



# Kraftfahrt-Bundesamt (Federal Motor Transport Authority)

Bundesrepublik Deutschland  
D-24932 Flensburg

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## Bestätigung

### über ein Bremssystem mit elektrischer Steuer-Übertragungseinrichtung

(Confirmation with respect with an  
electric control transmission braking system)

Hersteller: **WABCO Vehicle Control Systems**  
**Am Lindener Hafen 21**  
**D-30453 Hannover**

System: **Vario Compact Trailer ABS 2<sup>nd</sup>**  
**Generation (VCS II)**

Das elektronische Bremssystem, beschrieben im anliegenden Technischen Bericht  
(The electronic braking system described in the Technical Report attached)

Nr.: **EB 141.0E**  
No.

**vom 24.11.2003**  
dated

entspricht nach Aussage der  
(is, according to a statement issued by)

**RWTÜV Fahrzeug GmbH**  
**45307 Essen**

den Anforderungen an die speziellen Vorschriften für Anhänger mit elektrischer  
Steuer-Übertragungseinrichtung gemäß der ECE-Regelung Nr. 13 einschließlich  
Änderungsserie 09 (Ergänzung 8).

(in accordance with the special requirements for trailer vehicles equipped  
with an electric control transmission according to ECE-Regulation No. 13, series of  
Amendments 09 (Supplement 8)).

Hinsichtlich des Verwendungsbereichs und der Ein- bzw. Anbauvorschriften gelten  
die im oben genannten Technischen Bericht festgeschriebenen Angaben.

(With regard to the range of use and the installation or mounting regulations, the  
details laid down in the aforementioned Technical Report apply.)



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Die RWTÜV Fahrzeug GmbH 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 Nummer KBA-P 00009-95 registriert.

(RWTÜV Fahrzeug GmbH 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 00009-95.)

**Anlagen: 1 Technischer Bericht Nr. EB 141.0E**  
(Annex) 1 Technical Report No. EB 141.0E

Flensburg, 10.12.2003

Im Auftrag (By order)  
Volker Suwe

Beglaubigt:  
(Certified)

*Strenkau*



# Electronic Function & Safety Assessment Test Report

Approval Report No: **EB 141.0E**

RWTÜV Fahrzeug GmbH

A RWTÜV Group Company

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## 0. General

This Test Report has been compiled to verify compliance with the requirements of ECE-Regulation No. 13/09, Supplement 8 with respect to trailer braking systems equipped with an electric control transmission.

## 1. Identification

- 1.1 Manufacturer:** **WABCO Vehicle Control Systems**  
Am Lindener Hafen 21  
D - 30453 Hannover
- 1.2 System name/model:** **Vario Compact Trailer ABS 2nd Generation (VCS II)**
- 1.2.1 System variations:** see paragraph 2.3 and Appendix 1 oh the Manufacturer's Information Document.

## 2. System and Installation

- 2.1 Configurations:** **2S/2M - 4S/2M - 4S/3M**
- 2.2. Range of application:** Semi-, centre-axle and full trailers of categories O<sub>3</sub> and O<sub>4</sub> according to the framework Directive 70/156/EEC, Annex II or as defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3).
- 2.3 Type of interface:** The system has been designed to operate with towing vehicles having compressed air braking systems with one pneumatic supply line and one pneumatic control line according with paragraph 5.1.3.1.1 of ECE Regulation 13

**Note:**

Optionally, a communication with the towing vehicle is possible via the CAN interface conforming to the ISO 11992 standard. However, an **electrical control line is not part of this feature** (see paragraph 4.2 and Appendix 3 of the Manufacturer's Information Document).

**2.4 Methods of powering:**

The system configurations have the following powering options:

**Permanent**

To comply with the requirements of Directive 2002/78/EC and ECE Regulation 13/09 as amended by Supplement 8 the system shall be connected to an interface conforming to the following standards:

ISO 7638:1985	5 Pin
ISO 7638:1997 Part 1 (24 V)	5 or 7 Pin
ISO 7638:1997 Part 2 (12 V)	5 or 7 Pin

**Intermittent (optional):**

As an additional safety function in the case of a failure of the ISO 7638 electrical power the system is able to receive electrical power from the ISO 1185 (24N) or ISO 12098 connector (stop lamp circuit); see also Manufacturer's Information Document, paragraph 3.4.

**2.5 Identification of approved components:**

For detailed information see section 3 of the Manufacturer's Information Document.

