

Proposal for amendments to ECE/TRANS/WP.29/GRVA/2020/36

Submitted by the expert from Germany

Industry comments and proposals in red text.

OICA supports the proposal GRVA-07-05 from Czech Republic. This proposal in integrated in this document with blue text.

This document supersedes the OICA document GRVA-07-47.

The changes brought up by revision 1 are highlighted with purple.

ECE/TRANS/WP.29/GRVA/2020/36 was prepared by the expert from Germany. It is aimed to insert requirements for endurance braking systems for vehicles equipped with an electric regenerative endurance braking system. The text below is an alternative to the text proposed in ECE/TRANS/WP.29/GRVA/2020/37 tabled by the expert from the International Organization of Motor Vehicle Manufacturers (OICA) for discussion at the fifth session of the Working Party on Automated/Autonomous and Connected Vehicles (GRVA). It embraces some major parts of the aforementioned document, in paragraphs 5.2.1.29.7. and 1.8.2.4. (Annex 4). The proposed changes to the current text of the Regulation are marked in bold for new, and strikethrough for deleted characters.

I. Proposal

Insert new paragraph 2.40., to read:

2.40. ^[TP1] "**Brake performance Estimator**" means a function **estimating being able to estimate the remaining available friction brake vehicle-deceleration performance taking into account the effect of due-to-brake heat**, operating by models considering inputs such as for example type and position of the brakes, number and intensity of brake applications, vehicle speed or ambient temperature.

Insert new paragraphs 5.1.2.4. and subparagraphs, to read:

5.1.2.4. Endurance braking system

The endurance braking system shall make it possible to maintain a constant downhill speed over a long period of time without the use of the friction brakes.

The following requirements only apply to vehicles specified in Annex 4 paragraph 1.8.1.^[TP2] These requirements are deemed satisfied if the relevant test requirements specified in Annex 4 paragraph 1.8. are met.

5.1.2.4.1.^[TP3] As an equivalent of a long period of time, a time duration of at least **[12]** min is deemed to be adequate.

5.1.2.4.2. During the time duration specified in paragraph 5.1.2.4.1. the endurance braking system shall be able to maintain **a constant an average** ^[TP4] speed of **not more than [35] km/h** ^[TP5] **and not less than [30] km/h** on a 7 per cent down-gradient **for a distance of 6 km** ^[TP6].

However, for vehicles in which the energy is absorbed by the braking action of the engine alone, the tolerance on the average speed, as specified in Annex 4 paragraph 1.8.2.3., shall be applied.^[TP7]

5.1.2.4.3.^[TP8] Special requirements applicable endurance braking system incorporating electric regenerative braking systems

- 5.1.2.4.3.1.** ~~In the case of an endurance braking system incorporating electric regenerative braking systems,~~ it shall be deemed to comply with the requirements in paragraphs 5.1.2.4.1. and 5.1.2.4.2., ~~if the vehicle equipped with the ^[TP9]endurance braking system is able to store and/or dissipate [(e.g. with an extra-endurance brake)]^[TP10] the energy of the maximum negative vertical height difference (requiring energy storage capacity in the traction battery), limited to the energy level as required to fulfil the requirements in paragraphs 5.1.2.4.1. and 5.1.2.4.2.^[TP11],~~ that can be reached by the vehicle (consuming stored energy in the traction battery on the journey towards the relevant negative vertical height difference), considering the current electric state of charge, using methods such as a global navigation satellite systems combined with a topography model and an intelligent battery management system.

This shall be demonstrated to the satisfaction of the Technical Service.

- 5.1.2.4.4.3.2.** ~~In the case of an endurance braking system incorporating electric regenerative braking systems, as~~ As an alternative to paragraph 5.1.2.4.3.1., ~~endurance braking systems incorporating electric regenerative braking systems may use the service braking system when the vehicle's traction battery is not able to store recuperated energy due to a high state of charge, provided that the service braking system is able to shall ^[TP12]fulfil the requirements of Annex 4, paragraph 1.8.2.4.1.8.2.5.~~

In addition, a brake performance estimator shall warn the driver according to paragraph 5.2.1.29.7.

- 5.1.2.4.3.3.** **Additional requirement in the case of an endurance braking system solely based on an electric regenerative braking system:**

Prior to the time when the braking force of the electric regenerative braking can no longer be provided (e.g. when the battery is fully loaded), the driver shall be informed about the situation (e.g. an information on the remaining retardation capacity, a reduction of the provided retardation force).

Insert a new paragraph 5.2.1.29.7., to read:

- 5.2.1.29.7.** Vehicles equipped with an electric regenerative braking system of Category A or B (as defined in paragraphs 2.21.2. and 2.21.3.), using the service braking system in addition to the endurance braking system only when the state of charge of the traction battery does not allow storing of the energy due to a high state of charge, shall warn the driver at the latest when the service braking performance is decreased below the minimum performance value specified in

(a) **Annex 4, paragraph 1.6.3.^[TP13]** by the yellow warning signal according to paragraph 5.2.1.29.1.2. and

(b) **Annex 4, paragraph 2.2.1.^[TP14]** by the red warning signal according to paragraph 5.2.1.29.1.1.

The method to assess the service braking performance [(e.g. by temperature/ energy calculation and/or deceleration control)] shall be described by the vehicle manufacturer together with the documentation package required in Annex 18 of this Regulation to the Technical Service.

