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# Proposal for a supplement to the 11 series of amendments to UN Regulation No. 13 (Heavy vehicle braking)

## Status Report of the current EMB discussions

## I. Introduction

For the 11th GRVA session (27 September - 01 October 2021), CLEPA submitted document **ECE/TRANS/WP.29/GRVA/2021/24**.

At that time, this document was considered a more or less completed proposal to include in UN Regulation No. 13 requirements for the type-approval of Electro-Mechanical Braking (EMB) systems as state-of-the-art braking systems.

In electro-mechanical braking systems, electrical energy storage devices are used which, in contrast to conventional pneumatic or hydraulic storage devices, are subject to ageing during their lifetime.

In addition, their effectiveness may also be considerably influenced by temperature.

In order to ensure that the requirements for the braking system are met not only at the time of type-approval but also during the entire vehicle lifetime, very intensive expert discussions (industry and government representatives) have been held in the recent months. Thus, the provisions of document ECE/TRANS/WP.29/GRVA/2021/24 had been intensively reconsidered to also take account of the different nature of electrical energy storage device regarding the degradation of the braking performance during the vehicle lifetime.

In the following chapters an overview is given to show the current state of the EMB discussion of newly proposed major amendments to document ECE/TRANS/WP.29/GRVA/2021/2 (in **bold text** where not yet agreed text is in red, whilst in blue text are the explanatory notes).

It is planned to present an official and complete EMB document by the 14th GRVA meeting in September 2022.

Please note, that in this document not all requirements under discussion are renumbered in the correct way.

## II. New proposed amendments to Annex 7 (Part D)

The former Section 2 of Annex 7 was completely replaced by the new proposed requirements. In particular by these requirements the ageing effect of electrical energy storage device (e.g. batteries) is taken into account (see e.g the requirements regarding the **MRUP** value; see below in Chapter III the definition of paragraph 2.53)

*Annex 7,*

**D Electro-mechanical braking system**

*With the development of electro-mechanical brakes there is the need to be able to homologate systems using stored electrical energy.*

*In Annex 7 currently there exists only requirements for pneumatic, vacuum and hydraulic systems (Part A to C) using stored energy but there are no corresponding requirements for braking systems using electrical energy storage devices.*

*In Part D the basic principles of parts A to C are applied. However, due to significant differences of EMB systems with conventional braking system (e.g. non-considered EMB trailer interface and the possibility of vehicles to be equipped without a generator), certain modifications have been introduced in this Part D.*

**1. Capacity of electrical energy storage devices**

**1.1. General**

**1.1.1. Vehicles on which the operation of the braking system requires the use of electrical energy shall be equipped with electrical energy storage devices of a capacity meeting the requirements of paragraph 1.2. of this annex (Part D). Storage devices which are connected in series and/or parallel for the purpose of supplying a single braking circuit, shall be considered as one electrical energy storage device within this Annex and elsewhere in this Regulation.**

*This paragraph clarifies when single storage components (e.g. cells or modules) electrically connected (series/parallel combinations) together and are seen as one single electrical energy storage device.*

**1.1.2 It shall be possible to easily identify the electrical energy storage devices of the different braking circuits.**

**1.2. Power-driven vehicles**

**1.2.1. The electrical performance of the electrical energy storage device(s) of power-driven vehicles shall be such that, as a minimum, after eight full-stroke actuations of the service braking system control the electrical performance remaining in the electrical energy storage device(s) shall be not less than that required to obtain the specified secondary braking performance. It shall be such that, on at least the first actuation, the prescribed performance of the service braking system can be achieved.**

**1.2.2. The values of the electrical performance of the electrical energy storage device of each braking circuit, available to satisfy the condition of paragraph 1.2.1. above, shall be specified by the manufacturer as the minimum required usable performance.** [1]

**1.2.3. Testing shall be performed in conformity with the following requirements:**

[1] The value of the minimum required usable performance shall be stated in the approval document.

