

Submitted by the experts from
CLCCR/CLEPA/OICA

Informal document **GRVA-21-41**
21st GRVA, 20-24 January 2025
Agenda item 8(c)

UN Reg 13 amendment for e-axles and self-propelled trailers

CLCCR / OICA / CLEPA
Industry Task Force

GRVA-21

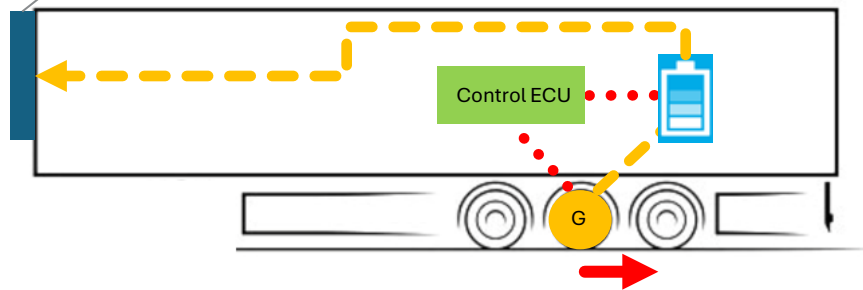
20-24 January 2025

General concepts and strategy

Background and scope

Dynamo trailer

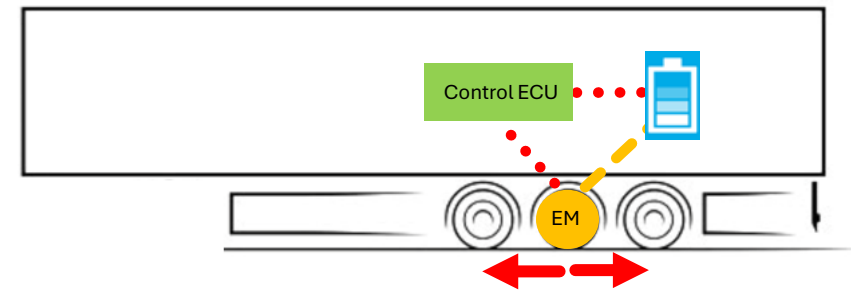
The trailer recuperates energy for trailer users, e.g. a cooling unit (usually energy consumption < 20 kW)



- Data communication
- Power flow
- ← force

E-trailer

The trailer recuperates energy and provides propulsion. Trailer users (cooling unit) may be installed as well.



The proposed amendment regulates both dynamo trailers and e-trailers, limited to categories O3 and O4. Light O2 trailers will be considered in a second step.

Definitions

UN R13 (proposal)

2.x “e-trailer” means a trailer that is able to contribute to the propulsion of the vehicle combination by using its own electric powertrain.

R.E.3. (current)

1.5. "Trailer" means any **non-self propelled vehicle**, which is designed and constructed to be towed by a power driven vehicle and includes semi-trailers.



An e-trailer is not a trailer...



An update of R.E.3. is needed.

General concept



Variant 1:

