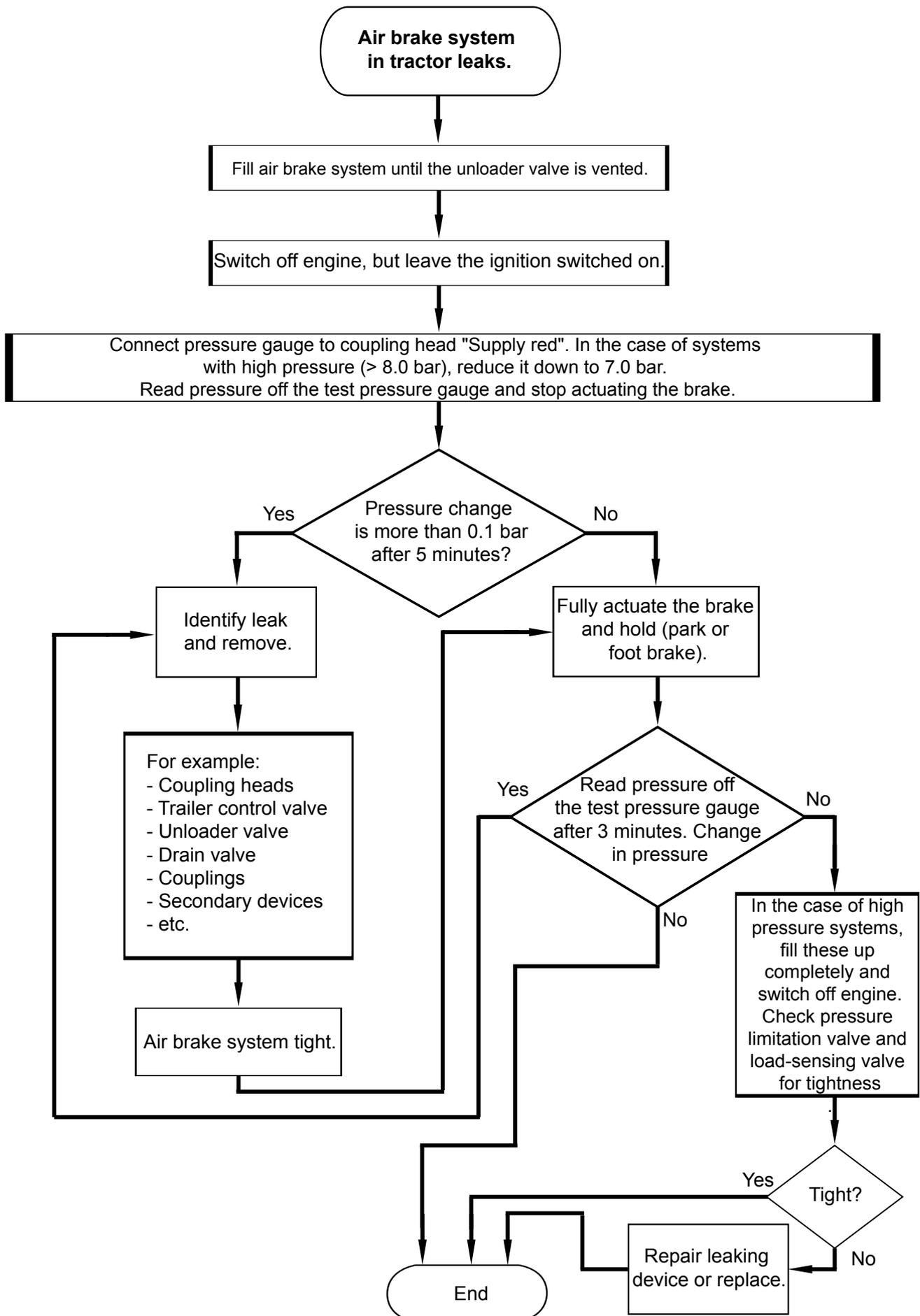
Test Instructions



Test Instructions



Test Instructions



5.5 Questions and Answers

Questions & Answers	
I want to fit an air compression system on my tractor. What do I have to do?	Please contact your WABCO contact person. You will receive the corresponding technical documents such as parts list and diagram.
I want to retrofit an air brake system on my trailer. What do I have to do?	Please contact your WABCO contact person. A brake calculation can be prepared based on the technical data of the trailer and the wheel brake name. Application for a brake calculation: http://www.wabco.info/i/470 (de) http://www.wabco.info/i/469 (en)
Which legal requirements must be met?	This is all included in our brochure "Air brake system – Agriculture and forestry – Legal requirements" (see section "Technical documents" on page 3).
Do I have to have the tractor inspected by the relevant technical supervision authority after installing an air brake system?	After fitting the air compression system, you have to have the vehicle inspected by the technical supervision authority (e.g. M.O.T) since otherwise the tractor's type approval will be void.
Which documents do I have to take with me when I first have my air brake system inspected by the technical supervision authority?	Please take the WABCO diagram, the parts list and the vehicle registration document (in which the air brake system will be entered).
Where can I go for support if I have any problems with my air brake system?	Ask your WABCO dealer or contact your WABCO contact person.
Can I buy repair kits or reconditioned equipment for repairs?	For many types of equipment you can buy spare parts or repair kits with descriptions, or inexpensive reconditioned units. Ask your dealer about these or find out about them in our product catalogue at http://inform.wabco-auto.com .
Can I repair any defective equipment myself, and am I allowed to do so?	All work that goes beyond the scope of repairs with spare parts must be carried out by authorised specialist companies.
What information materials are available on air brake systems?	Our catalogue describes all components and their functions, other brochures give details on installation, testing and advice on maintenance and troubleshooting. Several documents are listed in the section "Technical documents", page 3.
Can I take part in any training courses on air brake systems for vehicles used in forestry and agriculture?	You can register for training courses at the WABCO Academy: http://www.wabco-academy.com

