Submitted by the experts from
CLCCR/CLEPA/OICA

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Draft proposal amending document ECE/TRANS/WP.29/GRVA/2023/3 (CLCCR)
(Amendment to UN R13 for e-trailers)

(Produced by the joint CLCCR / CLEPA / OICA industry Task Force)

This document is a draft developed by the industry TF on e-trailers, with contribution from CLCCR, CLEPA and OICA experts.

Legend

- Blue text = changes to ECE/TRANS/WP.29/GRVA/2023/3
- Black text: same as in ECE/TRANS/WP.29/GRVA/2023/3
- The modifications to the current text of the Regulation are marked in bold for new and strikethrough for deleted characters.

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 and/or any presence of an electric propulsion 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.**~~"

Comment: Shifted to requirement section with lower value.

Paragraph 2.21., amend to read:

"2.21. *"Electric regenerative braking"* means a braking system which, during deceleration, **and/or while being towed in case of vehicles of category O,** provides for the conversion of vehicle kinetic energy into electrical energy."

~~*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."~~

Comment: Para 2.21.4. was just recently amended by EBSIG. No need for further amendment.

Add new Paragraph 2.5x., to read:

2.56. "e-trailer" means a trailer that is able to contribute to the propulsion of the vehicle combination by using its own electric powertrain."

Comment: To introduce a trailer with propulsion capability.

~~*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 O_3 or O_4, 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.**"~~

Comment: No need for change.

- This paragraph applies to motor vehicle, not to trailers. Consequently, this paragraph does not restrict nor prohibit any function on the trailer which would actuate the braking system (should it be friction, park or electric regenerative braking (ERB)) of the trailer.
- Today this requirement does not prohibit the trailer vehicle stability function (VSF) to brake the trailer independently from the motor vehicle to prevent a roll-over.
- Same interpretation should apply to e-trailers ERB.

~~*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.~~

Comment: No need for change. Coupling force control is only permitted in towing vehicles, not on trailers.

~~*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."**~~

Comment: Not relevant in the motor vehicle section.

~~*Paragraph 5.2.2.3.*, amend to read:~~

~~"5.2.2.3. Trailers of Categories O_3 and O_4 shall be equipped with a service braking system of the continuous or semi-continuous type.~~

~~**In addition, trailers of Categories O_3 and O_4 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).**~~~~"~~

Comment: Not necessary.

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."**

Comment: No change to GRVA-2023-03

~~*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 side of the same 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.**~~

Comment; Reshuffled in new section 5.2.2.26.

Insert new paragraph 5.2.2.26., to read:

5.2.2.26. Special additional requirements for trailers of category O3/O4 equipped with electric regenerative braking system

Comment: a similar paragraph will be added for trailers of category O2

The requirements in the following sub-paragraphs apply to trailers with or without propulsion capabilities. However, trailers without propulsion capabilities, equipped with an ERB system able to provide a retardation power of not more than 20kW

- **are exempted from all the following sub-paragraphs if the generated brake rate never exceeds 0.04 (for each axle);**
- **are exempted from all the following sub-paragraphs except 5.2.2.26.1.2. if the generated brake rate can exceed 0.04 (for each axle).**

Comment:

20 kW is a value low enough that it does negatively impact the motor vehicle, but high enough to supply a cooling system.

Polished ice adhesion is ~0.05, which is the most extreme condition. Rolling resistance of a trailer is ~0.01. A brake rate of 0.04 generated by the trailer ERB will never lead to a wheel lock (at least with an acceptable low probability).

5.2.2.26.1. General requirements

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

5.2.2.26.1.2. The brake forces generated by the ERB of the trailer shall be controlled such that the wheel(s) braked by the ERB system are prevented from locking by that system at speeds above 15 km/h.

The vehicle manufacturer shall demonstrate during the Annex 18 assessment that the ERB system has no critical influence on the operation of the anti-lock system.

5.2.2.26.1.3. The brake forces generated by the ERB of the trailer, and the propulsion forces generated by an e-trailer, shall not impair the operation of Vehicle Stability Function (VSF) of the trailer. This shall be demonstrated during the Annex 18 assessment.

5.2.2.26.1.4. When the motor vehicle transmits the following messages via the data communication part of the electric control line, the e-trailer shall switch off the propulsion forces:

- **"VDC active" EBS11 Byte 2, Bits 5-6 set to "active"**
- **a service/secondary braking demand value EBS11 Bytes 3-4**
- **a retarder demand value EBS11 Byte 6**
- **vehicle retarder control active/passive EBS11 Byte 1 Bits 5 – 6**
- **brake light switch EBS11 Byte 2 Bits 1 – 2**
- **……**

The propulsion forces shall also be switched off when a braking demand is present on the pneumatic control line and/or when the stop lamp electric signal is received.

Comment: to be reviewed when new ISO 11992-2:[202x] will be published.

5.2.2.26.1.5. Trailers shall be equipped with an electric control line conforming to ISO 11992-2:[2023/202x]. Additionally, they shall be able to identify whether the motor vehicle is equipped with an electric control line conforming to ISO 11992-

2:[2023/202x], and implement the "handshake procedure between towing and towed vehicle" procedure as specified in ISO 11992-2:[2023/202x].