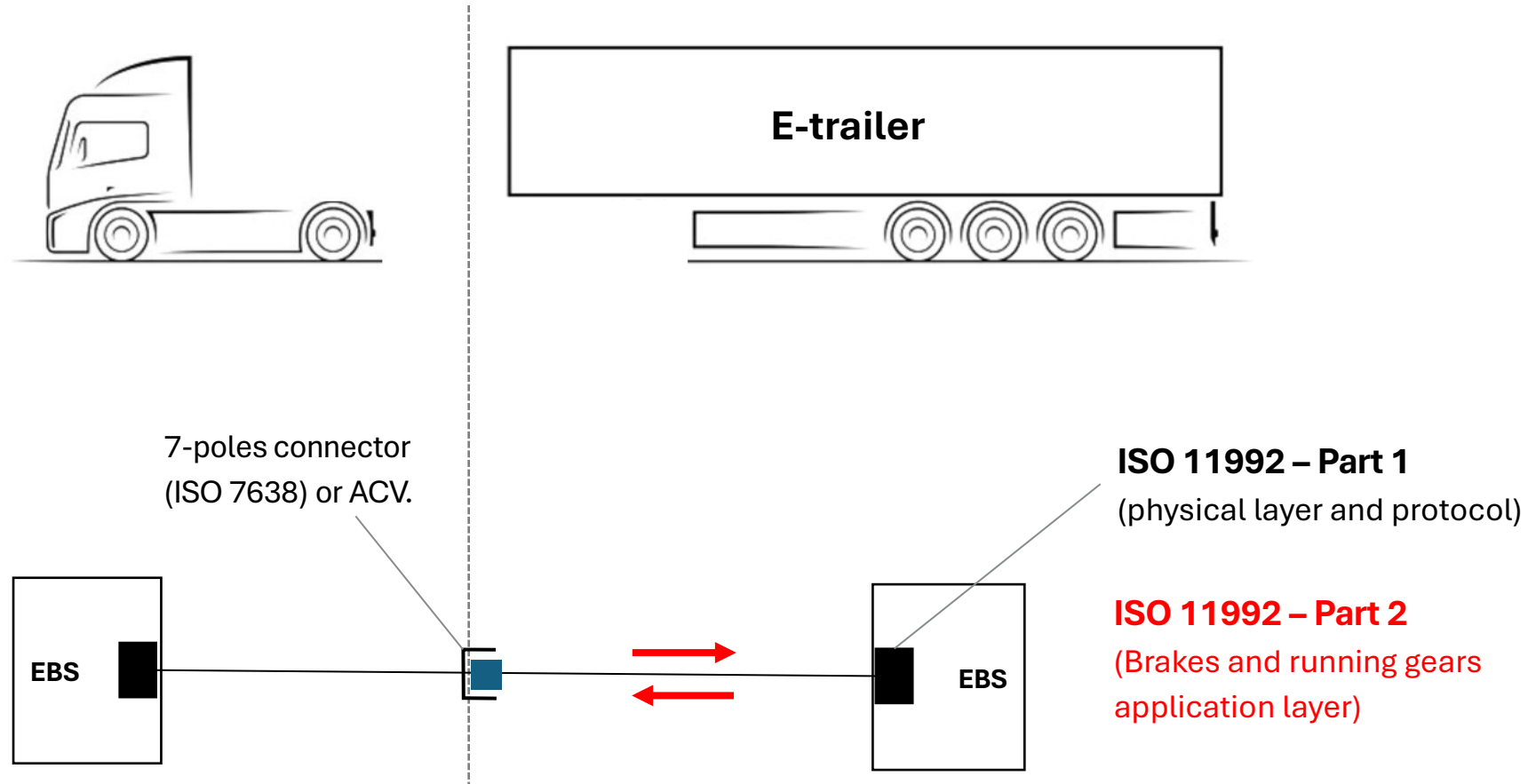
- The motor vehicle controls retardation / recuperation and propulsion of the e-trailer.
- The e-trailer sends a feedback to the motor vehicle on the actual status.

Variant 2:

- The e-trailer builds its own retardation / recuperation and propulsion demands and transmits the actual status to the motor vehicle.
- The motor vehicle integrates e-trailer information in its own braking and propulsion strategies, and has the capability to cut-off e-trailer forces whenever needed (e.g. cut-off propulsion in case of braking or an ESC intervention).

The concept could also be a mix of variants 1 and 2.

Implementation



The digital link and the electric connector are regulated by UN R13.
This ensures the interoperability of vehicles.

Implementation issues



- Current version 2014 of ISO 11992-2 (specified in R13) does **not** support e-trailers; the general concept described in a previous slide **cannot** be implemented.
- The ISO version 2023 was developed to support e-trailers, but it **cannot** be used, due to errors and omissions.
- An ISO working group is on-going to deliver an **updated version in 2026**.
- Industry cannot wait until 2026. An intermediate step needs to be developed.

Strategy for regulation update

❑ Rationales (reminder):

- Current version 2014 of ISO 11992-2 does not support e-trailers.
- Updated ISO version supporting e-trailers is planned for 2026.
- Industry cannot wait until 2026.

❑ Proposal to proceed in 2 steps:

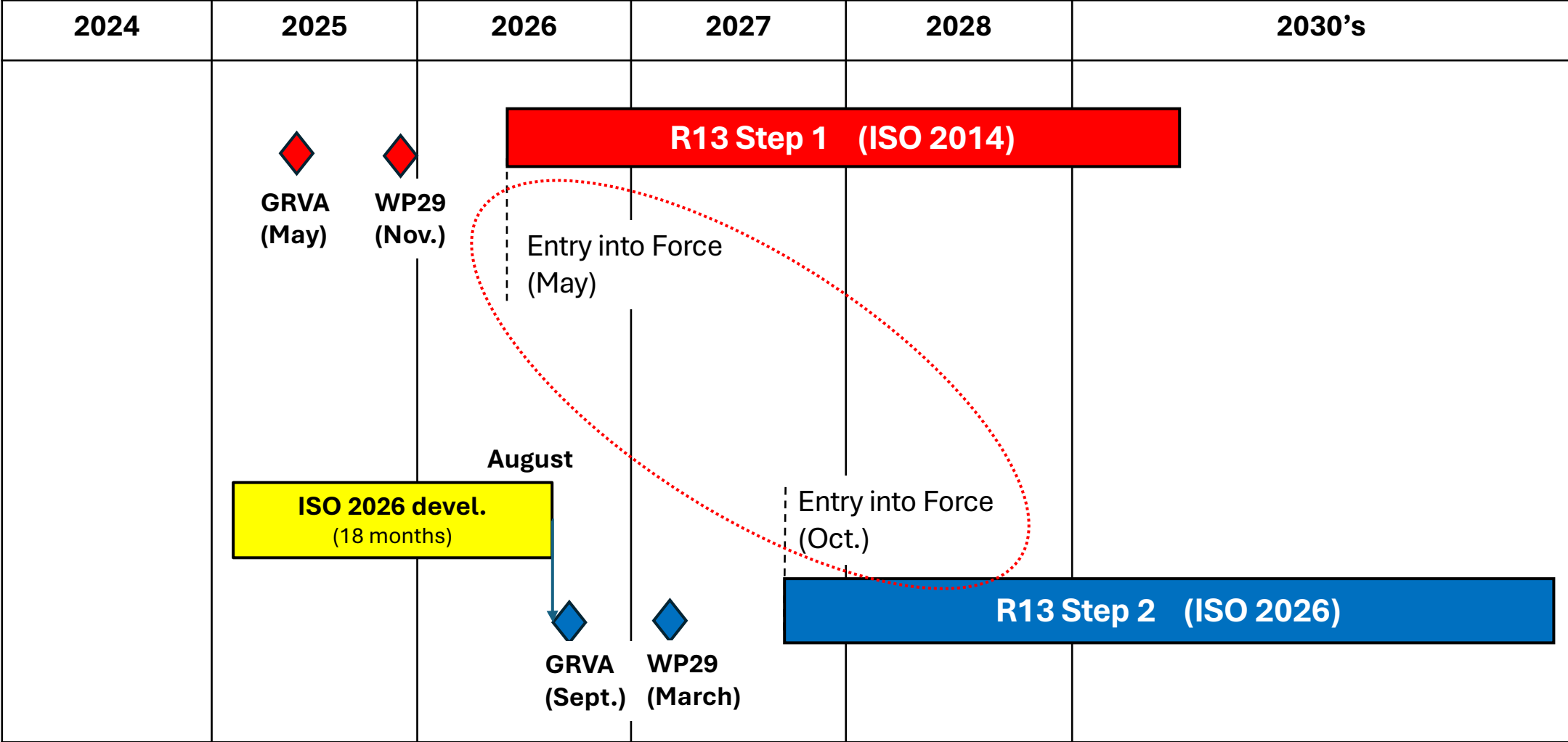
- Step 1 Require ISO 2014 for e-trailers, and implement **technical restrictions** to ensure safe operation with existing motor vehicles.
- Step 2 Require ISO 2026 for both tractor and trailer.

The motor vehicle has only limited control on e-trailer forces. The challenge is to maximize the use of e-trailers, while setting necessary restrictions to ensure e-trailers will not disturb the operation of the motor vehicle.

The way to implement the general concept described in the previous slides (i.e. the motor vehicle controls / can cut-off the e-trailer forces).

The text presented today is a draft proposal implementing the step 1.