6 Components

6.1 Adjusting the trailer predominance on the trailer brake valve 971 002 150 0

Combination of trailer brake valve 971 002 150 0 and load sensing valve 475 604 011 0 (combination number: 971 002 570 0)

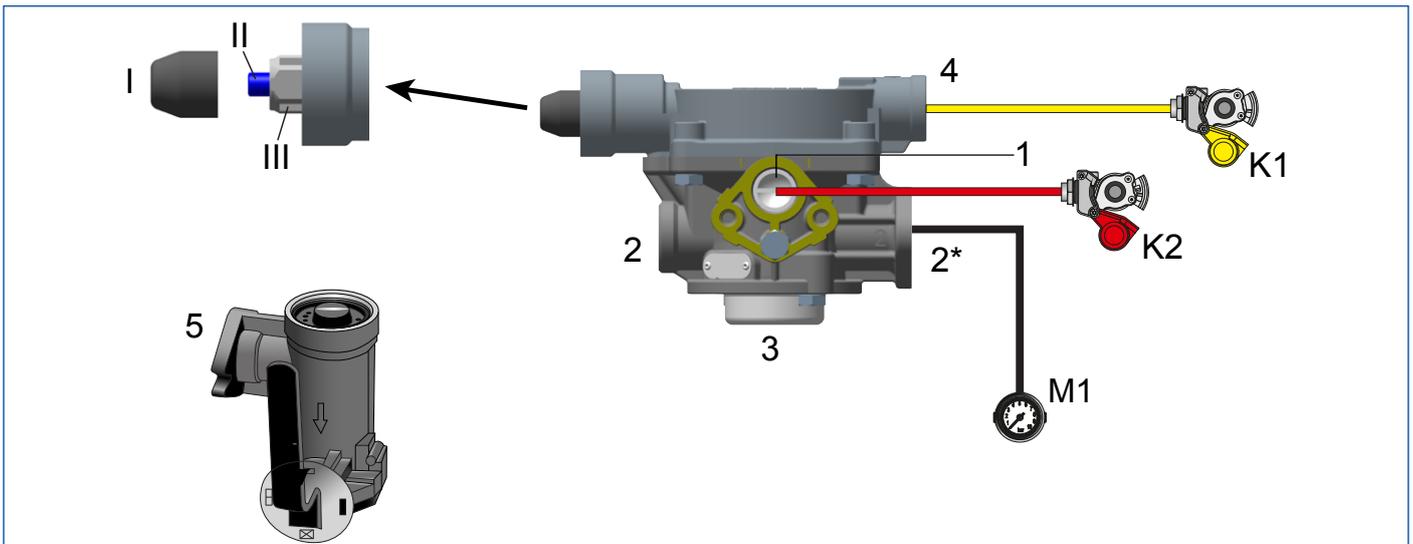


Fig. 1: Adjusting trailer predominance

Legend			
1	Energy supply M 22x1.5	2/2*	Energy discharge M 22x1.5
3	Venting	4	Control connection M 22x1.5
5	Load sensing valve 475 604 011 0		
I	Rubber cap	II	Grub screw
III	Plastic nut	M1	Pressure gauge
K1	Coupling head "brake yellow", 2 bar	K2	Coupling head "supply red", 7.3 bar

- Fit a test connection (if none is provided) and a pressure gauge **M1** to connection **2***.
- Remove the rubber cap **I**.
- Apply full supply pressure of 7.3 bar to port **1** (coupling head "supply red").
- Apply a pressure of 2.0 bar to port **4** (coupling head "brake yellow").
 - ⇒ The pressure gauge **M1** (at the test port) must indicate a pressure of $2^{+0.2}$ bar.
- Adjust the grub screw to set the predominance of 0 to max. 1 bar. When doing this, secure the plastic nut **III**.
- Fit the rubber cap **I**.

! When moving the vehicle, the load sensing valve must be set to the right position for the load carried on the trailer.