**1.2.3.1.** **The initial value of electrical energy in each of the electrical energy storage devices of each braking circuit shall be no greater than the minimum required usable performance value for that circuit as declared in accordance with paragraph 1.2.2. above. The electrical energy storage devices shall not be supplied with further energy.**
**The procedure by which the electrical energy storage devices are prepared for this test shall be agreed between the manufacturer and the type-approval authority. This procedure shall be recorded in the test report and included in the type-approval documentation.**

**1.2.3.2.** **Each full-stroke application shall be for a duration of at least 7.0 seconds with there being an interval of no more than 9.0 seconds between the release of the brake control and its subsequent actuation.**

*As in paragraph 5.2.1.27.5 of UN R13, paragraph 1.2.3.2. defines what is meant by a "full-stroke actuation".*

*However, deviating from the 20 seconds full application time required by paragraph 5.2.1.27.5., a time of 7.0 seconds is proposed as a more realistic time requirement.*

*The number "20" was set in square bracket for a long time in the nineties when paragraph 5.2.1.27.5 was under discussion. No one - at that time - had an idea what the appropriate number would be.*

*Since the electrical energy consumption for the electrical control transmission of a "conventional" EBS vehicle is comparatively low in relation to the available electrical energy, the relatively high number "20" was chosen to avoid any discussion.*

*However, the situation is completely different for EMB braking systems which also requires energy for the actuation of the brakes where the energy consumption can be considerable.*

*Furthermore, the test procedure of the eight full stroke actuations of paragraph 1.2.1. with an electro-mechanical braking system cannot be directly compared to a **conventional pneumatic** braking system, where:*

- *no additional energy is required to keep the braking force constant which, however, may be the case with an electro-mechanical braking system*
- *the brake performance is reduced at each brake application in contrast to an electro-mechanical braking system where the braking force at the first brake application will be similar to that of the ninth brake application.*

*In order to find a justifiable time requirement, a completely extreme and even unrealistic worse 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) would be 3,26 m/s², resulting in a braking time of **6,81 s** (compared to 4,44 s on a flat road).*

*Assuming the two cases:*

*a) A solo vehicle with a Gross Vehicle Weight (GVW) of 26 t (engine power of 330 kW) and*

*b) A vehicle combination of 40 t (engine power of 500 kW)*

*Driving down the gradient of 18 per cent and additionally accelerated by the engine with an acceleration of about 1.1 m/s² and considering - as a worst-case scenario - also the running resistances in the order of 0.14 m/s², then the time needed to accelerate these vehicles again to the speed of 80 km/h would be **8.1 s** (a) and **8.2 s** (b) respectively.*

*Taking these worst-case scenarios into account, a brake application time of 7.0 seconds followed by an unbraked interval of 9.0 seconds is therefore proposed for the test procedure according to paragraph 1.2.1. The reduced application time of 7.0 seconds is proposed to cover also electro-mechanical braking system which - in contrast to a conventional pneumatic braking system - also consumes energy during the brake application time after the brake force has already been fully applied.*

*Since, in an electro-mechanical braking system, the stored electrical energy does not only provide energy for the control but also for the much more consuming energy transmission, the reduced application time of 7.0 seconds is considered a more realistic value than the 20 s duration time as required by paragraph 5.2.1.27.5 of UN R13.*

**1.2.3.3** **Each full stroke actuation shall cause a power demand on the electrical energy storage devices equivalent to that required to provide maximum performance from**

**the service braking system. It shall be ensured that the energy provided to the brake system transmission during this test is provided only by the electrical energy storage devices.**

**1.2.3.4.** **In the case of power-driven vehicles to which the coupling of a trailer is authorized and with a pneumatic control line, the supply line shall be stopped and a compressed-air reservoir of 0.5 litre capacity shall be connected directly to the coupling head of the pneumatic control line. Before each braking actuation, the pressure in this compressed-air reservoir shall be completely eliminated. After the test referred to in paragraph 1.2.1. above, at the additional (ninth) actuation of the service braking system control, the energy level supplied to the pneumatic control line shall not fall below a level equivalent to one-half the figure obtained at the first brake actuation.**

*The testing conditions of paragraph 1.2.3. are the same as that of paragraph 1.2.2 of Part A.*
*Paragraph 1.2.3.4. (Part D) is in the version of paragraph 1.2.2.3 of Annex 7 Part A as amended during the fifth Working Party on Automated/Autonomous and Connected Vehicles (GRVA) session in February 2020.*

**1.2.3.5.** **It shall be ensured that the energy consumed by the service braking is not reduced by energy saving functions when carrying out the test during standstill compared to a driving situation.**

*Electro-mechanical braking systems which also consume energy when they keep the braking force constant **may** reduce or switch off the energy consumption by the service braking system when the parking brake is applied. Therefore, during this test procedure an energy saving function, if available, shall be disabled.*

