Kraftfahrt-Bundesamt

DE-24932 Flensburg

Bestätigung des Kraftfahrt-Bundesamt für

Confirmation by the Kraftfahrt-Bundesamt with respect to

[X] ein Prüfprotokoll über ein Anhänger-Bremsventil mit Notbremseinrichtung für Anhänger nach der UNECE-Regelung Nr. 13
with respect to a Trailer Brake Emergency Valve test report according to UNECE-Regulation No. 13

[X] einen Testbericht über ein Anhänger-Bremsventil mit Notbremseinrichtung nach der Richtlinie 71/320/EWG
with respect to a Trailer Brake Emergency Valve test report to Directive 71/320/EEC

Die Systemkomponente, beschrieben im anliegenden Technischen Bericht –
The system component described in the Technical Report attached

Prüfprotokoll Nr.: KO250.4E
Test report No.

vom 19.03.2010
dated

Hersteller:
Manufacturer:

Haldex Brake Products GmbH

Bezeichnung des Systems: **TrCM^{+}**
System name

entspricht nach Aussage der
- is, according to a statement issued by:

TÜV Nord Mobilität GmbH & Co.KG
DE-30519 Hannover und / and DE-45307 Essen

den Anforderungen der ECE-Regelung Nr. 13 einschließlich Änderungsserie 11 und den Anforderungen der Richtlinie 71/320/EWG in der Fassung 2006/96/EG für Anhängefahrzeuge mit Zweileitungs-Bremsanlagen mit rein pneumatischer oder pneumatisch-elektrischer Ansteuerung.

in accordance with ECE-Regulation No. 13, series of Amendments 11.and in accordance with Directive 71/320/EEC, as last amended by Directive 2006/96/EC for trailers with twin-line braking systems with purely pneumatic or pneumatic/electric control.

Hinsichtlich des Verwendungsbereichs und der Ein- bzw. Anbauvorschriften wird auf die Festlegungen im oben genannten Technischen Bericht hingewiesen. *(For details to the range of use and the installation or mounting regulations consult the aforementioned Technical Report.)*

Bestätigung: Die TÜV NORD MOBILITÄT GmbH & Co. KG ist vom Kraftfahrt-Bundesamt als Prüflaboratorium für Bremsanlagen nach der EG-Richtlinie 71/320/EWG und der ECE Regelung Nr. 13 akkreditiert und unter der KBA-P 00004-96 registriert.

Confirmation: TÜV Nord Mobilität GmbH & Co. KG is accredited by the German Federal Motor Transport Authority as a Testing Laboratory for braking systems according to Directive 71/320/EEC and ECE Regulation No. 13 and is registered under the No. KBA-P 00004-96.

Ort - Place: **DE-24932 Flensburg**

Datum - Date: **26.03.2010**

Unterschrift: **Im Auftrag**
Signature:

(Stegemann)

Anlagen: **1 Technischer Bericht. KO250.4E**
(Annex) 1 Technical Report No. KO250.4E

Technical Report

No. KO250.4E

on the „TRAILER CONTROL MODULE+“

TÜV NORD Mobilität GmbH & Co. KG

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0. General

This Technical Report serves as a working document for the officially authorised expert or examiner of the accredited testing laboratory in the assessment of trailers according to §§ 19, 20 and 21 StVZO or Directive 71/320/EEC and ECE Regulation No. 13.

With respect to the previous TÜV NORD Report KO250.3 this report covers the following amendments:

- Change of name from “Trailer Control Module” into “Trailer Control Module+”
- Reintroductions of version “A” and “C” (see previous TÜV NORD Report KO250.2) – modified internal non-return valve
- Adding of “Parking Hold” function (see paragraph 3.1.1)

For the sake of simplicity the abbreviation **TrCM+** is used in this report for the type „Trailer Control Module+“.

1. Identification

1.1	Manufacturer:	**Haldex Brake Products GmbH** **Mittelgewannweg 27** **D-69123 Heidelberg-Wieblingen**
1.2	Applicant:	**As 1.1**
1.3	System component:	**Trailer brake valve with emergency brake device, combined control valves (shunt and parking brake valve with “parking hold” function) and an optional pressure protection valve without backflow**
1.4	Type of device:	**Trailer Control Module+**

1.4.1 Versions:

A) with pressure protection valve and with internal non-return valve

B) with pressure protection valve and without internal non-return valve

C) without pressure protection valve and with internal non-return valve

D) without pressure protection valve and without internal non-return valve

2 Area of use

2.1 Vehicles:

Trailers of the categories O according to the Framework Directives 2007/46/EC (70/156/EEC) and according to Annex 7 of the "Consolidated Resolution on the Construction of Vehicles (R.E.3)"

2.2 Braking systems:

Power-operated braking systems with pneumatic transmission; designed according to the specifications of StVZO or Directive 71/320/EEC or ECE-Regulation No. 13

2.2.1 Notice:

The TrCM^{+} is intended for installation in twin-line braking systems with purely pneumatic (see paragraph 5.1.3.1.1 of ECE-13) or pneumatic/electric control (see paragraph 5.1.3.1.2 of ECE-13).