Changing the pressure setting of load sensing valves of the series 475 604 XXX 0

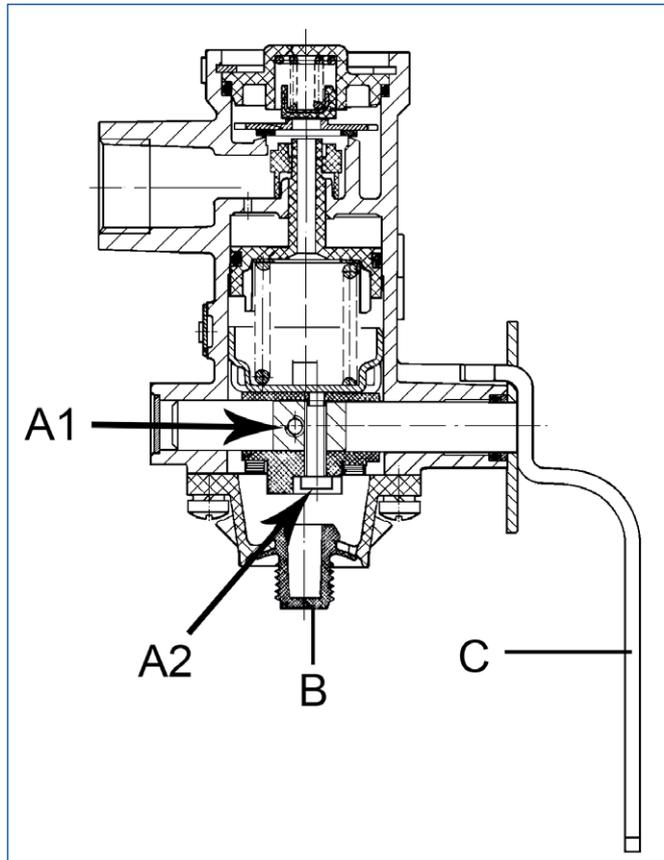


Fig. 2: Sectional view of the load sensing valve

Legend			
A1	Adjusting screw	A2	Adjusting screw
B	Protective plug	C	Lever

! When adjusting the adjusting screw **A1** or **A2** the load sensing valve must always be pressureless.

Adjusting the unladen pressure

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WABCO -brake calculation no: WDE 97228Z date 15.09.2015 DC page 2 / 5

brake diagram :

maximum pressure: 8,5 bar

axle 1:
  valve 1: 971 002 300 0 WABCO or 971 002 150 0
             relay emergency valve pin 2,0 bar pout 2,0 bar

  valve 2: 475 604 ... 0 WABCO
             load apportioning valve unladen pab 2,0 bar

brake cylinder: WABCO 925 376 000-004 0 / 925 376 1.. 0

test type III (zIII = 0,30) for rdyn min : axle1
at pm 3,3 bar => pcha in bar : 3,3
test type III (zIII = 0,06) for rdyn min : axle1
at pm 0,9 bar => pcha in bar : 0,9
    