**1.3.** **Interpretation of results**

**1.3.1.** **The capability to achieve the prescribed secondary braking performance shall be confirmed by dynamic testing in accordance with Annex 4, using only the electrical energy available from the electrical energy storage devices at the completion of the relevant tests of paragraph 1.2.3. above. However, the requirement of Annex 4, paragraph 2.2.5. to simulate a failure into the braking system shall not apply.**

**2.** **Capacity of the electrical supply device**

**2.1.** **General**

**The energy supply device (including the energy source, if fitted) shall meet the requirements set forth in the following paragraphs.**

**Testing shall be performed in conformity with the following requirements:**

**2.2.** **Conditions of measurement**

**2.2.1.** **The capacity of the energy supply device shall be assessed using the procedures of paragraph 1.5.1. of Annex 4 (Type-I test) and paragraph 1.5.3.1. (Hot performance). *Contrary to the requirements of the Type-I test, in all cases the number of brake actuations shall be 20.***

*Whereas Type-I deals with the fading characteristics of the brake ("heat capacity test"), this Annex 7 test ensures that the capacity of the electrical supply device is sufficient to provide the needed electrical energy also in a demanding driving situation. To standardize and harmonize the test procedure for all vehicle categories, the number of 20 brake actuations is defined (no brake line fading issue).*

**2.2.2.** **This test may be conducted under static conditions. In this case the duration of the braking event, the energy consumed by the braking system and the interval between braking events, shall be determined during the dynamic Type-I and hot performance tests of Annex 4.**

**a) In the case of vehicles of categories $M_3$ $N_2$ and $N_3$, the energy provided to the electrical energy storage device(s) during the static test shall be equivalent to the value of the energy provided by the electrical supply device to the electrical energy storage device(s) during 20 actuations of the dynamic Type-I and the hot performance test of Annex 4.**

**b) In the case of vehicles of categories $M_2$ and $N_1$, the brake actuations 16 to 20 shall be of the same duration and with and equivalent energy demand to that of actuation number 15. The interval between brake actuations shall be the same. The energy provided to the electrical energy storage device(s) during the static test shall be equivalent to the mean value of the energy provided by the electrical supply device to the electrical energy storage device(s) during 15 actuations of the dynamic Type-I and of the hot performance test of Annex 4.**

*As an alternative to the dynamic test procedure according to 2.2.1, the static test can be done at the discretion of the manufacturer by matching the conditions of the dynamic Annex 4 Type-I and hot-performance tests:*

- *energy consumed by the brakes in each of the cycles*
- *the duration of brake application*
- *the energy provided by the electrical supply device to the electrical energy storage devices*

**2.2.3.** **At the commencement of the test, the energy level in the electrical energy storage devices shall not exceed the value of the minimum required usable performance as confirmed by paragraph 1.2. above.**

**2.2.4.** **For vehicles authorized to tow a trailer of category $O_3$ or $O_4$, the electrical requirement of the trailer shall be represented by an electrical demand of 400 W. This demand shall be applied either directly to the electrical supply device or to the reserve of energy used for the trailer supply (indirect supply), whichever is appropriate. This requirement shall not apply if the electrical demand of the trailer is provided from a source that is neither directly nor indirectly maintained by the electrical supply device.**

**Where the energy supply device provides power for other vehicle systems, including auxiliary systems, and where they will not impose a power demand during the Type-I test procedure, the manufacturer shall declare the total power demand of those systems and this shall be represented during the test by an equivalent electrical demand on the electrical supply device.**

**The total power demand shall be continuously present throughout the test procedure.**

**2.3.** **Interpretation of results**

**2.3.1.** **The energy level in the electrical energy storage device(s) during, and on completion of, the test defined in paragraph 2.2. above, shall not fall to the [$SUP_W$] value as described in paragraph 5.2.1.13 [5.2.1.13.x] of this Regulation.**

*This means when the test defined in paragraph 2.2. above starts at the MRUP energy values for the respective braking circuits that during the 20+1 brake applications, the energy levels in the service braking circuits shall not fall to a level when the warning signal SUPw is required to be illuminated.*

## 2.4. Additional test

*In paragraph 2.5 of Part **A** of Annex 7, an additional test is prescribed in case if the power-driven vehicle is equipped with one or more energy storage devices for auxiliary equipment having a total capacity exceeding 20 per cent of the total capacity of the **pneumatic** braking energy storage devices. For an **electro**-mechanical braking system, an analogue "additional test" requirement is demanded by the newly proposed paragraph 2.5. of Part **D** of Annex 7.*

