Submitted by the expert from CLCCR

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Proposal for Supplement to the 11 Series of Amendments UN Regulation No. 13 (Heavy vehicle braking)

Submitted by the experts from the International Association of the Body and Trailer Building Industry (CLCCR)

The text reproduced below was prepared by the experts from CLCCR. The modifications to the current text of the regulation are marked in bold characters and strikethrough for deleted characters.

I. Proposal

Paragraphs 2.2.2.4., amend to read*:*

2. Definitions

2.2. "Vehicle type" means a category of vehicles which do not differ in such essential respects as:

2.2.2. In the case of trailers,

"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~~ 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**:**

(1) 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**;**

(2) if the trailer is equipped with an electric regenerative braking system, this system may also be used independent 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 that aforementioned systems may interact with trailer's service braking system by themselves (i.e. brake blending) as long as demanded deceleration will neither be decreased nor increased."**

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 the categories O3 and O4 may be equipped with an electric regenerative braking system which may be used by meeting one of the following conditions:

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

(2) 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

General

To tackle climate change, it is needed to significantly reduce CO2 emissions induced by the transport sector worldwide. 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 for a closer look on 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 driving modes but contribute to the overall CO2 balance of the vehicle combination. Therefore, it is logically to think about the role of the trailer and to find measures/technologies for a reduction of these emissions.

One of these features is a trailer 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, during accelerating/braking. This leads to lower fuel consumption of the motor vehicle respectively 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.

Paragraphs 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 axle, 1% 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 axle and 1.5% for the 3-axle trailer.

Paragraph 2.21.4.
This seems to be a typing error and this amendment is proposed to correct the wording.

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.

Paragraph 5.2.1.28.6.
In case the coupling force control is operating by a regenerative braking system this shall not be negatively effected by the friction brake of the other vehicle.

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 category O3 and O4. However, the trailers regenerative braking system shall not operate self controlled but activated by the towing vehicles endurance or service braking system. Furthermore brake blending should be allowed self managed for the trailer als long as the towing vehicles brake request will not be decreased or increased due to this.

Paragraph 5.2.2.7.
The functionality of the electric regenerative braking systems may overlay the friction brakes but friction braking source must be remain permanently connected.

Paragraph 5.2.2.24.
This paragraph is needed to allow a recuperation on 1 or more axles of the trailer but with the requirement of an equal distribution of the torque on the effected wheels whilst not interfering with steering of the vehicle.