3 Technical details

3.1 General:

The TrCM^{+} is a trailer brake valve with emergency brake device (automatic braking), combined control valves (shunt and parking brake valve) and an optional pressure protection valve without backflow.

The shunt valve allows the disconnection of the "emergency braking" function, see paragraph 3.5.6 below.

Actuation of the parking brake valve releases or applies the parking braking system.

3.1.1 Parking hold:

In case of pressure loss in the supply line, immediate change of parking brake control position from "not activated" to "activated".

The "parking hold" function is an additional safety feature to insure that no unintended release of the parking brake (spring brakes) occurs.

In case of pressure loss in the supply line (un-coupling of the red supply line), the parking brake control position changes automatically from “not activated” to “activated” (red control knob pulled out).

When the supply line is re-coupled, the supply line can only inflate the chamber of the spring brakes (parking brake released) after the driver has consciously pushed the parking brake control into the “not activated” position.

By this it is always ensured that the trailer is either braked “on air” (service brake) or in the case of insufficient brake air reservoir pressure by the spring brakes unless the driver consciously releases the parking brake by pushing the red control knob into the “not activated” position.

It is only possible to bring the red control knob into the “release position” (“not activated” position) when the supply line pressure has reached a certain level (around 400 to 500 kPa).

Versions A and B

The pressure protection valve without backflow integrated in the TrCM^{+} assures the priority compressed air supply of the braking system and prevents any inadmissible mutual pressure influence between braking system and auxiliary equipment.

Versions C and D

The TrCM^{+} without pressure protection valve may be used in braking systems without auxiliary equipment or in braking systems where the function of pressure protection is ensured by another device.

3.2 Installation:

The TrCM^{+} is intended for the installation in trailers (semi-trailers, centre-axle trailers, full trailers) with ABS or EBS and with spring actuated braking systems.

3.3 Identification:

Haldex part numbers *

	Version			
	A	**B**	**C**	**D**
352 067	60x	50x	62x	52x
	61x	51x	63x	53x
	64x	54x		
	65x	55x		
	66x	56x		
	67x	57x		
	68x	58x		
	69x	59x		

* The Haldex numbers not fully specified (by the letter "x) in this report indicate that modifications to the TrCM^{+} (e.g. threaded connections, characteristics etc.) are possible, but such modifications do not affect the function and performance in relation to the assessment conducted.

3.4 Ports:

The TrCM^{+} has the following ports:

Port 1: Supply line (coupling head, red)

Port 4: Control line (coupling head, yellow)

Port 21: Control line (to the braking device/modulator or LSV)

Port 12: Connecting line from TrCM^{+} to port 21

Port 2: Spring braking system

Ports 1-2: Brake air reservoir

Port 3: Exhaust

Ports 23, 24, 25 (only versions A and B): Shorted (common) connections for the auxiliary equipment (e.g. air suspension, backup interlock for trailing axles etc.)

3.5 Function

3.5.1 Pressure loss in the supply line / automatic braking

Air reservoir / auxiliary equipment:

If the supply line (red coupling head) breaks off, integrated non-return valves prevent the supply air from escaping out of the air reservoir(s) of the trailer braking system and – if any – of the auxiliary equipment.

Effect on the service braking system:

If the pressure in the supply line falls by at least 100 kPa per second, the trailer is automatically braked before the pressure in the supply line has fallen to 200 kPa (see par. 2.2.1.18.4.2, Annex I of Directive 71/320/EEC or par. 5.2.1.18.4.2 of ECE Regulation No. 13). In addition a direct connection is made between the brake air reservoir (port 1-2) and the control line (port 21).

This assures that the automatic braking is provided by the service braking system and hence is ABS-controlled.

Wheel locking is prevented by ABS control until the spring actuated parking brake forces cause the wheels to lock because the brake air reservoir pressure has dropped below the application pressure of the spring braking system.

This application pressure is normally below 450 kPa. In the case of the Haldex **EB+** the pressure of 450 kPa is equivalent to the warning pressure at which the red and yellow warning signals indicate that the prescribed service braking performance is no longer ensured.

Note: "Application pressure" is used here to mean the pressure at which the wheel brakes are applied if the pressure in the spring compression chamber is **lowered** from a high pressure (e.g. 650 kPa) to a lower pressure.