**3. Compliance with ECE-R13**

**3.1 General notes:**

**- Test equipment:**

For the purpose of verification of the prescribed requirements a simulation test rig and a 3-axle semi-trailer were utilised

**- Version ISO 11992:**

At the 53rd GRRF the change to reference ISO11992:2003 was confirmed and subsequently accepted by WP29 and is referenced in supplement 8 to the 09 Series of amendments to ECE Regulation 13.

**3.2 Supported messages and parameters:**

Annex 16 of ECE-Regulation No. 13 prohibits the sending or receiving of certain messages defined in Part 3 of ISO 11992:1998.

It is confirmed that none of the prohibited messages are utilised by the system, see the list of supported messages in Appendix 3 of the Manufacturer's Information Document.

**Note:** Due to the new ISO11992:2003 version Annex 16 has been deleted by supplement 8 to the 09 Series of amendments to ECE Regulation 13 (see also previous note in paragraph 3.1).

**3.3 ISO 11992 physical and data link layer:**

The manufacturer provided an ISO 11992 Conformity Test Report (number TR 6380 142 203 0022 535 of 13.11.2003) for the controller with respect to the physical and data link layer. The results demonstrated compliance with standard ISO 11992:2003.

**3.4 Compliance with ECE-R13 Annex 17:**

n / a (see note in paragraph 2.3)

**3.5 Failure Warning**

**3.5.1 Yellow warning signal (PIN 5)** The yellow warning signal via pin 5 of the ISO 7638 connector is transmitted when a failure occurs which is listed in the "Failure deactivation matrix" (see Appendix 6 of the Manufacturer's Information Document)

**3.5.2 Amber warning signal request:** The amber warning signal request via pin 6/7 of the ISO 11992 interface is transmitted simultaneously to the yellow warning signal via pin 5 of the ISO 7638.

**3.5.3 Low voltage warning:**

Simulations of the different low voltage conditions:

- Reduction of the voltage on Pins 1 and 2 of the ISO 7638 connector below 17 V

**System reaction:** warning signal transmitted via Pin 5 of the ISO 7638 connector (yellow warning) - ABS function available

- Reduction of the voltage on Pins 1 and 2 of the ISO 7638 connector below 15 V

**System reaction:** warning signal transmitted via Pin 5 of the ISO 7638 connector (yellow warning) - ABS function not available

### 3.5.4 Dynamic sensor fault indication:

It is required that wheel speed sensor faults that cannot be detected when the vehicle is stationary shall be recognised when the vehicle speed is greater than 10 km/h and stored for future display (see item 4.1 of Annex 13 to ECE-Regulation No. 13).

#### Observations:

At a vehicle speed of greater than 10 km/h a dynamic sensor fault was introduced. Then the speed was reduced to zero and the ignition switch turned off. When the ignition was turned on again it was observed that a “permanent” yellow failure-warning signal was transmitted via pin 5 of the ISO 7638 connector.

Following correction of the fault it was verified that when the vehicle speed was increased that the transmission of the warning signal was terminated before a speed of 10 km/h was produced.

On bringing the vehicle to rest the ignition switch was turned off and then turned on again and it was verified that the warning signal followed the correct “no fault” warning sequence.

During the above verification phase it was observed that the pneumatic pressure control modulators were cycled in series.

### 3.5.5 Non specified failures:

Non-specified faults (e.g. excessive brake lining wear, failure in the control channel of the auxiliary equipment etc.) shall be indicated only by the flashing of the warning signal. However, the warning signal shall be extinguished when the vehicle speed exceeds 10 km/h (paragraph 5.2.1.29.6.3 of ECE-Regulation No. 13).

The following tests were carried out:

- a) Introduction of a non-specified fault (simulation of an excessive brake lining wear by an electrical line interruption) at a vehicle speed  $\geq 10$  km/h with the following reduction of the vehicle speed to 0 km/h

**System response:** No warning signal was transmitted.

- b) After the internal recognition time of the failure according to a) the ignition of the system was switched off and on again.

**System response:** After energising the ABS the flashing of the yellow signal started only after the normal

warning signal sequence was completed (see para. 3.4 of the manufacturer's Information Document)

- c) With the failure according to a) still present, the vehicle speed was increased again  $\geq 10$  km/h.

**System response:** The flashing yellow warning signal was terminated.

- d) The test conditions according to a) and b) were repeated and, in addition, a specified failure (wheel sensor o/c) was introduced.

