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World Forum for Harmonization of Vehicle Regulations**Working Party on Automated/Autonomous and Connected Vehicles****Fifteenth session**

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Item 8(b) of the provisional agenda

UN Regulations Nos. 13, 13-H, 139, 140 and UN GTR No. 8:**Electromechanical Brakes****Proposal for a supplement to the 11 series of amendments to
UN Regulation No. 13 (Heavy vehicle braking)****Submitted by the experts from the International Association of the
Body and Trailer Building Industry***

The text reproduced below was prepared by the experts from the International Association of the Body and Trailer Building Industry (CLCCR). The modifications to the current text of the Regulation are marked in bold for new and strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2023 (A/77/6 (Sect.20), para 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



I. Proposal

Paragraph 2.2.2.4., amend to read:

“2.2.2.4. A different type of braking equipment **or any presence of an electric regenerative braking system with the power and torque characteristics per trailer above [60 kW] or [2 kNm]. Electric regenerative braking system below these limits do not require special consideration here.**”

Paragraph 2.21.4., amend to read:

“2.21.4. “*Electric state of charge*” means the instantaneous ratio of ~~electric~~ **electric** quantity of **electric** energy stored in the traction battery relative to the maximum quantity of electric energy which could be stored in this battery.”

Paragraph 5.2.1.21., amend to read:

“5.2.1.21. In the case of a power-driven vehicle authorized to tow a trailer of Categories O₃ or O₄, the service braking system of the trailer may only be operated in conjunction with the service, secondary or parking braking system of the towing vehicle. However:

- (a) **An** automatic application of the trailer brakes alone is permitted where the operation of the trailer brakes is initiated automatically by the towing vehicle for the sole purpose of vehicle stabilization;
- (b) **If the trailer is equipped with an electric regenerative braking system, this system may also be used independently from the towing vehicle's service-, auxiliary- or parking braking system as long as the electric regenerative braking system does not negatively affect the stability of the vehicle combination and is controlled either by the trailer or the towing vehicle. The towing vehicle shall be able to suppress the function of the electric regenerative braking system in the trailer.**”

Paragraph 5.2.1.28.6., amend to read:

“5.2.1.28.6. A coupling force control system shall control only the coupling forces generated by the service braking system of the motor vehicle and the trailer. Coupling forces resulting from the performance of endurance braking systems **and/or electric regenerative braking systems may be compensated by the electric regenerative braking system of the trailer according to paragraph 5.2.2.3. but** shall not be compensated by the service braking system of either the motor vehicle or trailer. It is considered that endurance braking systems are not part of the service braking systems.

Insert new paragraph 5.2.1.28.7., to read:

“5.2.1.28.7. **Notwithstanding the provisions of paragraph 5.2.1.28.6. of this Regulation, endurance and regenerative braking systems of the trailer may be operated in a mode so that aforementioned systems can interact with the trailer's service braking system by themselves (i.e. brake blending) as long as the demanded deceleration neither decrease nor increase.**”

Paragraph 5.2.2.3., amend to read:

“5.2.2.3. Trailers of Categories O₃ and O₄ shall be equipped with a service braking system of the continuous or semi-continuous type.

In addition, trailers of Categories O₃ and O₄ may be equipped with an electric regenerative braking system, which may be used when meeting one of the following conditions:

- (a) **The endurance braking system of the towing vehicle according to paragraph 2.15.2.1. is activated,**

- (b) **The service braking system is operating in a mode that allows an interaction with the electric regenerative braking system of the trailer (i.e. brake blending)."**

Paragraph 5.2.2.7., amend to read:

"5.2.2.7. The braking surfaces required to attain the prescribed degree of effectiveness shall be in constant connection with the wheels, either rigidly or through components not liable to failure.

Where braking torque for a particular axle or axles is provided by both a friction braking system and an electrical regenerative braking system of category B, disconnection of the latter source is permitted, providing that the friction braking source remains permanently connected."