*This further 'additional test' of paragraph 2.4. is included in Part D of Annex 7 since an **electro-mechanical** braking system may have also **pneumatic** energy storage devices for **auxiliary** equipment fed by the same air compressor providing the air for the compressed-air braking system of the trailer. Thus, this test is added (independent on the size of the air reservoirs of the auxiliary equipment) to limit the maximum permitted filling time when **all** air reservoirs of a vehicle combination are filled up.*

**2.4.1. If the power-driven vehicle is equipped with one or more pneumatic energy storage devices for auxiliary equipment, an additional test shall be performed during which no irregularity shall occur in the operation of the valves controlling the filling of the pneumatic energy storage device(s) for auxiliary equipment.**

**2.4.2. In the event of a failure in the pneumatic auxiliary equipment it shall be prevented that this failure cannot cause a pressure drop in the supply line (if present) below the pressure of 650 kPa.**

*The performance braking requirements in UN Regulation No. 13 assume at least a pressure of 650 kPa in the supply line. Therefore, a failure in another vehicle system (e.g. air suspension) should not have an effect on the braking system that this assumed minimum pressure level is not anymore available.*

*The philosophy of this requirement is similar to that of the requirement of paragraph 5.2.1.15. in UN Regulation No. 13, where a failure of the trailer's braking system or in the event of an interruption in the supply line cannot cause the performance of the service braking system of the **motor** vehicle to fall under a certain performance level.*

**2.4.3. It shall be verified during the aforesaid test that the time $t_5$ necessary to raise the pressure from 0 to $p_4$ in the attached trailer energy storage device is less than:**

**2.4.3.1. 11 minutes**

*The corresponding requirements as laid down in Part A (paragraph 2.5.2.2) regarding the filling times are taken over (see also the testing conditions defined in paragraph 2.4.3.2.).*

**2.4.3.2. The test shall be performed with all air reservoirs installed in the towing vehicle and with an attached trailer energy storage device of a volume as defined in paragraph 3.2.4.**

## III. Newly added definitions (still under discussion)

**2.44.** **"*Electro-mechanical brake*" means a friction brake where electrical power only is converted to actuating forces by purely mechanical means.**

**2.47.a.** The "performance of an electrical energy storage device" means both its energy capacity (J**oules**) and its ability to provide electrical power (W**atts**).

**2.47.b.** *"$e_w$* [SUPw ?]" **means the warning level established according to paragraph 5.2.1.13.x indicating the low performance of an electrical energy storage device.**

**2.50.** **"*Electrical energy storage device*" means an energy reserve comprising a device, or combination of individual devices, each capable of storing an electrical charge, that are connected, in series and/or parallel, and provide electrical power to the braking system.**

**2.51.** **"*Electrical supply device*" means a device (e.g. battery, REESS, DC/DC converter, generator, fuel-cell or a combination of those components) that supplies electrical power to the braking system's electrical *energy* storage device(s).**

**2.52.** **"Certified Usable Performance (CUP)" means the performance of an electrical energy storage device available for the [service] braking system determined at the time of type approval.**

**2.53.** **"Minimum Required Usable Performance (MRUP)" means the minimum** performance of an electrical energy storage device [available] for the brake system **to fulfil the requirements of this Regulation.**

*The MRUP defines the energy required to perform prescribed braking independent of the degradation of the storage device.*

**2.54.** **"Actual Electric Usable Performance (AEUP)" is the instantaneous per centage value of maximum usable performance at the time.**

**2.55.** "**State of Health Performance (SHP)**" is the performance of an electrical energy storage device expressed as a percentage of the CUP value.

# IV. Agreed new or amended paragraphs

*Insert new paragraph 5.2.1.2.7.2.3*

**5.2.1.2.7.3.** **Notwithstanding the provisions of paragraph 5.2.1.2.7.2. above, in an electro-mechanical braking system that depends exclusively on the use, controlled by the driver, of an energy reserve, there shall be at least two completely independent energy reserves, each provided with its own control transmission likewise independent; each of them shall control the energy transmission of the brakes of one or more wheels. The energy transmission may share the energy reserve of its control transmission or use a separate independent reserve. It shall be ensured that, in the event of a failure of a transmission, the brakes supplied by the remaining independent transmissions are so selected as to be capable of ensuring the prescribed degree of secondary braking without endangering the stability of the vehicle during braking; in addition, each of the aforesaid energy reserves shall be equipped with a warning device as defined in paragraph 5.2.1.13. below. This should not be construed as a departure from the requirements of paragraph 5.2.1.8. of the Regulation.**

Renumber existing paragraph 5.2.1.2.7.3. as 5.2.1.2.7.4.