Effect on the parking braking system:

In the case of a pressure loss in the supply line the "parking hold" function comes into operation. The parking brake control position changes automatically from "not activated" to "activated" (red control knob pulled out); see paragraph 3.1.1.

Once the automatic braking is initiated, the current pressure of the brake air reservoir is introduced by the incorporated two-way check (anti-compounding) valve into the service brake actuators and spring brake actuators via ports 21 (12) and 2 respectively.

3.5.2 Pressure loss in the auxiliary equipment (Version A and B)

Brake air reservoir:

In the case of pressure loss in the auxiliary equipment a "securing pressure" of at least 520 kPa in the brake air reservoir of the service braking system is guaranteed by the integrated pressure protection valve (opening pressure of 620 (+10/-20) kPa) in order to meet the statutory requirements (see Directive 2002/78/EC, Annex I, paragraph 2.2.2.15 or ECE Regulation No. 13, paragraph 5.2.2.14 and paragraph 3.5.3 below in this report).

Effect on the service braking system:

A pressure loss in an auxiliary equipment does not reduce the pressure in the service braking system below the required "securing pressure" of at least 520 kPa (see paragraph 4.3 below).

Effect on the parking braking system:

With the spring braking system **released** (red control knob pushed) the pressure in the spring braking system is not lowered.

With the spring braking system **applied** (red control knob pulled out) the parking brake performance is maintained.

3.5.3 Pressure loss in brake air reservoir

Auxiliary equipment: (Version A and B)

In the case of pressure loss in the brake air reservoir the auxiliary equipment is protected by a non-return valve integrated in the pressure protection valve. There is no backflow from the auxiliary equipment to the braking system. In this way the test requirement of isolating the energy storage device(s) for the auxiliary equipment according to paragraph 1.3.2.2 (Annex IV (A), Directive 71/320/EEC or Annex 7 (A) of ECE Regulation No. 13) is fulfilled.

Effect on the service braking system:

Lowering of the brake air reservoir pressure also reduces the pressure in the supply line (port 1), which triggers the automatic braking (see chapter 3.5.1 above).

Effect on the parking braking system:

see chapter 3.5.1

3.5.4 Pressure input through the coupling head of the control line / response time

Supply line connected -
Effect on auxiliary equipment / brake air reservoir:

With the supply line connected the supply pressure provided by the towing vehicle is available in the braking system without limitation.

Supply line connected
Effect on service braking system:

With pressure input through the coupling head pressure of the control line is passed on undiminished to control port "21" via port 4 ("push through").

Response time:

Based on the design of the TrCM+, a similar response time to that for a conventional relay emergency valve (REV) is expected (see also chapter 4.5).

Supply line connected
Effect on parking braking system: None

Supply line not connected:

Red control knob pulled out; see paragraph 3.1.1.

In the case of pressure input through the coupling head of the control line (e.g. with applied parking braking system of the towing vehicle) the brake air reservoir and hence as well the auxiliary equipment with a pressure reduced by the overflow loss (see also paragraph 4.5) are filled. Filling of the auxiliary equipment depends on the opening pressure of the integrated pressure protection valve.
As a result, an empty / partially filled braking system is **already** filled **before** the coupling head of the supply line is connected.

The automatic braking initiated by the disconnected coupling head of the supply line is **not** affected by this, i.e. even with no braking pressure at the coupling head of the control line (for instance with no longer applied parking braking system of the towing vehicle) the automatic braking is sustained.

With the incorporated two-way check (anti-compounding) valve the current pressure of the brake air reservoir is feeding the service brake actuators via port 21 and the spring brake actuators via ports 21 (12) and 2.

3.5.5 Actuation of parking braking system:

By pulling the red control knob (**applied** position) the spring brake chamber (port 2) is connected with the air exhaust (port 3), either directly or via the service brake circuit ports 12, 21 and 4 (depending on the actual position of the two-way check valve).

Via the two-way check (anti-compounding) valve the spring braking system (port 2) is connected either with the brake air reservoir (port 1-2) or the service brake circuit (ports 21 and 12 respectively). By pushing the red control knob the spring brake chamber is inflated with the higher pressure acting on this valve. In this way the pressure in the spring braking system is increased and the parking braking system is **released**.

3.5.6 Release device (Shunt valve):

The shunt valve allows the cancellation of the automatic braking ("emergency braking") triggered by disconnecting the supply line (see EC Directive, Annex I, paragraph 2.2.2.11 or ECE-R13, paragraph 5.2.2.11).
The automatic braking is cancelled by pushing the black control knob (with the supply line disconnected). This is achieved by disconnecting port 21 from port 1-2 and connecting port 21 to port 4.*****

When the supply line is reconnected and compressed air is made available the shunt valve returns automatically into normal operation position (see Directive 2002/78/EC, Annex I, paragraph 2.2.2.11 or ECE Regulation No. 13, paragraph 5.2.2.11).