Target Time-plan : regulation ready mid-2026

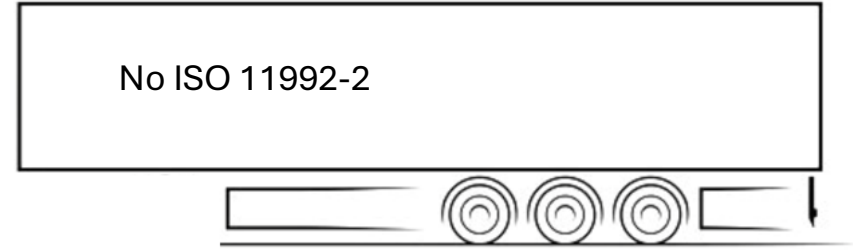


◆ adoption

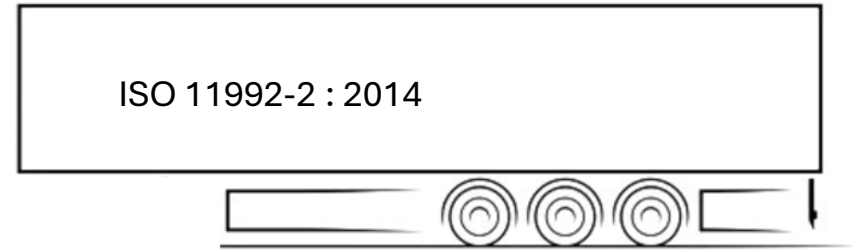
Overview of different configurations

Configurations – Current situation

No ISO 11992-2



ISO 11992-2 : 2014



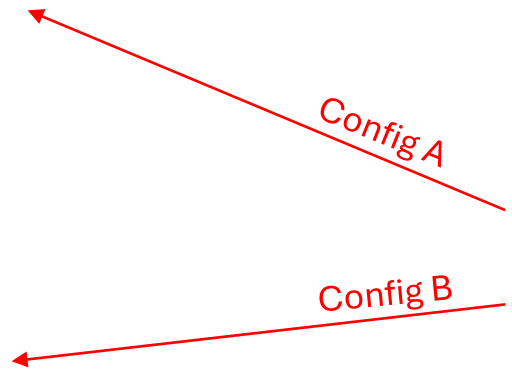
Interoperability is ensured

Configurations - R13 Step 1

No ISO 11992-2



ISO 11992-2 : 2014



This slide is showing the configurations of e-trailer combinations that will exist in the field once step 1 will be implemented.

Dynamo trailer configurations are not shown here.

Configurations - R13 Step 1 + Step 2

This slide is showing the configurations of e-trailer combinations that will exist in the field once step 1 and step 2 will be implemented.

Dynamo trailer configurations are not shown here.