(5.2.1.29.4. to 5.2.1.29.4.3. below are from the existing text of the Regulation)

*5.2.1.29.4.* *Except where stated otherwise:*

*5.2.1.29.4.1.* *A specified failure or defect shall be signalled to the driver by the above-mentioned warning signal(s) not later than on actuation of the relevant braking control;*

*5.2.1.29.4.2.* *The warning signal(s) shall remain displayed as long as the failure/defect persists and the ignition (start) switch is in the "on" (run) position; and*

*5.2.1.29.4.3.* *The warning signal shall be constant (not flashing).*

*Insert new paragraph 5.2.1.29.4.4.*, to read:

**5.2.1.29.4.4.** **In the case of an electromechanical braking system employing an electrical energy storage device (or devices) it shall be ensured that the value of electrical performance at which the warning signal required by paragraph 5.2.1.35_old_29.2.2 and 5.2.1.35_old_29.2.3 is activated, is respected despite the effect of environmental conditions (e.g., temperature). The manufacture shall show to the satisfaction of the type-approval authority, how this is achieved.**

*Annex 13,*

*Paragraph 5.1.1.4., amend to read:*

**5.1.1.4. The service braking control device shall then be fully actuated four times in succession with the vehicle stationary. In the case of an electro-mechanical braking system, each full-stroke application shall be for a duration of at least 7.0 seconds with there being an interval of no more than 9.0 seconds between the release of the brake control and its subsequent actuation.**

*The second sentence is added to take into account the special characteristics of electro-mechanical braking systems (regarding this clarification, see also the detailed Justification as to paragraph 1.2.3.2. of Annex 7, Part D).*

# V. New paragraphs under discussion

5.2.1.13.2. ~~In the case of an electro-mechanical braking system, the requirements of paragraph 5.2.1.35.7 shall apply instead of the requirements of paragraph 5.2.1.13.1. to this Regulation.~~ The electrical energy storage devices may be used also by other vehicle systems as long as the energy consumption of these systems cannot cause the reserves of energy to fall under a level which ensures the prescribed service braking performance.

**5.2.1.13.x** **Vehicles equipped with electro-mechanical braking systems ~~, any vehicle fitted with a service brake actuated from an electrical energy storage device~~ shall be provided with a warning device, giving an optical or acoustic signal when the AEUP, in any part of the system, falls below the value of [SUPw] at which irrespective of the load conditions of the vehicle, the [prescribed service braking performance is still be ensured] and where it shall be possible to apply the service brake control a fifth time after four full-stroke actuations and obtain at least the secondary braking performance (without recharging the electrical energy storage device).**

**This warning device shall permanently monitor each braking circuit. The red warning signal specified in paragraph 5.2.1.29.1.1. shall be used as the optical warning signal.**

**In addition, the vehicle shall be equipped to display the AEUP. [This shall be expressed as a percentage of the [certified energy] of the electric storage device.] This indicator may share an area of a visual display common as permitted by UN R121 and need not be permanently visible. However, it must be visible immediately to the driver in response to a single manual demand at any time that the ignition/start switch is in the "on" (run) position. Furthermore, the [percentage value of stored energy] shall be displayed automatically on activation of the SUPw warning.**

**Note:**

**It is intended to revise the above paragraphs 5.2.1.13.2 and 5.2.1.13.x and incorporate them into the current Section 5.2.1.13 of UN R13.**

**5.2.1.35.7.2._new The yellow warning signal specified in paragraph 5.2.1.29.1.2 shall be indicated to the driver at the latest when a fully charged electrical storage device is not able to meet the MRUP value for the brake system (e.g. by effects of ageing and temperature). The MRUP value shall at least fulfil the energy requirements of Annex 7, Part D, paragraph 1.2.1.**

**5.2.1.35_old_29.2.2** In the case of a power-driven vehicle equipped with an electro-mechanical braking system, each electrical energy storage device **of each braking circuit** shall be monitored to assess the effect of ageing on its energy capacity. A warning signal shall be displayed when the **electrical performance** of that device falls below the initial value established in accordance with paragraph 1.2.3.1. of Annex 7, Part D to this Regulation. The yellow warning signal described in paragraph 5.2.1.29.1.2. shall be used.