```

Fig. 3: Examples of a WABCO brake calculation

To set the unladen pressure determined by the WABCO brake calculation (Fig. 3), the adjusting screw **A1** needs to be adjusted.

- Turn the lever **C** to the "Full load" position.
- Remove the protective plug **B**. You can now reach adjusting screw **A1** using a hexagon key.
- Turn the adjusting screw out to increase the pressure to be measured in the cylinders.
Turn the adjusting screw in to decrease the pressure to be measured in the cylinders.

Setting the pressure to ½ load

The pressure change for the ½ load position can be carried in the same way as for the unladen pressure.

- Turn the lever **C** to the "Release" position. The correction is made at the adjusting screw **A2**.

! Load sensing valves without the "Release" position have a screw plug at the side of the housing. You can access the adjusting screw **A2** by moving the lever to the "Unladen" position and unscrewing the screw plug.

6.2 Alternatives for trailer control valve 470 003 000 0

! The trailer control valve 470 003 000 0 (or 470 003 000 7) is no longer available.

Alternatively (Fig. 6) you can use trailer control valve 470 015 010 0 (as pos. 8) in connection with trailer control valve 471 200 008 0 (pos. 7).

The trailer control valve 470 015 010 0 is controlled hydraulically, just like the old control valve 470 003 000 0. However, it builds up pressure rather than reducing it.

Hence trailer control valve 471 200 008 0 must be used as well. This valve reduces the pressure and also reduces the supply pressure to 5.3 bar (the pressure is applied at the "single line black" coupling head).

Components

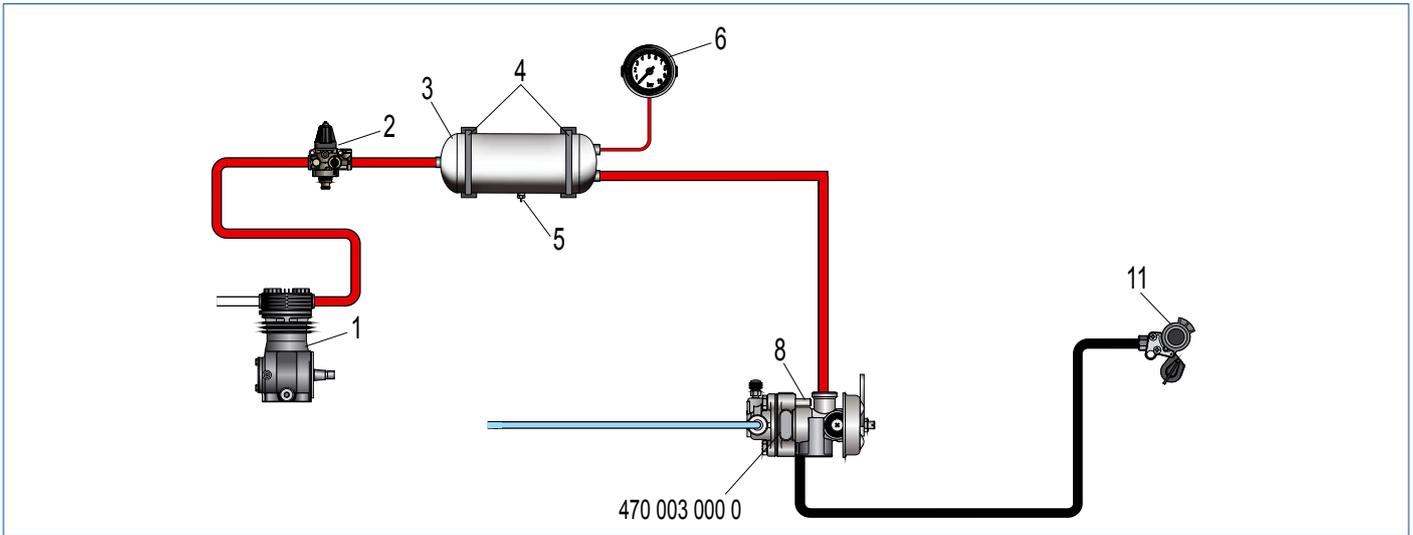


Fig. 5: Old system (with 470 003 000 0)

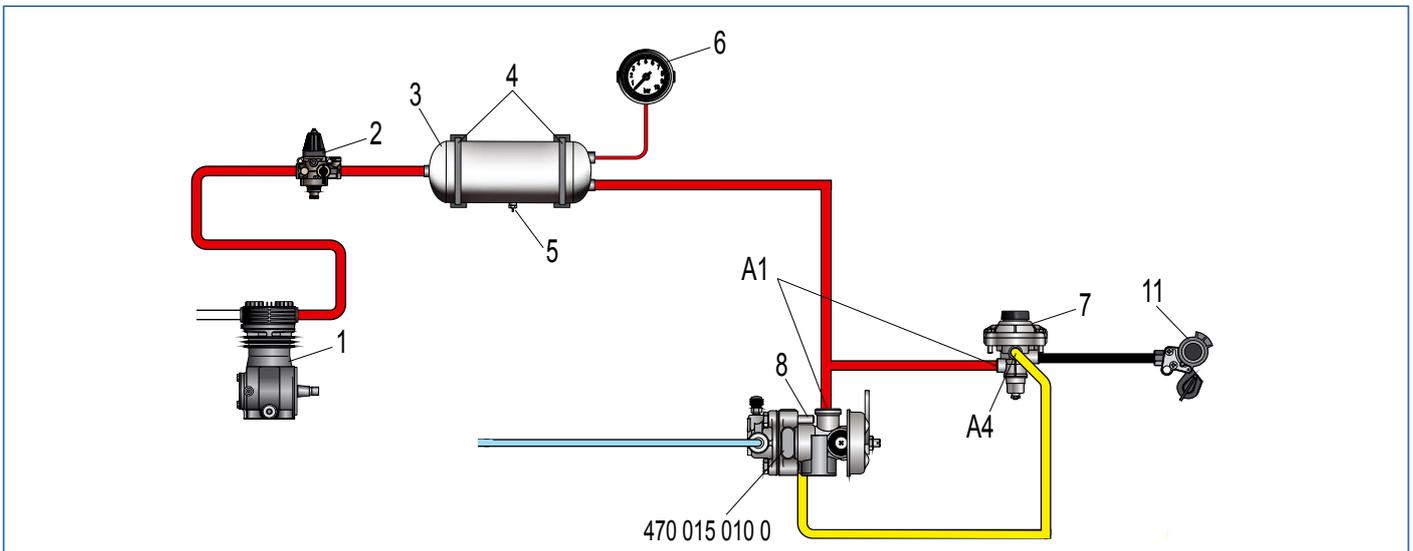


Fig. 6: Alternative system as single line system

Legend

1	Compressor	2	Unloader valve
3	Air reservoir (20 litres)	4	Clamping band
5	Drain valve	6	Pressure gauge
7	Trailer control valve (single line) (471 200 008 0)	8	Trailer control valve (470 003 000 0 or 470 015 010 0) is no longer available
9	Coupling head "supply red"	10	Coupling head "brake yellow"
11	Coupling head "single line black"		
A1	Port (for supply)	A4	Port (for control pressure)

When braking, trailer control valve 470 015 010 0 is controlled hydraulically and outputs pneumatic pressure to port **A4** of trailer control valve 471 200 008 0 in proportion to the hydraulic input pressure.

The supply pressure is passed to both trailer control valves via port A1.

In control valve 471 200 008 0 the supply pressure is reduced to 5.3 bar.