Additionally,

- **the trailer shall support the relevant messages specified in Annex 16, providing information to the motor vehicle on the actual configuration and status of the trailer (with regard to the ERB and to the propelling function),**
- **the trailer shall execute the commands received from the motor vehicle (e.g. the "retarder demand value"),**
- **the retarder and the propulsion demand received from the motor vehicle (via message "retarder demand value") shall have priority on the demands elaborated within the trailer. A retarder demand value equal to "0" shall be interpreted by the trailer as a demand to cut-off both retardation and propulsion.**

Comment: to be reviewed when new ISO 11992-2:[202x] will be published.

5.2.2.26.1.6. When the speed is higher than 15 km/h, the propulsion forces shall never exceed the overall driving resistance forces of the trailer. /footnote

/footnote: this restriction will be reconsidered once technical progress will have ensured the stability of combination in those cases.

Comment:

- Above 15 km/h, the trailer can still provide propulsion forces but not beyond the point when the trailer is pushing the truck.
- Below 15km/h, the force is not limited, in order to allow moving-off capabilities of the combination, while not putting at risk stability at higher speed (risk of jackknifing if the trailer is pushing).
- This restriction may be removed once technology will be ready with solutions to ensure stability of the combination in all cases.

5.2.2.26.1.7. The strategies implemented in the trailer to control the ERB system and the propulsion forces shall be described in the type approval documentation and be a part of the Annex 18 assessment.

5.2.2.26.2. Requirements applicable to the case where the trailer cannot communicate with the motor vehicle via the electric control line:

a) The ERB system shall not provide a retardation power exceeding 20kW for the complete trailer.

b) An e-trailer shall not provide any propulsion force.

Comment:

- the motor vehicle is not equipped with an electric control line, or
- the ISO 7638 electrical connector is not plugged, or

- There is an electrical failure on the line...

5.2.2.26.3. Requirements applicable to the case where the communication between the trailer and the motor vehicle (via the electric control line) is operational:

5.2.2.26.3.1. In the case where the handshake procedure (specified in 5.2.2.26.1.5.) is not performed successfully:

a) The ERB system may provide a retardation power exceeding 20kW for the complete trailer provided

- **the motor vehicle is not in a traction phase, and**
- ***to be defined.***

b) An e-trailer may provide a propulsion force provided

- **The motor vehicle is in a traction phase, and**
- ***to be defined.***

The method by which the trailer fulfils the requirements above shall be described in the type approval documentation and be a part of the Annex 18 assessment.

Comment: covers the case where the motor vehicle is equipped with version of ISO 11992-2 earlier than that of [2023/202x]).
Requirements to be defined in order to ensure there is no negative influence on the motor vehicle's CFCS, mass and slope estimation etc. If proper requirement cannot be defined to address the concern, same requirements as in 5.2.2.26.2 shall apply.

5.2.2.26.3.2. In the case the case where the handshake procedure (specified in 5.2.2.26.1.5.) is performed successfully:

The trailer shall adapt the control strategy of the ERB and of the propulsion system to the value of the motor vehicle parameter "truck drive system control support:

- **0 - no drive system control support by truck,**
- **1 - truck supports only negative torque to control drive systems in the trailer,**
- **2 - truck supports only positive torque to control drive systems in the trailer,**
- **3 - truck supports negative and positive torque to control drive systems in the trailer.**

The influence of the value of motor vehicle parameter "truck drive system control support" on the trailer control strategies shall be described in the type approval documentation.

Comment: Both truck and trailer are designed for an optimal control of ERB and e-trailer.

Annex 4, Insert new paragraph 1.7.1.3. to read:

"1.7.1.3. In case of trailers equipped with an electric regenerative braking system the regenerative braking system shall be switched off during the brake applications."

Annex 4, Insert new paragraph 3.1.2.6. to read:

"3.1.2.6. In case of trailers equipped with an electric regenerative braking system the regenerative braking system shall be switched off during the brake test."

Annex 4, Insert new paragraph 3.1.3.5. to read:

"3.1.3.5. If the trailer is equipped with an electric regenerative braking system the regenerative braking system shall be switched off during the brake test."

Comment: As we do not have any requirements for the performance of regenerative trailer braking systems, we may take them as bonus, but do not test them.

Annex 13, Insert new paragraph 4.7. to read:

"4.7. Vehicles equipped with an electric regenerative braking system shall also be equipped with an anti-lock braking system acting at least on the service brakes of the electric regenerative braking system´s controlled axle and on the electric regenerative braking system itself, and shall fulfil the relevant requirements of this annex."

Annex 16, paragraph 2.4.1., amend table to read:

Function / Parameter	*ISO 11992-2:2003 Reference*
Vehicle type	EBS11 Byte 2, Bit 3-4
VDC (Vehicle Dynamic Control) Active / passive[1]	EBS11 Byte 2, Bit 5-6
Brake demand value for front or left side of vehicle	EBS11 Byte 7
…	
Trailer regenerative system demand value	…

Annex 16, paragraph 2.4.2., amend table to read:

Function / Parameter	*ISO 11992-2:2003 Reference*
Support of side or axle wise brake force distribution	EBS21 Byte 2, Bit 3-4
Wheel based vehicle speed	EBS21 Byte 3-4
Lateral acceleration	EBS21 Byte 8
…	
Actual trailer regenerative braking system torque	…

Comment: Annex 16 needs to be amended according to the update of ISO 11992-2:202x