* **Note**

During disconnection of the supply line the parking brake control position changes automatically from "not activated" to "activated" (red control knob pulled out), see paragraph 3.1.1. Thus, after applying the shunt valve the parking spring brakes have to be released to manoeuvre the trailer.

3.5.7 Size of the brake air reservoirs:

Paragraph 1.3 of Annex IV of the Directive 71/320/EEC or paragraph 1.3 of Annex 7 of the ECE Regulation No. 13 demand that brake air reservoirs with which trailers are equipped shall be such that, after eight full-stroke actuations of the towing vehicle's service braking system, the energy level supplied to the operating members using the energy does not fall below a level equivalent to one-half of the figure obtained at the first brake application and without actuating either the automatic or the parking braking system of the trailer.

See also the measurement performed in chapter 4.8 below.

4 Tests

4.1 General:

The tests listed below were conducted on sample braking systems (bench and vehicle tests).

Bench tests: See annexes **2a** (with "**TrCM**") and **2b** (with conventional "**REV**"): brake air reservoir 120 l, reservoir for auxiliary equipment 60 l, size of brake actuators 6x30"/30".

Vehicle tests: Annex 3 shows the braking system of a three-axle semi-trailer which was also used to prove the functionality of the TrCM (up to TÜV NORD Report KO250.3) and TrCM+ device.

4.2 Pressure loss in the supply line / automatic braking (chapter 3.5.1)

Brake air reservoir / auxiliary equipment:

With the supply line disconnected/broken off (red coupling head) the air consumption of the automatic braking operation lowered the pressure level of the brake air reservoir slightly, the pressure level of the air reservoir for the auxiliary equipment remained unchanged. Escape of the supply air from the brake air reservoir on the interrupted supply line is prevented.

Effect on the service braking system:

When the pressure in the supply line fell by at least 100 kPa per second, the automatic braking began at a pressure of approx. 230 kPa.

Version B and D (without internal non-return valve)

By means of driving tests performed by the manufacturer (see chapter 5.1 below) on roadways with a low coefficient of adhesion it was demonstrated that ABS control prevented wheel locking up to an brake air reservoir pressure of approx. 370 kPa (see also chapter 3.5.1). At this pressure a braking force was produced by the spring brake actuators.

Version A and C (with internal non-return valve)

These versions prevents that the pressure in the spring brake chambers is lowered with decreasing brake air reservoir pressure. Thus, the ABS function is also ensured until a pressure is reached where automatic braking occurs; see also paragraph 3.5.1.

Effect on the parking braking system:

With the spring braking system **released** (red control knob pushed) the pressure in the spring braking system was maintained until the automatic braking started at approx. 230 kPa. Once the automatic braking had started the pressure levels in ports 21, 2 and 1-2 were balanced.

With the spring braking system **applied** (red control knob pulled) port 2 was exhausted and stayed so when the pressure in the supply line was lowered.

4.3 Pressure loss in the auxiliary equipment (chapter 3.5.2) (Versions A and B)

Brake air reservoir:

When pressure loss occurred in the auxiliary equipment a “protecting pressure” of approx. 560 kPa was reached in the brake air reservoir of the service braking system.

Effect on the service braking system:

With service braking system **released** and simultaneous pressure loss in the auxiliary equipment no direct effect on the service braking system was established (service braking system stays released).
With service braking system **applied** (p_m = 830 kPa) and simultaneous total pressure loss in the auxiliaries

circuit the pressure previously fed into the service brake actuators fell from 810 kPa to approx. 560 kPa. The pressure in the brake air reservoir had also fallen to 560 kPa.

Effect on the parking braking system:

With the spring braking system **released** (red control knob pushed) the pressure in the spring braking system was not lowered.

With the spring braking system **applied** (red control knob pulled out) the parking brake performance was maintained.

4.4 Pressure loss in the brake air reservoir (chapter 3.5.3) (with insuffient recharging from the supply line*)

*** Supply line connected; however, closed.**

Auxiliary equipment:

Versions A and C (with pressure protection valve)

When the pressure in the brake air reservoir was lowered from 850 kPa to a value of 0 kPa there was no backflow from the air reservoir of the auxiliaries.

Effect on the service braking system:

Lowering the brake air reservoir pressure reduced the pressure in the supply line (port 1) which triggered the automatic braking (at around 220 kPa). Thus, the resulting braking pressure corresponded to the current pressure of the brake air reservoir of the service braking system.