When braking, the pressure at the coupling head "single line black" (pos. 11) is reduced relative to the pneumatic pressure applied at port **A4** of trailer control valve 471 200 008 0 (pos. 7).

Components

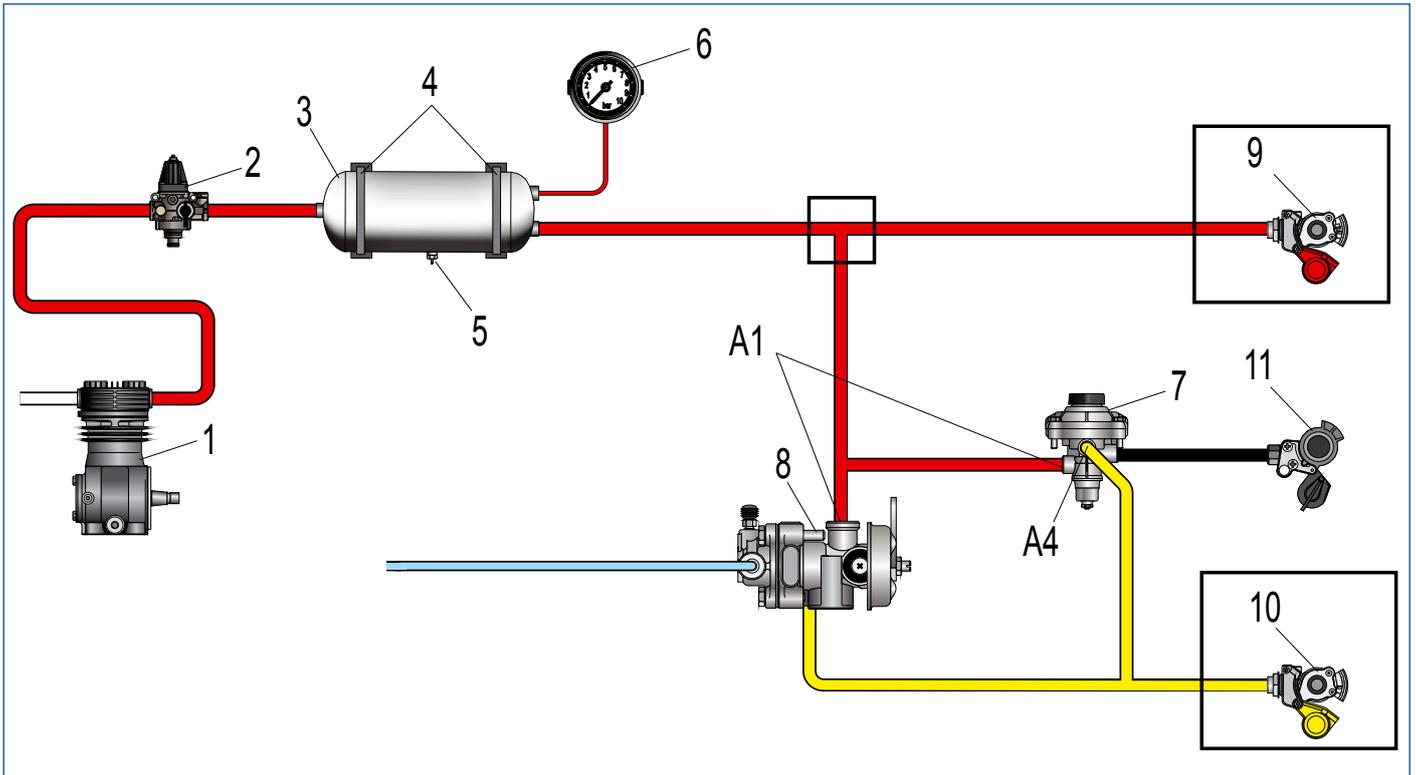


Fig. 7: Alternative system as combined single and dual line system

Legend

1	Compressor	2	Unloader valve
3	Air reservoir (20 litres)	4	Clamping band
5	Drain valve	6	Pressure gauge
7	Trailer control valve (single line) (471 200 008 0)	8	Trailer control valve (470 003 000 0 or 470 015 010 0) is no longer available
9	Coupling head "supply red"	10	Coupling head "brake yellow"
11	Coupling head "single line black"		In addition
A1	Port (for supply)	A4	Port (for control pressure)

This makes it possible to also tow trailer vehicles with dual line braking systems (which are common these days).

The following are required in addition:

Products	Product number
1x T-piece for the trailer control valve and the coupling head, "supply red"	See Coupling Catalogue (see section "Technical documents" on page 3)
1x coupling head "supply red" (pos. 9)	952 200 221 0
1x coupling head "brake yellow" (pos. 11)	952 200 222 0

6.3 Conversion of single line to dual line air brake systems in trailers

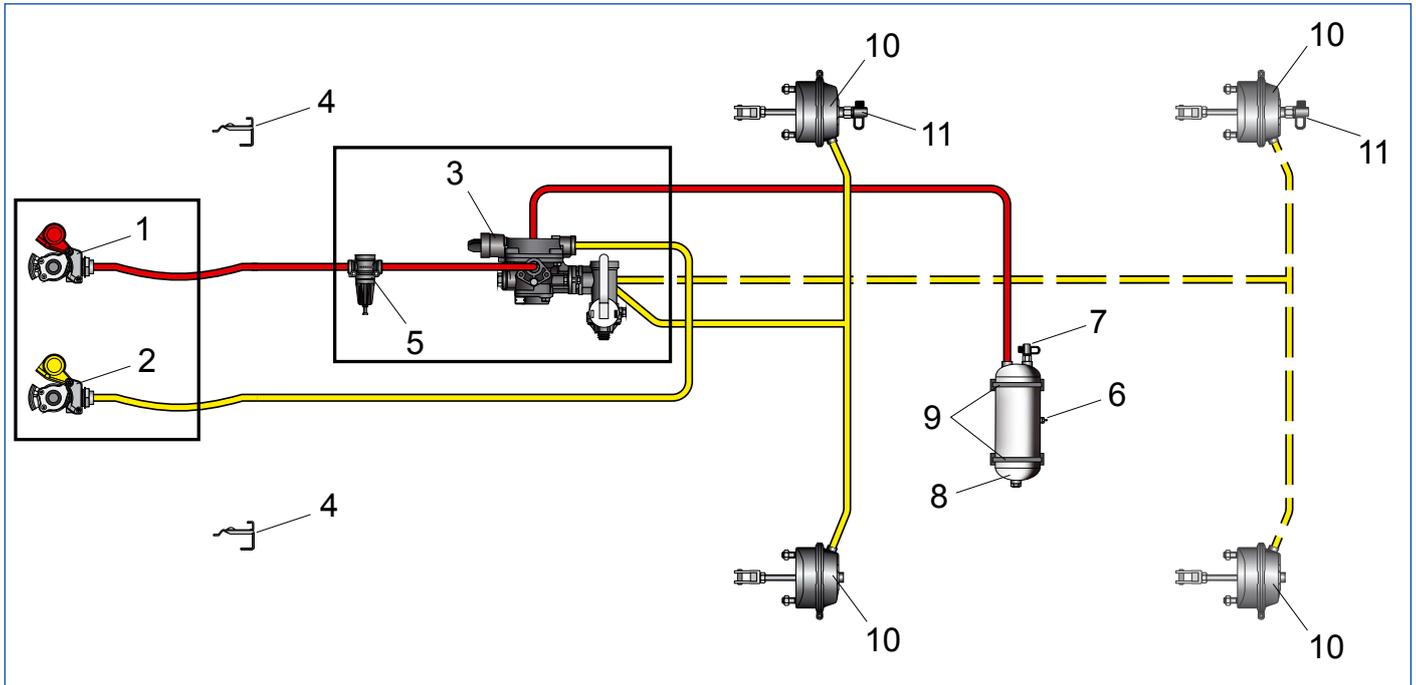


Fig. 8: 2 axle trailer with manual control device

Legend			
1	Coupling head "supply red" with filter	2	Coupling head "brake yellow" with filter
3	Trailer emergency valve with load-sensing valve	4	Dummy couplings with fastening
5	Pressure limiting valve	6	Drain valve
7	Test connection	8	Air reservoir
9	Clamping band	10	UNISTOP™ diaphragm brake cylinder (for conversion)
11	Test connection (for conversion); on port 2		New / in addition

- Replace position 3 with trailer brake valve 971 002 150 0 (re-fit the manual control device)

The following are required in addition:

Product	Product number
Pressure limiting valve 5.7 ^{+0.3} bar (pos. 5)	475 010 003 0
Coupling head "supply red" with filter (pos. 1)	952 201 004 0
Coupling head "brake red" with filter (pos. 2)	952 201 003 0

7 Test instruction for load sensing valve 475 713

7.1 General Information

! Carefully read through all the safety information before starting the test.

General safety instructions

- Only trained and qualified technicians may carry out the test of the device.
- Observe all accident regulations of the respective company as well as regional and national regulations.
- Use personal protective equipment if required (protective goggles, respiratory protection, ear protectors, etc.).
- Do not install a repaired device in the vehicle unless it has passed the following tests.