Insert new paragraph 5.2.2.24., to read:

"5.2.2.24. **In the case of trailers equipped with an electric regenerative braking system this system shall distribute its action appropriately among each axle where such a system is active.**

The electric regenerative braking system of the trailer may be active on more than one axle of the trailer.

However, the electric regenerative braking system shall not impair the function of the anti-lock braking system.

II. Justification

1. It is needed to significantly reduce CO₂ emissions induced by the transport sector worldwide to tackle climate change. The transport sector is an important CO₂ emitter after the energy sector and other industry branches. Therefore, stringent goals for heavy duty vehicles are defined to limit the CO₂ emissions. It might be interesting to have a closer look at the potential of trailers to contribute to the overall CO₂ reduction of a vehicle combination. The trailer or semitrailer itself does not emit CO₂ in standstill or in driving modes but it contributes to the overall CO₂ balance of the vehicle combination. Therefore, it is logical to think about the role of the trailer and to find measures/technologies for a reduction of these emissions.

2. One of these measures/technologies for a reduction of these emissions is to equip trailers with an electric regenerative braking system and/or a propulsion system in its axle. These new axles in trailers have the potential to convert the kinetic energy of an axle to supply electric systems (e.g. cooling units for reefer) as well as to support the motor vehicle (e.g. the tractor) during start-stop manoeuvres or during accelerating/braking. This leads to lower fuel consumption of the motor vehicle or the cooling units (ergo lower CO₂ emissions). These functions of the trailer/semi-trailer will be controlled to safely follow the towing vehicle. The trailer/semi-trailer in a vehicle combination shall be controlled within the vehicle combination in such a way that the longitudinal/lateral stability of the combination is not negatively influenced. Such regenerative braking system of the trailer/semi-trailer can operate in the full speed range of the vehicle combination and is not limited to low-speed applications.

3. Justification for paragraph 2.2.2.4.: Compared to the total possible braking power or the total torque of the wheel brakes of a trailer, the braking effect of an electric regenerative braking system of max. 60 kW or max. 2 kNm can be regarded as negligible. For the operation and simple control of such low-threshold systems, it is advantageous if interaction with the towing vehicle is not mandatory. A braking torque of around 44 kNm is normally installed on a trailer axle. That means that 60kW per axle at 89km/h is about 1.2 kNm braking torque (= 2.5 per cent per axle, 1 per cent for the 3-axle trailer) and is therefore negligible. The same applies to the 2 kNm regenerative braking force, which is in the range of 4.5 per cent per axle and 1.5 per cent for the 3-axle trailer.

4. Justification for paragraph 2.21.4.: This seems to be a typing error and this amendment is proposed to correct the wording.
5. Justification for paragraph 5.2.1.21.: It should be permitted to use the trailers regenerative braking system without activated service braking system of the towing vehicle to gain the highest possible effects of recuperation. However, in this case this shall only be activated by the towing vehicle (e.g. by the control device of the endurance braking system) or if it is controlled by the trailer.
6. Justification for paragraph 5.2.1.28.6.: In case the coupling force control is operated by a regenerative braking system, it shall not be negatively affected by the friction brake of the other vehicle.
7. Justification for paragraph 5.2.2.3. [and 5.2.1.28.7.]: With this paragraph the use of a regenerative braking system would be permitted for trailers of Categories O₃ and O₄. However, the trailers' regenerative braking system shall not operate self-controlled but be activated by the towing vehicles endurance or service braking system. Furthermore, self-managed brake blending should be allowed for the trailer as long as the towing vehicles brake request will not be decreased or increased due to this.
8. Justification for paragraph 5.2.2.7.: The functionality of the electric regenerative braking systems may overlay the friction brakes but the friction braking source must remain permanently connected.
9. Justification for paragraph 5.2.2.24.: This paragraph is needed to allow a recuperation on one or more axles of the trailer but with the requirement of an equal distribution of the torque on the affected wheels whilst not interfering with steering of the vehicle.