**System response:** The flashing yellow warning signal was replaced by a non-flashing signal.

### 3.6 Protection of the service braking system:

It is required that the braking system is protected from an overload within non braking systems/functions (paragraph 5.2.2.18 of ECE-Regulation No. 13).

#### Observations:

An excessive current of the power supply to an auxiliary device that resulted in an electrical overload was introduced. It was observed that the braking system continued to function without fault and the supply to the auxiliary device was isolated.

### 3.7 Distribution of braking:

Paragraph 5.2.2.5 of ECE Regulation 13 requires that systems that incorporate functions - such as anti-lock - which may cause deviation from the symmetrical distribution of braking must be declared.

The anti-lock braking function has been assessed in accordance with the procedure defined in Annex XIV to Directive 98/12/EC and Annex 19 to ECE-Regulation No. 13 respectively – see RWTÜV Test Report No. EB140.0E.

According to the different ABS configurations (2S/2M - 4S/2M - 4S/3M) the left and right braking forces may be distributed asymmetrically depending on the operational conditions (road surface, brake imbalance, load distribution, etc.).

**3.8. Special features:**

- Generic Input/Output functionality
- Tractor/trailer communication interface according to ISO 11992
- Diagnostic interface according to ISO 14230 (KWP2000)
- Blink code
- Automatic recognition of lift axles

see also Manufacturer's Information Document, paragraph 3.2

**3.9 Safety assessment:**

A safety assessment of the system was carried out in conjunction with the

**TÜV Kraftfahrt GmbH**

Institute of Traffic Safety

Test Centre of Vehicle Electronics

as recognised experts in the field of the safe operation of safety critical electronic systems. The assessment of the system was carried according to annex 18 to ECE Regulation 13 "Special Requirements to be applied to the Safety Aspects of Complex Electronic Vehicle Control Systems"

**Comments:**

The results of the above assessment are recorded in Appendix 1 to this report. It was considered that the safety provisions applied by the manufacturer were satisfactory for the application.

**3.10 Electro magnetic compatibility:** The system has been tested and verified to conform to the requirements of Directive 72/245/EEC as last amended by Directive 95/54/EC\*. A copy of the approval report is included in the Manufacturer's Information Document (see paragraph 3.6 and Appendix 2 of that document).

\* **Note:** This approval does not make reference to ECE-Regulation 10, however, the performance requirements of this Regulation are identical to those defined within the EC Directive. Therefore compliance with ECE-Regulation 10 is assured.



**3.11 ADR regulations:**

Within this report no assessment was performed against ADR (Regulation governing Road Transport of Hazardous Goods). For information, see statement in the Manufacturer's Information Document, paragraph 3.4.

**Date of tests:**

November 2003

**6 Additional Information (provided by the manufacturer)**

- ISO 11992 Conformity Test Report (number TR 6380 142 203 0022 535 of 13.11.2003)

**7 Attached Documentation**

- Electronic Safety Assessment Test Report (see Appendix 1 to this report)
- Electronic Function & Safety Assessment Information Document No. ID\_EB141\_0 – 21.11.2003

**8 Conclusions**

The Vario Compact Trailer ABS 2nd Generation system described within the Manufacturer's Information Document No ID\_EB141\_0 has been technically assessed and the results recorded within this report. Based on this assessment it is confirmed that the system conforms to the special requirements for trailers which are equipped with an electric control transmission according to ECE Regulation No. 13/09 Supplement 8.

**RWTÜV Fahrzeug GmbH**


**LABORATORY FOR VEHICLE TECHNOLOGY**

**Essen, 24<sup>th</sup> November 2003**

Order-No. 204 390 30

**Institute for Vehicle Technology**

**Technical Service for Braking Systems**



**Dipl.-Ing. Gaupp**



# Electronic Safety Assessment Test Report

## 1. General

This test report has been compiled in accordance with Annex 18 to ECE Regulation 13:

“Special Requirements to be applied to the Safety Aspects of Complex Electronic Vehicle Control Systems”

## 2. Identification

- |     |                           |  |
|-----|---------------------------|--|
| 1.1 | <b>Manufacturer:</b>      | <b>WABCO Vehicle Control Systems</b><br>Am Lindener Hafen 21<br>D - 30453 Hannover |
| 1.2 | <b>System name/model:</b> | <b>Vario Compact Trailer ABS 2nd Generation (VCS II)</b>                           |

## 3. Manufacturer's documentation

- 3.0 The manufacturer's documentation was made available in two parts as follows.