- Never install a leaking or damaged device on the vehicle. This could cause an accident.

Equipment/tools required

- Test bench 435 197 000 0 or adequate testing equipment
- Test hoses
- Matching test ports
- Test template (example Fig. 9)
- Nozzle Ø 0.8
- Soapsuds and brush

Additional documents required

- Test bench 435 197 000 0 - Operating instructions (815 000 048 3)
- General repair and test notes 815 020 109 3
- Outline Drawings



Documents

The documents are available on the WABCO website INFORM <http://inform.wabco-auto.com> - simply enter the product or document number in INFORM.

Hints for testing

- It is imperative that you follow these test instructions while testing the device.
- Only start testing after you have read and understood all information required for testing.
- Test the device only on a calibrated test bench.
- In cases of doubt, only use test values stipulated by the vehicle manufacturer.
- Perform the following test steps in the specified order.

7.2 Preparations

- Place the device onto the workbench.

 CAUTION	Risk of injury due to the device falling The falling device may injure your feet. <ul style="list-style-type: none">– <i>Ensure that the device cannot roll or drop off the workbench.</i>
--	--

External evaluation

- Examine the test device for signs of visible damage.
- Visually check all connections of the device for free passage.

Other preparations

- Clamp the test template into a vice.
- Fasten the device in the test template and align the zero point of the measurement scale to the centre point of the shaft of the LSV controller.

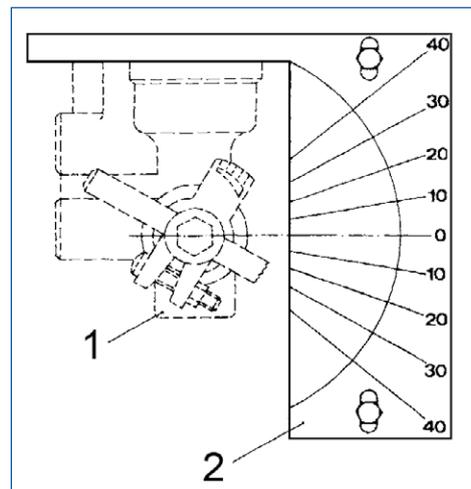


Fig. 9: Device with fastened test template

Legend			
1	LSV controller	2	Adjustable measurement scale

- Connect device to the test bench 435 197 000 0 or adequate test facility (see testing diagram).

 CAUTION	Risk of injury due to the hose coming off A hose that comes loose may cause injury. <ul style="list-style-type: none">– <i>Make sure that plug-in connections on the test bench / testing equipment and on the device are safely plugged.</i>
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Test instruction for load sensing valve 475 713



Outline Drawing

For the relevant supply pressure, refer to proposal drawing. You will find the outline drawing in the product catalogue INFORM at <http://inform.wabco-auto.com>

Make sure that the shut-off cocks on the test bench 435 197 000 0 are in the correct normal position.

Normal position of the shut-off cocks on the test bench 435 197 000 0