Effect on the parking braking system:

Spring braking system **released** (red control knob pushed) - Version A

Lowering the brake air reservoir pressure (initial pressure 830 kPa) reduced the pressure in the supply line (port 1) which triggered the automatic braking (at around 220 kPa) which resulted in positioning the red control knob into the applied position (pulled position); see paragraph 3.1.1 “parking hold” function.

With further pressure reduction in the brake air reservoir lead to same pressure level at ports 21, 2 and 1-2 until ports 21 and 2 were evenly vented (application of the spring brakes).

Spring braking system **applied** (red control knob pulled out), pressure in spring brake chamber 0 kPa, no control pressure from towing vehicle
Lowering the brake air reservoir pressure (initial pressure 830 kPa) reduced the pressure in the supply line (port 1) which triggered the automatic braking (at around 220 kPa).

In the event of automatic braking a temporary pressure rise via the internal two-way check (anti-compounding) valve in the spring brake chamber to around 210 kPa occurs.

With further pressure reduction within the service braking system energy reserve resulted in a corresponding reduction in the pressure in the spring compression chamber (Port 2 remained connected to exhaust).

Note

Due to the low test pressure of less than 200 kPa in the supply line the red knob could not be pushed fully home in order to stay in this position (see paragraph 3.1.1).

4.5 Pressure input through the coupling head of the control line / response time (chapter 3.5.4)

Supply line not connected:

Parking brake control position changed automatically to the "**activated**" position (red control knob pulled out).

In the case of **pressure input** through the coupling head of the control line (e.g. with applied parking braking system of the towing vehicle) the control line (port 21) to the braking device (ABS/EBS modulator) was aerated. Parallel to this, the brake air reservoirs and (hence once the opening pressure of the integrated pressure protection valve of 620 kPa was exceeded) the auxiliaries' circuit was as well filled with a pressure which was approx. 150 kPa below the opening pressure of the charging valve (overflow loss).

The automatic braking and the pressure in the reservoirs were maintained after venting of the coupling head of the control line.

The disconnected unpressurised supply line was unaffected during the filling phase through the coupling head of the control line and so the automatic braking initiated through the disconnected coupling head of the supply line was sustained.

While the spring braking system was **applied** (red control knob pulled out) port 2 remained vented, i.e. the action of the spring braking system was not released.

Response time:

With a view to the response time, reference measurements were conducted on the sample braking systems according to annexes 2a and 2b with the TrCM* and the conventional Haldex relay emergency valves (REV) Nos. **351008 …, 351 009 …** and **351 033 ….**

Time between the moment when the pressure of 65 kPa introduced by the simulator into the control line is reached and the moment when the pressure in the brake cylinder of the trailer reaches 75% of the asymptotic value.			
Haldex TrCM* 352 067 …	**Haldex REV 351 008 …**	**Haldex REV 351 009 …**	**Haldex REV 351 033 …**
0.44 s	**0.41 s**	**0.41 s**	**0.41 s**
pneumatic control			

* Previous name for the TrCM+

The measurements revealed a comparable time response.

4.6 Actuation of parking braking system (Chapter 3.5.5):

At a pressure of 820 kPa in the brake air reservoir the pressure in the spring braking system was exhausted by pulling the red control knob and the parking braking system was **applied**.

By pushing the red control knob the pressure in the spring braking system was increased and the parking braking system **released**.

4.7 Release device (Shunt valve) (Chapter 3.5.6):

The automatic braking (emergency braking) was suspended by pushing the black control knob (with the supply line disconnected).
When the supply line was reconnected and compressed air was fed, the shunt valve returned automatically into normal operating position. This was also achieved by manual operation (pulling the black control knob).

4.8 Size of the brake air reservoir for the braking system:

The brake air reservoir pressure of the sample braking system tested (see **Annex 2a**) had fallen to 810 kPa after the first full braking. After the eighth full braking the pressure in the brake air reservoir was still 630 kPa.

5 Test documents:

5.1 Engineering Report No. C9414 of 08.06.2004: Trailer Control Module Valve Performance Tests

5.2 Engineering Report No. A9915 of 11.10.2007: TrCM Evaluation ED 1521

6 Annexes

Diagram of Trailer Control Module^{+}	Annex 1
Test set-up – Bench test **with** TrCM	Annex 2a
Test set-up – Bench test with REV (**without** TrCM)	Annex 2b
Test trailer **with** TrCM^{+} (Version A and C)	Annex 3

7 Concluding certification

It is hereby confirmed that there is no technical reason to object to the installation / replacement of the trailer brake valve of the type TrCM^{+} instead of the combination of a conventional relay emergency valve (REV) with separate “Park & Shunt Valve”, see brake diagram of **Annex 2b**.

The previous trailer brake valve of the type TrCM can be replaced by the new type TrCM^{+}.