### Part A

**Appended Electronic Function & Safety Assessment Information Document No. ID\_EB141\_0**

### Part B

Additional material and analysis data of paragraph 3.4.4 of ECE R13, Annex 18, which was confidentially made available for assessment, but was retained by the manufacturer.

**Note:** For the sake of simplicity “Electronic Function & Safety Assessment Information Document No. ID\_EB141\_0 is abbreviated to “ID\_VCS”

**The documentation of Part A contains the following:**

**3.1 Periodic technical inspections**

How the current operational status of the Vario Compact Trailer ABS 2nd Generation system can be checked is described in section 6 of ID\_VCS.

**3.2 Description of the functions of “The System”**

A description of the function of the System is given in section 2.5 of ID\_VCS.

**3.2.1 List of all input variables with their working ranges**

A list of all input and sensed variables and the associated working ranges is included in section 4.1 of ID\_VCS.

**3.2.2 List of all output variables with their working ranges**

A list of all output variables controlled by the VCS II system and the associated working ranges is included in section 4.2 of ID\_VCS.

**3.2.3. Limits of the boundaries of functional operation and environmental conditions**

The limits defining the boundaries of functional operation are described in section 8 of ID\_VCS.

The manufacturer demonstrated that, during the system development, adequate provisions had been made to take account of the environmental conditions to which the Vario Compact Trailer ABS 2nd Generation system will be subjected (Documentation Part B - Product Identification Nos. 480 500 070 0 (Standard version), 480 500 081 0 (Premium version), 480 500 085 0 (ECU version) - Doc.-Code No. 435).

**3.3 System layout and schematics**

**3.3.1 Inventory of components**

Inventory of components and function of the units – see section 3 and Appendix 6 of ID\_VCS

### 3.3.2 Functions of the units

The functions of the units are described in section 3 and Appendix 4 of ID\_VCS.

### 3.3.3 Interconnections

The interconnections are shown in section 5 and in appendices 4 and 5 of ID\_VCS.

### 3.3.4 Signal flow and priorities

The signal flow and priorities are depicted in section 5.3 of ID\_VCS.

### 3.3.5 Identification of units

#### 3.3.5.1 Identification of hardware

The version of the hardware is identified by a part number; see section 3 of ID\_VCS and is permanently attached to each unit. In addition the identification label / plate includes a date code manufacturing reference.

The hardware versions of the Vario Compact Trailer ABS 2nd Generation modulator at the date of type approval were Nos 400 500 070 0, 400 500 081 0 and the version of the ECU was No. 446 108 085 0.

#### 3.3.5.2 Identification of software

The software is identified by an alphanumerical number which provides an identification with respect to the assessed performance requirements of ECE Regulation 13 (see also section 3.2 of ID\_VCS).

The current software version of the Vario Compact Trailer ABS 2nd Generation system **at the date of type approval** was:

**“ V C 0 B A A A B ”**

**Note:** The first three characters in the software number of the Vario Compact Trailer ABS 2nd Generation system (see above characters “VCO”) denote the software version as far as ECE-Regulation No. 13 is concerned.

The following characters is an identifier and may vary although the function of the VCS II as far as ECE-Regulation No. 13 is concerned is unchanged (compare ECE-R13, paragraph 3.3.5.1 of Annex 18).

### **3.4 Safety concept of the manufacturer**

During the assessment the design provisions built into the VCS II system regarding the generation of safe operation under fault conditions were explained.

The following design provisions to protect against failures in the VCS II system are implemented as follows:

- Monitoring functions to recognise faults within the electronic control unit (ECU) and external faults (e.g. of sensors, actuators, cables, etc.) associated with the system.
- In the case of a failure, the driver will be warned by the prescribed warning signals.
- Fall-back to partial system operation: the various detected failures and their effects are described in section 7.5 of ID\_VCS.
- Appendix 5 of ID\_VCS gives an overview of the reaction of the system to possible failures.

#### **3.4.1 Statement of the manufacturer**

The required statement of the manufacturer which affirms that the strategy chosen to achieve the “The System” objectives under the conditions defined in paragraph 3.4.1 of Annex 18 of ECE-Regulation No. 13 is provided in paragraph 7.1 of ID\_VCS.

#### **3.4.2 Software of VCS II system (outline architecture, software design methods and tools used)**

The outline architecture was explained by a document which was generated by a special tool (Fuhi) showing the functional hierarchy of the software.

The software design method and tools applied were explained (see also section 7.4 of the ID\_VCS).

