

Sébastien Paternotte

From: Buch, Andreas <Andreas.Buch@knorr-bremse.com>
Sent: 15 January 2021 09:42
To: Winfried Gaupp; Moritz Christoph HNV; Seglö, Fredrik
Cc: Kuhn, Thomas; Adam Christoph HNV; Nilsson, Anders
Subject: RE: Updated Master document EMB ECE-R13
Attachments: calculation.xlsx

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Gentlemen,

As discussed find the proposal below – I attached the calculation.

NEW - important to consider battery relaxing after loading with battery equipped systems - therefore the unbraked time shall be limited to consider worst case scenarios.

The proposal is that the vehicle is accelerated again to the speed of 80 km/h in one step however with an active engine acceleration **and** also considering tractive resistances of 1.6 m/s².

22,22m/s : 2.62m/s² = 8.48s → 9s (44t, 500KW)

22,22m/s : 2.72m/s² = 8.16s → 9s (40t, 500KW) – agreed during our meeting to use this scenario

22.22m/s : 3.33m/s² = 6.68s → 7s (26t, 500 KW)

22.22m/s : 2.74m/s² = 8.11s → 9s (26t, 330 KW)

Paragraph 1.2 is based on paragraph 1.2 of Part A. However, ...

*In order to find a justifiable time requirement, a completely extreme and even unrealistic worst case scenario is considered in which a motor vehicle with a braking system with the minimum prescribed service braking performance of only 5 m/s² is braked to standstill on a downhill with an 18 per cent gradient (the largest slope assumption in UN R13) at a speed of 80 km/h. Under these extreme conditions the actual deceleration (neglecting any running resistances losses) would be 3,26 m/s², resulting in a braking time of **6,81 s** (compared to 4,44 s on a flat road).*

*To accelerate the vehicle again to the speed of 80 km/h, (40t, 500kW) it is assumed that the speed is increased by the downhill acceleration and additionally the vehicle is accelerated with about 1 m/s² by the e-motor. To consider a worst-case scenario, also a running resistance in the order of 0,14 m/s² is assumed. These worst-case assumptions result then in an acceleration time of about **8.16 s**.*

*Taking this worst-case scenario into account, a brake application time of **7 s** followed by an unbraked interval of **9s** is therefore proposed for the test procedure according to paragraph 1.2.1.*

Best regards,

Andreas Buch

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From: Winfried Gaupp <winfried.gaupp@outlook.com> **On Behalf Of** Winfried Gaupp
Sent: Wednesday, January 13, 2021 4:23 PM
To: Moritz Christoph HNV <christoph.moritz2@zf.com>; Buch, Andreas <Andreas.Buch@knorr-bremse.com>; Seglö, Fredrik <Fredrik.Seglo@Haldex.com>
Cc: Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>; Adam Christoph HNV <christoph.adam@zf.com>; Anders Nilsson <Anders.Nilsson@Haldex.com>
Subject: AW: Updated Master document EMB ECE-R13

Dear Andi, Anders, Christoph A. & M., Fredrik and Thomas,

Please, see my attached document.

Best regards

Winni

Von: Moritz Christoph HNV <christoph.moritz2@zf.com>
Gesendet: Dienstag, 12. Januar 2021 15:15
An: Winfried Gaupp <winfried@gaupp-brc.com>; Buch, Andreas <Andreas.Buch@knorr-bremse.com>; Seglö, Fredrik <Fredrik.Seglo@Haldex.com>
Cc: Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>; Adam Christoph HNV <christoph.adam@zf.com>; Anders Nilsson <Anders.Nilsson@Haldex.com>
Betreff: RE: Updated Master document EMB ECE-R13

Dear brake colleagues,

I also just checked the issue raised by Andreas and found the sentence from the justification (in blue) somewhat differing from the intended idea or thought. For reference, I attached the calculation slides we discussed about.

One of the assumptions of the calculation was, that, for simplicity reasons, it was an **ideal** calculation. So, no losses (e.g. driving resistances from wind, tyres, etc.) were considered.

Instead the 1.02 m/s² on a flat road were supposed to be **tractive acceleration** induced by the engine. In that case, the pure downhill-slope acceleration and the tractive acceleration **add up** to 2.76 m/s².

We haven't discussed, if we need or want to include any losses or driving resistance. But that could be a topic for Friday.

Would it maybe help to re-formulate the justification so that it reads:

*To accelerate the vehicle again to the speed of 80 km/h, it is assumed that the speed is increased by the downhill acceleration as well as the acceleration from the engine which is assumed to be 1,02 m/s² on a flat road. The resulting acceleration amounts then to 2,76 m/s², resulting in an acceleration time of **8,05 s**.*

Looking forward to your comments.

Mit freundlichen Grüßen/Kind regards
Christoph Moritz

Innovation Project Leader - Electrification
Product Engineering - Product Innovation
Commercial Vehicle Control Systems

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From: Winfried Gaupp <winfried.gaupp@outlook.com> **On Behalf Of** Winfried Gaupp
Sent: Dienstag, 12. Januar 2021 08:20
To: Buch, Andreas <Andreas.Buch@knorr-bremse.com>; Seglö, Fredrik <Fredrik.Seglo@Haldex.com>
Cc: Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>; Adam Christoph HNV <christoph.adam@zf.com>; Moritz Christoph HNV <christoph.moritz2@zf.com>; Anders Nilsson <Anders.Nilsson@Haldex.com>
Subject: AW: Updated Master document EMB ECE-R13

Dear Andi,

Please, take this document instead of the document I have sent to you yesterday evening. In this document I made some small corrections and additions.