Annex 4,

Paragraph 1.5.1.8, amend to read:

1.5.1.8.^[TP15] For vehicles equipped with an electric regenerative braking system of category B, the condition of the vehicle batteries at the start of the test, shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions listed in the ~~fourth clause~~ **four clauses** of paragraph 1.4.1.2.2. above.

Insert a new paragraph 1.6.5., to read:

1.6.5.^[TP16] For vehicles equipped with an electric regenerative braking system, the condition of the vehicle batteries at the start of the test, shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions listed in the four clauses of paragraph 1.4.1.2.2. above.

Insert a new paragraph 1.8.2.4., to read:

1.8.2.4.^[TP17] For vehicles equipped with an electric regenerative braking system, the condition of the vehicle batteries at the start of the test, shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions listed in the four clauses of paragraph 1.4.1.2.2. above.

insert a new paragraph 1.8.2.5., to read:

1.8.2.5. For vehicles equipped with an endurance braking system incorporating electric regenerative braking systems and where the service braking system is used when storing of the energy in the traction battery is not possible only due to ~~a high state of charge~~ **the maximum battery state of charge is reached**, two different types of tests shall be carried out:

(a) A test following paragraph 1.8. of Annex 4^[TP18] where the state of charge of the traction battery is in a condition that allows the conduction of the test without the use of the service braking system (e.g. the state of charge of the traction battery is sufficiently low); and

(b) A test under the conditions of paragraph ~~1.4.1.2.2. 1.6.1~~^[TP19] above **with a slope of 7%. During the test, the service braking system shall be used and may be supported by an endurance braking system (e.g. an electric regenerative braking system, an additional endurance brake like a cooled resistor)**. After this test and under consideration that the service brakes shall not cool significantly down, an additional test following the provisions of paragraph 1.6.3. of Annex 4^[TP20] shall be performed. The mean fully developed deceleration shall correspond to a value not below 5m/s².

The condition of the vehicle batteries at the start of the test as per 1.6.1. shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions listed in the four clauses of paragraph 1.4.1.2.2. above.^[TP21]

II. Justification

1. Germany understands from previous discussions at GRVA that the current endurance braking performance test in UN-Regulation No. 13 (Type-IIA), which applies to certain vehicles of category M₃, N₃ and certain vehicles subject to Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (compare paragraphs 1.8.1.1. to 1.8.1.3. in Annex 4) and which is non-specific with regard to the type of drive (the test is technology-neutral in this regard), poses to be an economical burden to battery electric vehicles incorporating electric regenerative braking systems. Therefore, in order to contribute to the ambition in finding a practical and safe solution for the described challenge, Germany has prepared a proposal as an alternative to ECE/TRANS/WP.29/GRVA/2020/37 (OICA), which also embraces major parts of the aforementioned document (paragraphs 5.2.1.29.7. and 1.8.2.4. (Annex 4)).

2. The approach taken by Germany was to “extract” requirements for endurance braking systems from the existing endurance braking performance test (paragraph 1.8. in Annex 4) and introduce the identified requirements into the “requirement-part” (paragraph 5 “specifications”) of UN Regulation No. 13.

3. It is noted that the performance requirements for endurance braking systems summarized in paragraphs 5.1.2.4., 5.1.2.4.1. and 5.1.2.4.2. are not modified compared to the current specifications from Annex 4. This proposal only suggests to additionally introduce the requirements into paragraph 5 of the Regulation, with the intention to make the endurance brake specification (in general) more transparent.

4. The performance requirements for endurance braking systems (paragraphs 5.1.2.4., 5.1.2.4.1. and 5.1.2.4.2.) are valid for all vehicles equipped with endurance braking systems, no matter which power unit is technically used in the vehicle. Additionally, for battery electric driven vehicles incorporating electric regenerative braking systems further performance requirements regarding the endurance braking system are introduced in paragraphs 5.1.2.4.3. and 5.1.2.4.4. as alternatives:

(a) Alternative 1 (paragraph 5.1.2.4.3.) introduces a new requirement to take the position of the vehicle and topography of its surrounding into account, whereby the necessary battery capacity, which needs to be available, is deviated from.

(b) Alternative 2 (paragraph 5.1.2.4.4.) introduces a new requirement allowing the usage of friction brakes for endurance braking, if recuperation is prevented in case of a too high battery state of charge of the traction battery. (This means that the requirements shall always be fulfilled without the usage of friction brakes if the state of charge at the beginning of the endurance brake application is sufficiently low.) If friction brakes are used, it is always necessary that the remaining available brake deceleration after fulfilling the endurance brake requirements is still $\geq 5.0 \text{ m/s}^2$. Additionally, vehicles using the friction brakes shall be equipped with a brake estimator alerting the driver in case the efficiency of the brakes falls below the Type-II hot performance test. (This is intended to provide additional safety – it will not activate after the described endurance brake activation, since at that point, the full performance of 5.0 m/s^2 is required.)

5. Paragraph 5.2.1.29.7., introducing a warning for the driver (copied without change) and paragraph 1.8.2.4. amending the according endurance braking performance test in Annex 4 (copied with slight amendment to the wording), are taken over from OICA’s proposal (ECE/TRANS/WP.29/GRVA/2020/37) which are supported by Germany and are understood to still be up for discussion since the fifth session of GRVA.