The provisions of Directive 71/320/EEC in the version of the Directive 2002/78/EC and ECE Regulation No. 13, including Supplement 3 to the 11 series of amendments* and of Section 41 StVZO can be regarded as satisfied with respect to the statutory requirements given in this report.

* The technical content of this report remains valid for future amendments of ECE-Regulation No. 13 provided that such future amendments do not change the technical requirements and procedures associated with the device covered by this report.

Regulatory note

with respect to a proposal for Annex 8 of ECE-R13 adopted by the brake experts group in Geneva (GRRF) at its 67th Session.

The original official UK proposal ECE/TRANS/WP.29/GRRF/2010/11 of 23rd November 2009 was amended by the following Informal Document No. **GRRF-67-08 -** (67th GRRF, 2-5 February 2010):

> *2.8. Trailers which utilise the service braking system energy reserves to fulfil the requirements for the automatic brake as defined in paragraph 3.3 of Annex 4 shall also fulfil one of the following requirements when the trailer is uncoupled from the towing vehicle and the trailer park brake control is in the released position (spring brakes not applied):*
>
> - *When the energy reserves of the service braking system reduce to a pressure no lower than 280kPa the pressure in the spring brake compression chamber shall reduce to 0kPa to fully apply the spring brakes. This requirement shall be verified with a constant service braking system energy reserve pressure of 280kPa.*
> - *A reduction in the pressure within the service braking system energy reserve results in a corresponding reduction in the pressure in the spring compression chamber.*

The above paragraph is only applicable when "*when the trailer is uncoupled from the towing vehicle and the trailer park brake control is in the released position (spring brakes not applied)*".

These conditions are never met by the TrCM+. When the trailer is uncoupled from the towing vehicle the trailer park brake control is always in the **applied** position.

Essen, 19th March 2010
TDB/Gaupp
Order-No. 8106402620

TÜV NORD Mobilität GmbH & Co. KG
Institute for Vehicle Technology and Mobility (IFM)