I hope that you are able to join our web meeting at 9:00 h.

Best regards

Winni

Von: Winfried Gaupp **Im Auftrag von** Winfried Gaupp
Gesendet: Montag, 11. Januar 2021 20:48
An: Buch, Andreas <Andreas.Buch@knorr-bremse.com>; Seglö, Fredrik <Fredrik.Seglo@Haldex.com>
Cc: Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>; Adam, Christoph (christoph.adam@zf.com) <christoph.adam@zf.com>; Christoph Moritz <christoph.moritz2@zf.com>; Anders Nilsson <Anders.Nilsson@Haldex.com>
Betreff: AW: Updated Master document EMB ECE-R13

Dear Andi,

Please, see my attached document.

Best regards

Winni

Von: Buch, Andreas <Andreas.Buch@knorr-bremse.com>
Gesendet: Montag, 11. Januar 2021 14:55
An: Seglö, Fredrik <Fredrik.Seglo@Haldex.com>; Winfried Gaupp <winfried@gaupp-brc.com>
Cc: Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>
Betreff: RE: Updated Master document EMB ECE-R13

Hello Fredrik,
Hello Winni,

One of my colleague did some crosscheck about the justification done for Annex 7, part D.

To accelerate the vehicle again to the speed of 80 km/h, it is assumed that the speed is increased by the downhill acceleration and reduced by an assumed driving resistance on a flat road of 1,02 m/s². The resulting acceleration amounts then to 2,76 m/s², resulting in an acceleration time of 8,05 s.

1. Wenn das tatsächlich als Widerstand berücksichtigt ist, dann muss man ihn aus der Beschleunigung von der Gefälle (1.74 m/s² bei 18%) subtrahiert und nicht addiert werden: also $1.74 - 1.02 = 0.72 \text{ m/s}^2$ (und nicht $1.74 + 1.02 = 2.76 \text{ m/s}^2$ wie oben), womit man eine Beschleunigungszeit auf 80 km/h von 30.9 s, statt 8.05 s bekomme.
2. Woher kommt die Größe des Fahrwiderstands von 1.02 m/s²?
Das finde ich extrem hoch und es ist auf Off-road Niveau.

Der Rollwiderstands-Beschleunigung lässt sich wie folgt errechnet: $f_0 \times \cos(\alpha) \times g$, wo $f_0 = 0.01$ bei Asphalt und normaler Reifendruck.

Das ergibt bei 18% Steigung: $0.01 \times g \times \cos(\arctan(0.18)) = 0.096 \text{ m/s}^2$

Der Luftwiderstandskraft ist: $1/2 \times \rho \times c_w \times A \times v^2$, wo

- Luftdichte: $\rho = 1.2 \text{ kg / m}^3$
- Formfaktor bei Long Haul mit Semitrailer: $c_w = 0.65$
- Frontfläche: $A = 9 \text{ m}^2$

Bei LkWs ist der Luftwiderstand bei 80 km/h so: $1.2 / 2 \times 0.65 \times 9 \times (22.2)^2 = 1730 \text{ N}$, wenn man das mit 40t Fahrzeuggewicht auf Beschleunigung umwandelt: $1730 / 40000 / 9.81 = 0.0044 \text{ m/s}^2$.

So der Gesamtwiderstand bei 80 km/h ist: $0.096 + 0.0044 = 0.1 \text{ m/s}^2$ (vs. 1.02 oben).

Das Fahrzeug Beschleunigung dann bei 18% Steigung mit $1.74 - 0.1 = 1.64 \text{ m/s}^2$, und die realistische Beschleunigungszeit auf 80 km/h: $22.2 / 1.64 = 13.5 \text{ s}$.

Das ist ein bisschen konservativ, dass der Fahrzeugantrieb dabei nicht berücksichtigt ist. Damit könnte diese Zeit sogar halbiert werden. Wenn wir bei diesen Ansatz bleiben, dann müssen wir 14 s statt 9 s vorschlagen.

Check and comment, please.

Kind regards,
Andreas

Best regards,

Andreas Buch

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From: Seglö, Fredrik <Fredrik.Seglo@Haldex.com>

Sent: Friday, January 8, 2021 3:04 PM

To: Paolo Alburno <p.alburno@clepa.be>

Cc: Nilsson, Anders <Anders.Nilsson@Haldex.com>; Gaupp Winni Privat <winfried@gaupp-brc.com>; Kuhn, Thomas <Thomas.Kuhn@knorr-bremse.com>; Buch, Andreas <Andreas.Buch@knorr-bremse.com>; ADAM_Christoph

[<christoph.adam@wabco-auto.com>](mailto:christoph.adam@wabco-auto.com)

Subject: Updated Master document EMB ECE-R13

Hello Paolo,

With reference to our call earlier today, please find attached the updated Master document after the separate discussion in the ad hoc group concerning Annex 7 in particular.

It would be beneficial if you could distribute this to the other industry group members and ask for their comments/approval. I have also talked to Winni a few minutes ago and once we have collected the comments (if any) our proposal is to submit an informal document upfront the next GRVA meeting with the latest update. Winni has promised to prepare this for us in the suitable format, highlighting the updates.

Best Regards

Fredrik

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