Shut-off cocks	A	B	C	F	L	V	2	3	4	6	7	11	12	21	22
at	x											x			
to		x	x	x	x	x	x	x	x	x	x		x	x	x

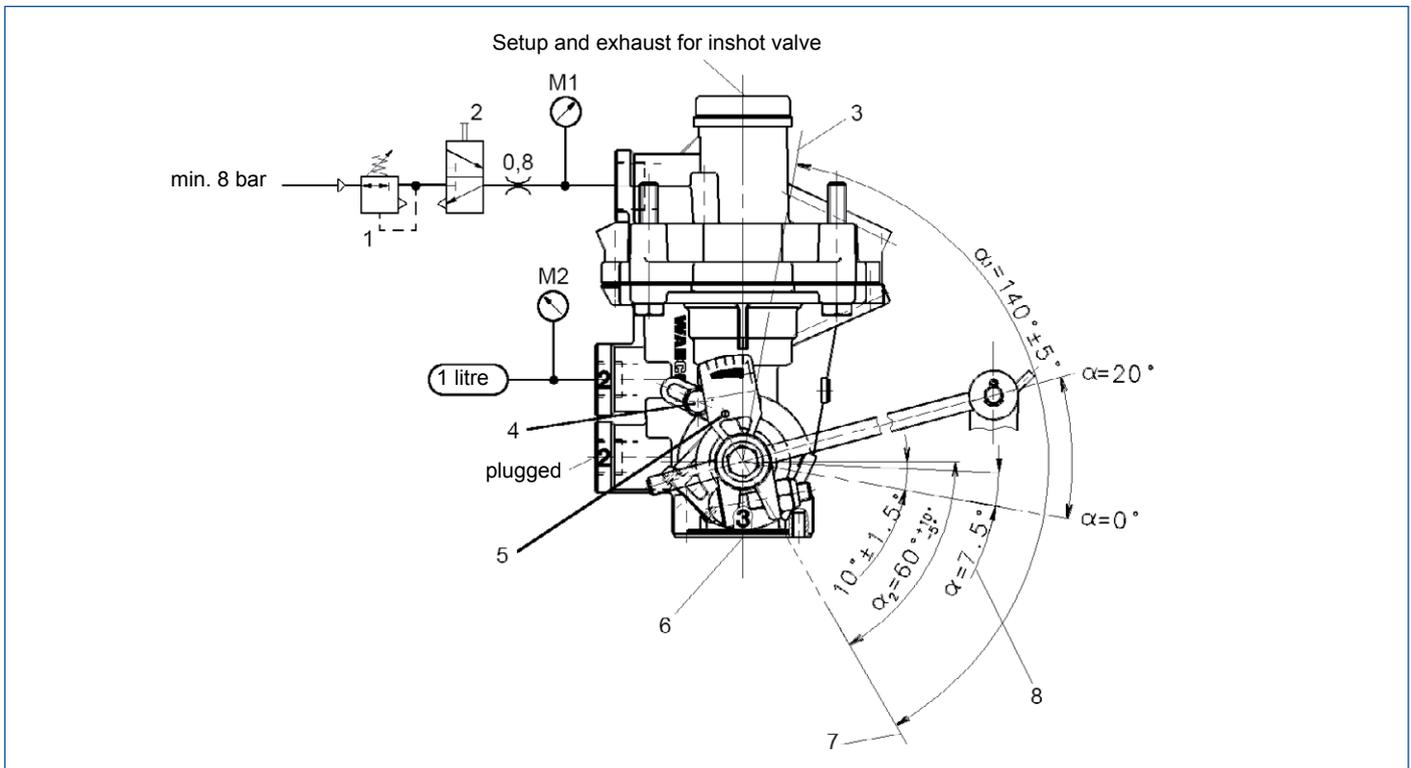


Fig. 10: Test scheme

Legend

1	Fine control valve 1	2	Shut-off cock 1
3	Stop 1	4	Hexagon screw
5	Parallel pin $\varnothing 3h 11 \times 40$ DIN 7	6	Venting
7	Stop 2	8	Set point
M1, M2	Pressure gauge		

Test instruction for load sensing valve 475 713

7.3 Test

No.	Test step	Default value		Test value M2 [bar]	Comment
		Lever position [°]	M1 [bar]		
1	Connect device according to diagram.	-	0	0	1x close port 2.
2	Open shut-off cock 1. Charge device several times via precision control valve 1. Open and close shut-off cock 1 several times.	-	7.5	-	
	Move the lever from stop 1 to stop 2 several times.	$\alpha_1 = 140^\circ \pm 5^\circ$ $\alpha_2 = 60^\circ + 10^\circ / -5^\circ$			The lever must move easily. It must be possible to reach angles α_1 and α_2 .
	Lower pressure with precision control valve 1.		0	0	
3	Increase pressure with precision control valve 1.	-	0.5	-	Permissible leakage at the device vent: $V_n \leq 8 \text{ cm}^3/\text{min}$.
4	Setting the pilot control				
4.1	Increase pressure using precision control valve 1.	-	7.5	-	
4.2	Move the lever until the lowest value is reached on M2.	-	0 ... 7.5 ... 0		Arrest the lever position. You must block the lever for each subsequent lever position or angle change.
4.3	Lower pressure via precision control valve 1.	-	0	-	
4.4	Increase pressure using precision control valve 1.	-	1.4	0.7 +0/-0.1	If the test value at M2 is not correct: Change the pilot control setting. Repeat the test from no. 4.3.
5	Setting the characteristic curve				
5.1	Increase pressure using precision control valve 1.	-	7.5	-	
5.2	Close shut-off cock 1.	-	0	0	
5.3	Move lever.	≈ 7.5	0	0	Lever length $\approx 7.5^\circ$ starting from 0° after test setup.
5.4	Open shut-off cock 1.	≈ 7.5	7.5	2.85 ± 0.1	If the test value at M2 is not correct: Correct the lever position until the test value corresponds. Repeat the test from no. 5.2 ... 5.4.
5.5	Close shut-off cock 1.	-	0	0	
5.6	Open shut-off cock 1.	-	7.5	2.85 ± 0.1	If the value at M2 differs, repeat test from no. 5.2 to 5.4.
5.7	Determine the angle difference between the desired angle and the actual angle.	-	7.5	-	
5.8	Close shut-off cock 1.	-	0	0	
5.9	Loosen hexagon screw M8 on the clamping piece.	-	0	0	
5.10	Move the lever to the stop to change the determined angle difference.	-	0	0	Angle $< 7.5^\circ$ towards stop 1 Angle $> 7.5^\circ$ towards stop 2
5.11	Tighten hexagon screw M8 on the clamping piece.	-	0	0	Tightening torque: M10 -2Nm Ensure that the clearance 62 ± 3 according to outline drawing is maintained.