The manufacturer gave evidence of the means by which he determined realisation of the system logic during the design and the development process, see section 7.4 of the ID\_VCS

#### **3.4.3 Design provisions built into “The System” so as to generate safe operation under fault conditions**

##### **a) Fall-back operation**

The Vario Compact Trailer ABS 2nd Generation system is installed as an “add-on”-system to the mechanical-pneumatic service braking system.

The system incorporates a selective fall-back strategy.

Due to the severity of the failure the anti-lock function is switched off partially or total (see paragraph 7.5 of the ID\_VCS).

Even if the whole anti-lock system is switched off due to a failure within the ABS, the generation of maximum braking forces is ensured (without the anti-lock function).

The system reactions to the various faults are delineated in Appendix 6 of the ID\_VCS.

#### **b) Change over to a separate back-up system**

**n/a**

#### **c) Removal of a high level function**

Depending on the detected fault the system may suspend “The System” (see paragraph “a” above).

### **3.4.4 Safety analysis**

The manufacturer carried out a safety analysis which shows, how the VCS II will behave when any faults occur which may influence the vehicle control performance or safety.

The safety analysis was based on a System FMEA (No. 400 010 203 0 - Doc.- Code No. 658) and a Design FMEA (No. 446 108 112 4 – Doc.-Code No. 660

Based on the evidence supplied in the documentation and the results of subsequent evaluation of possible failures it is evident that the safety concept described is systematic and complete.

#### **3.4.4.1 Parameters being monitored (fault monitoring) and warning signal given to the driver and/or service/technical inspection personal**

The parameters being monitored and the fault condition for which a warning signal is given are itemised in the System FMEA mentioned in the above paragraph 3.4.4.

##### **see also ID\_VCS:**

- Fault conditions for which warning signals are transmitted are defined in Appendix 6 of ID\_VCS
- Monitored parameters (see section 5)

## **4.0 Verification and Test**

**4.1** The functional operation of “The System”, as described in ID\_VCS II as required in paragraph 3 of Annex 18 of ECE Regulation 13, was verified as follows:

### **4.1.1 Verification of the function of “The System”**

Track and bench tests were carried out to verify the performance of the vehicle system under non-fault conditions. These demonstrated that the system operated in a manner that ensured that the relevant provisions of EC and ECE braking performance requirements would be fulfilled.

### **4.1.2 Verification of the safety concept**

Introducing individual internal and external faults to the system enabled the safety concept of the system to be evaluated by observing the reaction of the individual system elements and their effect on the braking system as a whole.

The protection measures against environmental influences were evaluated.

Electromagnetic compatibility (EMC)

- Appropriate measures have been taken within the design and corresponding tests have been carried out to show the electromagnetic compatibility with respect to conducted and radiated disturbances.

In order to fulfil the legal requirements regarding EMC, the electronics have been certified according to Directive 72/245/EEC as last amended by Directive 95/54/EC. An Approval to this Directive has been obtained with respect to compliance with the EMC provisions. A copy of the approval certificate is reproduced in Appendix 2 of ID\_VCS.

In addition (see also paragraphs 3.6 of ID\_VCS) further EMC tests have been carried out in accordance to the WABCO product specifications which are specified in section 6.3 of the documents mentioned in paragraph 3.2.3 above.

#### **4.1.2.1 Comparison of the verification results with the documented summary of the failure analysis**

From the tests carried out it was concluded that the reaction by the system to these faults were as described in the supporting documentation and failure analysis.

### **5. Summary**

Based on the documentation presented and examined in combination with the tests carried out it is anticipated that the measures taken by the manufacturer with respect to the failure detection and management are appropriate to attain the required level of safety.

### **6. Note:**

The System assessment was carried out jointly by the Institute of Traffic Safety of TÜV Kraftfahrt GmbH and the Technical Service for Braking Systems of RWTUV.

### **7 Place and date and of assessments:**

Hanover - November 2003


**Cologne and Essen, 24<sup>th</sup> November 2003**

**TÜV Kraftfahrt GmbH  
Institute of Traffic Safety  
Test Centre of Vehicle Electronics**



**Dipl.-Ing. Heinz Trier**

**RWTÜV Fahrzeug GmbH  
Institute for Vehicle Technology  
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Accreditation of Kraftfahrt-Bundesamt (KBA) of Federal Republic of Germany under the registration No DAR-No: KBA-P 00010-96

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The Testing Laboratory is accredited by the Accreditation Body of the German Federal Motor Transport Authority (KBA) to conduct inspections according to ECE, EG-TypV (EEC), StVZO and FzTV (KBA-P 00009-95).