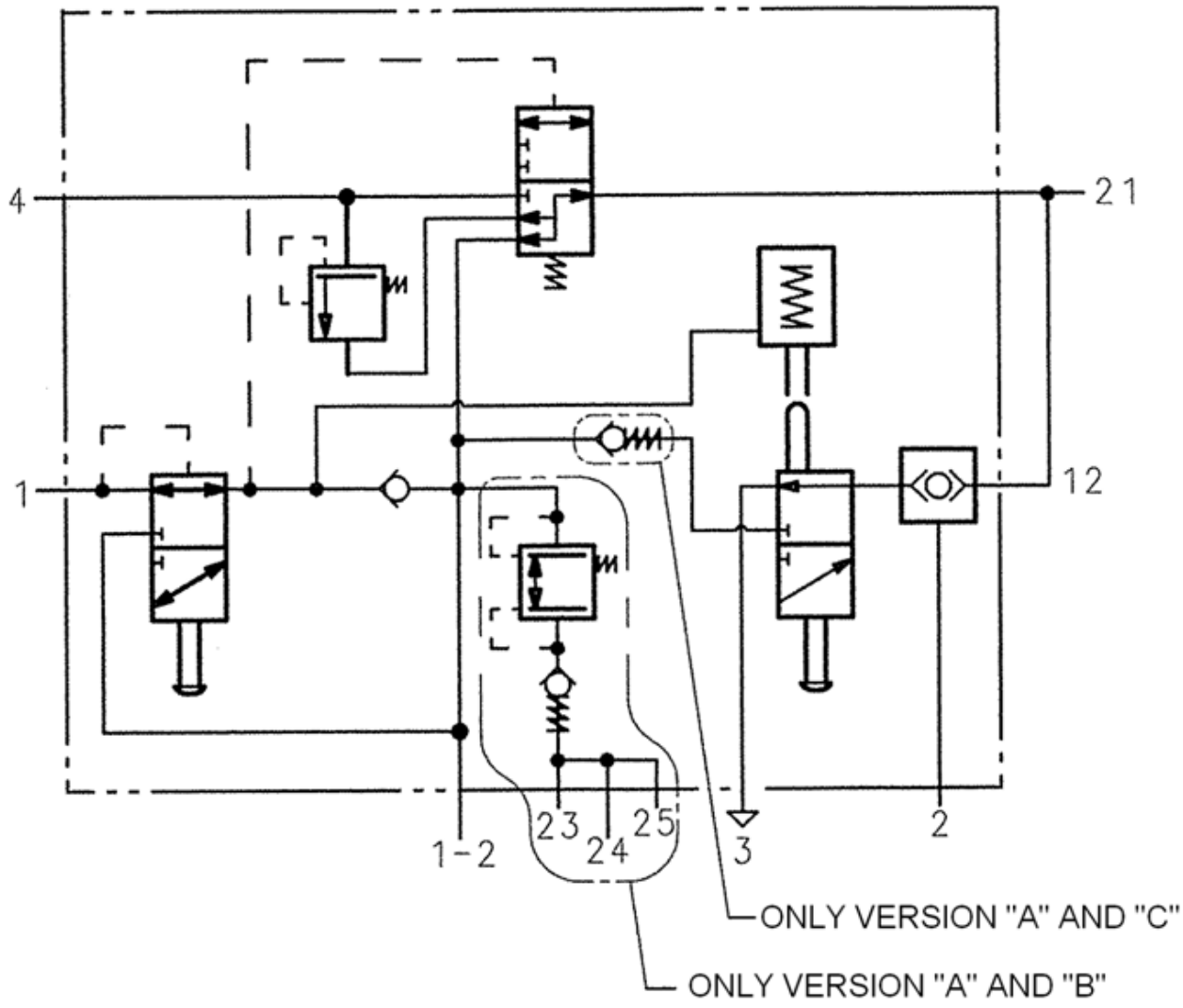
Technical Service for Braking Systems

Dipl.-Ing. Winfried Gaupp

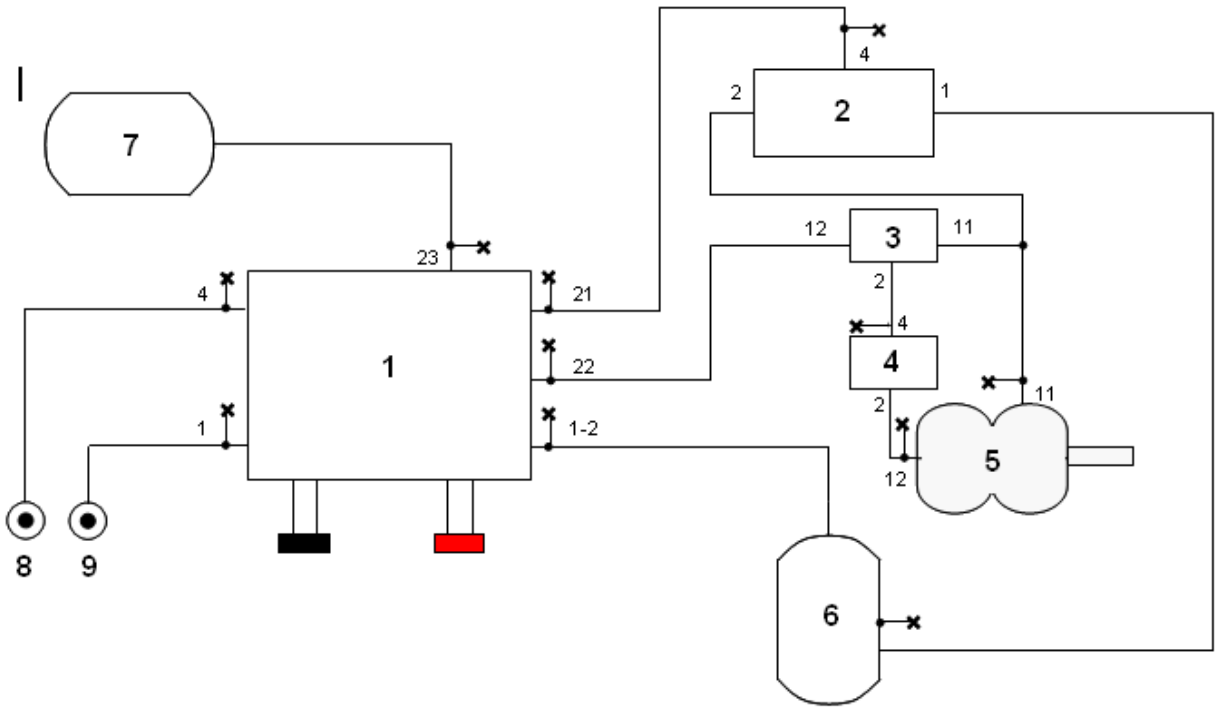
Accredited by the accreditation authority of the Kraftfahrt-Bundesamt Bundesrepublik Deutschland - Federal Republic of Germany - DAR-registration-number KBA-P 00004-96

