



HAVE it

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The future of driving.

Deliverable D42.2 Brake-by-Wire Truck pre- homologation

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Revision and history chart

Version	Date	Reason
0.1	2011-05-27	Initial document
1.0	2011-06-01	Reviewer comments integrated.
	2011-06-05	Final editing and submission
	2011-09-09	Updated according to the EC reviewers recommendations
	2011-10-06	Final editing, generation of version intended for publication

Table of contents

- Revision and history chart 3
- Table of contents..... 3
- Executive summary 4
- 1 Introduction..... 5
- 2 TÜV Technical report (separate document embedded below) 6
- 3 Conclusions..... 7
- 4 References 7

Executive summary

This document describes the work performed concerning the legal aspects of the Brake-by-Wire truck development within the HAVEit project. The vehicle demonstrator is a Volvo FH12 4x2 truck, which normally is equipped with an electronically controlled pneumatic brake system (EBS), has now been equipped with a new Brake-by-Wire system architecture, hereafter called Electro Mechanical Brake (EMB) system. This system has been described earlier in D23.1 and after integration also in D42.1 and consists of two independent electrical power sources and communication architectures.

ECE-R13 is the most influential brake rule in world braking terms and applies to vehicles of categories M2, M3, N and O with regard to braking. One objective within WP 4200 in the HAVEit project has been to analyze ECE-R13 and to perform a technical review together with TÜV Nord, a leading technical service provider and experts in vehicle certification, concerning potential future homologation of an EMB system for heavy trucks. As the scope for this project has been reviewing a single Truck, the report embedded under section 2 does not consider trailers and is only for motor vehicles which do not tow trailers.

Energy accumulators for braking systems as described in the present version of annex 7 of ECE-R13 does not foresee electrical energy as a source. The HAVEit system is a fully electric system and therefore equivalents were necessary to find when comparing against the pneumatic terminology used in the regulation.

Evaluation against annex 18 of ECE-R13 which covers “Special Requirements to be applied to the Safety Aspects of Complex Electronic Vehicle Control Systems” was also performed.

The EMB system of HAVEit has in many aspects been able to comply with ECE-R13, however not fully. This is due to the fact that the EMB system produces actuation forces using electrical energy instead of hydraulic or pneumatic energy in the case of conventional braking systems. Therefore, due to the nature of the electro-mechanical braking system the HAVEit EMB system cannot literally meet all of the technical requirements of ECE-R13.

For the requirements which cannot be met proposals are made for updating ECE-R13.

1 Introduction

One of the objectives set up at the beginning of the project was to perform a pre-homologation of a Brake-by-Wire system for a truck. Earlier attempts of developing Brake-by-Wire on heavy vehicles (see for example the SPARC project, a STREP project within FP6 with contract No. 507859) have mainly been focusing on brake performance improvement. Within HAVEit focus has been on system safety when using a Brake-by-Wire system. To verify that the system safety aspects were met and also to move the position forward towards a system prepared for serial development, a close co-operation have been done during the project with TÜV Nord in Germany.

This result will serve as a good base for further development in this area and as mentioned in the executive summary updates are suggested in certain areas of ECE-R13 in order to fully benefit from the system architecture and its performance.

Based on internal version of an EMB product specification, further in the document referred to ID_EMB, the whole structure of ECE-R13 has been reviewed in the light of the Brake-by-Wire system shown and described in D 42.1.

This deliverable consists of the working document used during the project between Haldex and TÜV Nord including the proposed amendments for ECE-R13.

2 TÜV Technical report (separate document embedded below)

Please find this document as a separate attachment.



EB177-0E.PDF

3 Conclusions

Working out the documentation to cover ECE-R13 in this pre-homologation process has been very valuable to understand where the existing regulation needs to be updated. However in most cases the EMB system proved to be able to cope with the existing version of the ECE-R13 as the intension of the regulation is not to prescribe a specific technology to be used but the performance and safety level of the system.

The work being done will serve as a good platform for future developments in this area. In addition below the summary statement from the TÜV Report¹. embedded in section 2 above.

19 Summary

Based on the submitted documentation presented by the manufacturer **Haldex Brake Products AB**, the **Haldex EMB⁺** system as described in ID_EMB has been technically assessed according to the "Table "Scope of assessment" of paragraph 2.2 taking also into account of its footnotes.

As described in detail in paragraph 2.4 the new EMB technology is not been fully covered by the technical requirements of ECE-R13. This is due to the fact that the EMB produces actuation forces using electrical energy instead of hydraulic or pneumatic energy in the case of conventional braking systems. Therefore, due to the nature of the electro-mechanical braking system the Haldex EMB⁺ system cannot literally meet all of the technical requirements of ECE-R13.

For the requirements which cannot be met proposals are made (see paragraph 2.4) for updating ECE-R13.

This report assesses the **Haldex EMB⁺** system for vehicles of categories N₃ and M₂ /M₃ according to the requirements of ECE-Regulation No. 13 including Draft Supplement 7 to the 11 series of amendments with regard to the items/functions/requirements as specified in the Table "Scope of assessment" of paragraph 2.2 with its numerous footnotes which indicate, e.g.

- deviations from ECE-R13 or
- tests which are not yet carried out but prescribed by ECE-R13 (in particular see footnote 2).

Deviations from ECE-R13 in general are specified in this report in particular in paragraphs 2.2, 2.4, 4.1.1 (Special additional requirements for service braking systems with electric control transmission) 4.1.3 and 6).

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TDB/Gaupp

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¹ Technical Report, Approval Report No: EB177.0E according to ECE - Regulation No. 13/11, TÜV NORD Mobilität GmbH & Co. KG, IFM – Institute for Vehicle Technology and Mobility, Adlerstraße 7, 45307 Essen, Germany

4 References

- [1] Deliverable D23.1 Brake by Wire for challenge 4.2, Anders Nilsson, Peter Nilsson, Fredrik Seglö, HAVEit, 2009.
- [2] Deliverable D42.1 Brake by Wire Truck platform installed and working, Anders Nilsson, Jacob Svendenius, Fredrik Seglö, HAVEit, 2010.
- [3] ECE-Regulation No. 13/11
- [4] ID_EMB, Preliminary information document of Haldex EMB+, Jacob Svendenius, Anders Nilsson, Haldex internal document.