Test instruction for load sensing valve 475 713

No.	Test step	Default value		Test value		Comment
		Lever position [°]	M1 [bar]	M2 [bar]	M2 [bar]	
6	Check the characteristic curve					
6.1	Move lever.	17.5	0	0		
6.2	Open shut-off cock 1.	17.5	7.5	6.6 +0.5/-0.3		
6.3	Lower pressure with precision control valve 1.	17.5	0	0		
7	Tappet clamping					
7.1	Increase pressure with precision control valve 1.	17.5	1.4	1.0 ±0.1		Max. permissible pressure drop $\Delta p = 0.1$ bar in 10 sec.
7.2	Move lever.	$-5^\circ < \alpha < 0^\circ$	1.4	*		* value determined in no. 7.1
7.3	Lower pressure with precision control valve 1.	-	0	0		
8	Fully laden position					
8.1	Set lever.	21.5	0	0		Fix this lever position with a parallel pin $\varnothing 3 \times 40$ via the hole $\varnothing 3$ of the bracket and the clamp piece. Tighten the screw with M4 ₁ Nm. Remove parallel pin.
8.2	Increase pressure with precision control valve 1.	21.5	0.2	> 0		Pressure indication on M2.
8.3	Increase pressure with precision control valve 1.	21.5	7.5	7.5		Value on M2 must follow immediately.
8.4	Check device for tightness.	21.5	7.5	7.5		Permissible leakage: $v_n \leq 8$ cm ³ /min.
8.5	Lower pressure with precision control valve 1.	21.5	5.5	< 7,5		
8.6	Lower pressure with precision control valve 1.	21.5	0	0		Value on M2 must follow immediately.
9	Unladen position					
9.1	Set lever.	0	0	0		
9.2	Increase pressure with precision control valve 1.	0	0.4	> 0		Pressure indication on M2.
9.3	Increase pressure with precision control valve 1.	0	1.5	-		
9.4	Test grading.	0	> 1.5			Pressure stages on M2 ≤ 0.1 bar.
9.5	Increase pressure with precision control valve 1.	0	6.5	-		Value on M2 must follow immediately.
9.6	Test grading.	0	> 6.5			Pressure stages on M2 ≤ 0.1 bar.
9.7	Increase pressure with precision control valve 1.	0	7.5	1.2 ±0.15		
9.8	Check device for tightness.	0	7.5	1.2 ±0.15		Permissible leakage: $v_n \leq 8$ cm ³ /min
9.9	Lower pressure with precision control valve 1.	0	4	< M2*		M2 * = actual value same is with no. 9.7 and 9.8
9.10	Lower pressure with precision control valve 1.	0	0	0		Value on M2 must follow immediately.
10	Full-load position after a break of linkage					
10.1	Release lever.		-	-		The lever must move up to stop 1.
10.2	Increase pressure with precision control valve 1.		7.5	7.5		
11	Completion of test					
11.1	Set precision control valve 1 to 0 bar.	0	0	0		Open port 2 2x.
11.2	Unclamp device.					Do not disconnect the hose connections until you have vented the device to 0 bar. Clean device.



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