**5.2.1.35_old_29.2.2** In the case of a power-driven vehicle equipped with an electro-mechanical braking system, each electrical energy storage device **of each braking circuit** shall be monitored to assess the effect of ageing on its energy capacity. A warning signal shall be displayed when the **electrical performance** of that device falls below the initial value established in accordance with paragraph 1.2.3.1. of Annex 7, Part D to this Regulation. The yellow warning signal described in paragraph 5.2.1.29.1.2. shall be used.

Ageing

Para 5.2.1.35_old_29.2.2 is intended to address the assessment of reduced energy capacity in an electrical energy storage device due to ageing. This assessment requires each device to be charged to (or near) its maximum capacity and for its energy content to be measured. In normal running this condition may not always exist, due to energy consumption by the brakes for example, and so the assessment can only be made under the defined conditions. The assessment is therefore required of each electrical energy storage device and is unique to electro-mechanical braking systems.

**5.2.1.35_old_29.2.3** In the case of a power-driven vehicle equipped with an electro-mechanical braking system, a warning signal shall be displayed when the energy in the braking system falls to a value at which the conditions of paragraph 1.2.1. of Annex 7, Part D to this Regulation cannot be fulfilled. The yellow warning signal described in paragraph 5.2.1.29.1.2. shall be used. However, this signal may be suppressed for a period not greater than 60 seconds following identification of the energy threshold being reached.

Low energy capacity

Para 5.2.1.35_old_29.2.3. is concerned with the more dynamic monitoring of energy, i.e. the fluctuation of energy value under normal driving conditions. In these circumstances the interest is in the energy available to the system rather than the energy capacity of individual electrical energy storage devices. This is more comparable with what is required of a pneumatic system today.

The proposal recognises that energy levels will fluctuate during normal use due to brake use and recharging. There is a risk that this may result in the warning signal cycling on and off – particularly towards the end of the service life of the electrical energy storage device. The proposal therefore includes a provision to allow up to 60 seconds of recharge time after the low energy condition is identified (the same interval used between brake applications in the Type-I test).

***5.2.1.35_old_29.2.2.1*** The warning signal may not be displayed as specified above in case the electrical performance of the electrical storage of a given braking circuit would fall below the minimum required usable performance value (as specified by the manufacturer in paragraph 1.2.2. of Annex 7, Part D), provided the following conditions are all fulfilled:

(a) The other braking circuit has a sufficient performance to ensure the requirements of paragraph 1.2.1. of Annex 7, Part D are fulfilled,

(b) The ageing of that circuit remains within the maximum ageing defined by the manufacturer,

(c) The stability of the vehicle during braking is not endangered.

As soon as condition (a) and/or (b) is no longer fulfilled, the yellow warning signal described in paragraph 5.2.1.29.1.2. shall be displayed.

The maximum ageing of the electrical storage as specified in item (b) above shall be demonstrated to the technical services (e.g. based on validation test reports).

The stability of the vehicle during braking required in item (c) shall be demonstrated to (tested by) the technical services in the worst cases.

**5.2.1.35.9._new The functions to monitor the ageing and charging of the electrical energy storage devices shall be checked at the time of type approval. The method by which this check is carried out shall be agreed between the vehicle**

**manufacturer and technical service. The values of CUP, MRUP, AEUP etc, specified by the manufacturer and verified in the assessment, shall be declared in Annex 2 paragraph 17.x.**

**5.2.1.35.10._new .... ⇐ Placeholder for a requirement regarding the definition of SHP (Definition 2.55)**

**5.2.1.35.11._new In the case where the braking system of the vehicle shares the same energy supply as other vehicle systems and there is a failure in the energy supply, the braking system shall have priority.**

**However, if that energy supply also supplies the steering system, the steering system shall have priority over the braking system in accordance with UN Regulation 79.**

**Annex 2**

**"17. Additional information in the case of power-driven vehicle equipped with an electro-mechanical braking system ('EMB')**

**17.1. Vehicle is/is not[2] equipped with an electro-mechanical braking system**

**17.2. In the case where a towing vehicle is equipped with an electro-mechanical braking system the vehicle is/is not[2] authorized to tow a trailer with a compressed-air braking system**

**17.3. Low electrical energy warning level $e_w$ in J or Wh: .....**

**17.4. Certified Usable Performance (CUP) in J or W: .....**

**17.5. Minimum Required Usable Performance (MRUP) in ... :**