TB:	KO250.4E	Annex 1
Brake device:	TrCM+	

Diagram of Trailer Control Module+

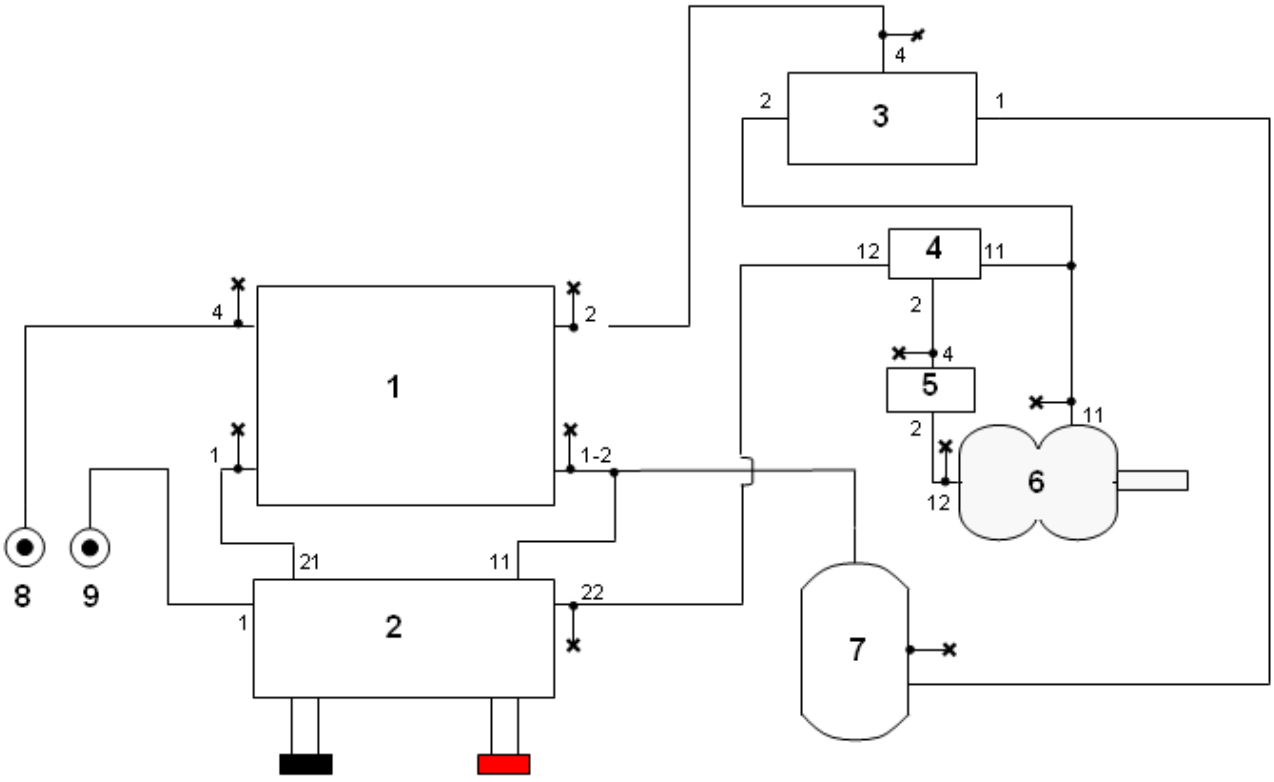


Bench test – Trailer Control Module



Nr. / No	Anz./ Qty.	Bezeichnung	Description
1	1	Trailer Control Module	Trailer Control Module
2	1	ABS / EBS / Relais	ABS / EBS - Relay
3	1	Zweiwegeventil	Two - way check valve
4	1	Schnelllöseventil	Quick release valve
5	6	Kombizylinder Typ 30/30	Spring brakes Type 30/30
6	1	Vorratsbehälter 120 Liter	Reservoir 120 litre
7	1	Vorratsbehälter Nebenverbraucher 60Liter	Reservoir 60 litre (Auxiliary)
8	1	Kupplungskopf - Gelb (KKG) Kupplungskopf - Bremse (KKB)	Coupling head CONTROL - LINE / yellow
9	1	Kupplungskopf - Rot (KKR) Kupplungskopf - Vorrat (KKV)	Coupling head SUPPLY - LINE / red

Bench test – REV



Nr. / No	Anz./ Qty.	Bezeichnung	Description
1	1	REV	Relay - Emergency Valve
2	1	P&S Doppelllöseventil	Park & Shut Valve
3	1	ABS / EBS / Relais	ABS / EBS - Relay
4	1	Zweiwegeventil	Two - way check valve
5	1	Schnelllöseventil	Quick release valve
6	6	Kombizylinder Typ 30/30	Spring brakes Type 30/30
7	1	Vorratsbehälter 120 Liter	Reservoir 120 litre
8	1	Kupplungskopf - Gelb (KKG) Kupplungskopf - Bremse (KKB)	Coupling head CONTROL - LINE / yellow
9	1	Kupplungskopf - Rot (KKR) Kupplungskopf - Vorrat (KKV)	Coupling head SUPPLY - LINE / red

TB: KO250.4E	Annex 3
Brake device: TrCM+	

Test Trailer with TrCM+