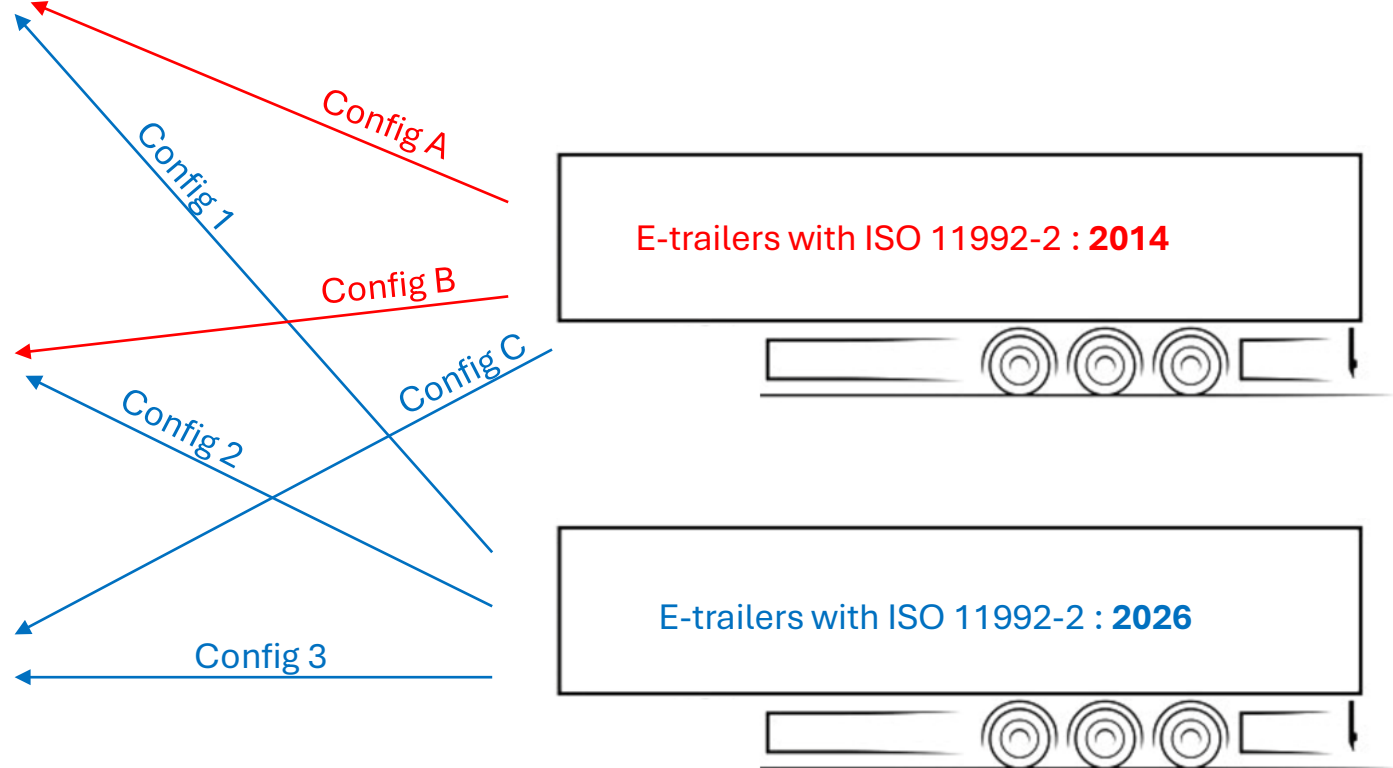
No ISO 11992-2



ISO 11992-2 : 2014



ISO 11992-2 : 2026



Overview of proposed requirements and outstanding issues

General requirements

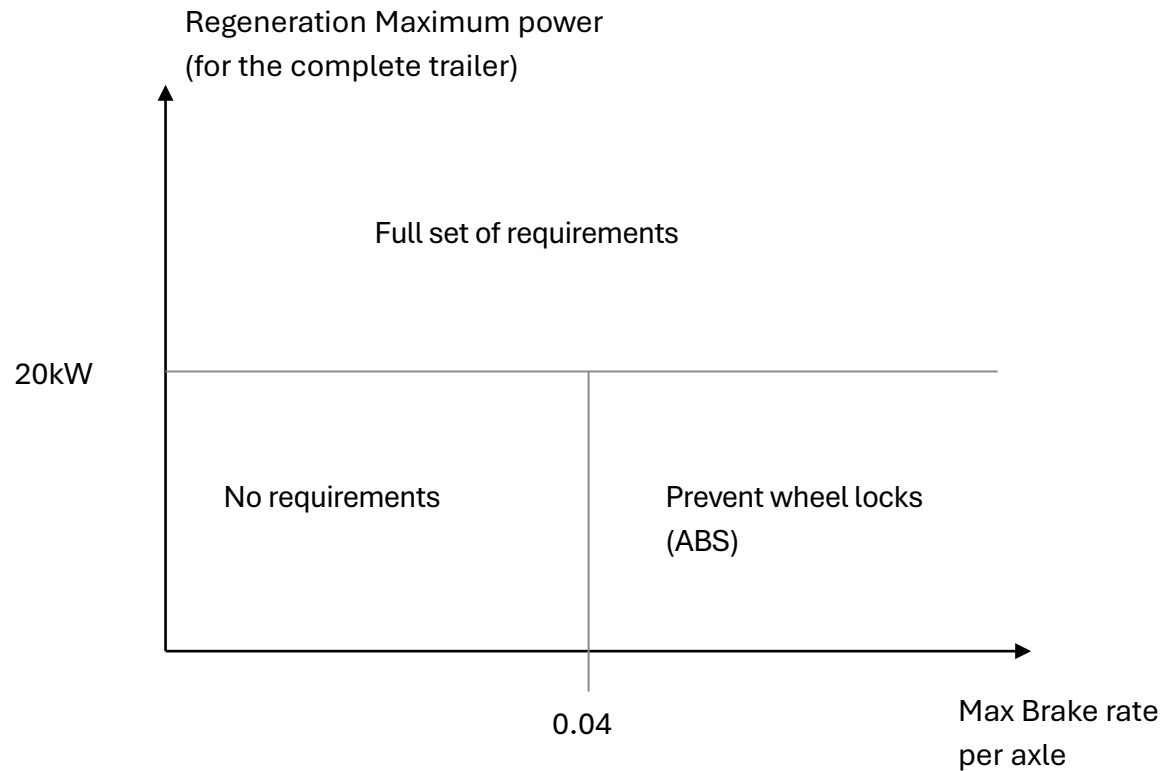
- Regenerative brake forces to be distributed equally left - right of an axle
- Control of regenerative brake forces to prevent locking of wheels at speeds above 15 km/h (same threshold to be found in Reg 13, Annex 5 and Annex 13)
- Regenerative brake forces shall not impair the operation of the trailers Vehicle Stability Function (VSF)
- E-trailer shall be equipped with an electric control line according to ISO 11992-2:2014
- E-trailer shall shut off propulsion in case of
 - Braking (service, parking and/or endurance braking)
 - VSF / ESC intervention
- At speeds higher than 15 km/h, the propulsion forces shall not exceed the overall driving resistance forces of the trailer. Driving resistance is sum of rolling resistance, aerodynamic drag and effect of mass.
- Requirements regarding functional safety need to be reflected according to Reg 13, Annex 18

Technical restrictions and limits

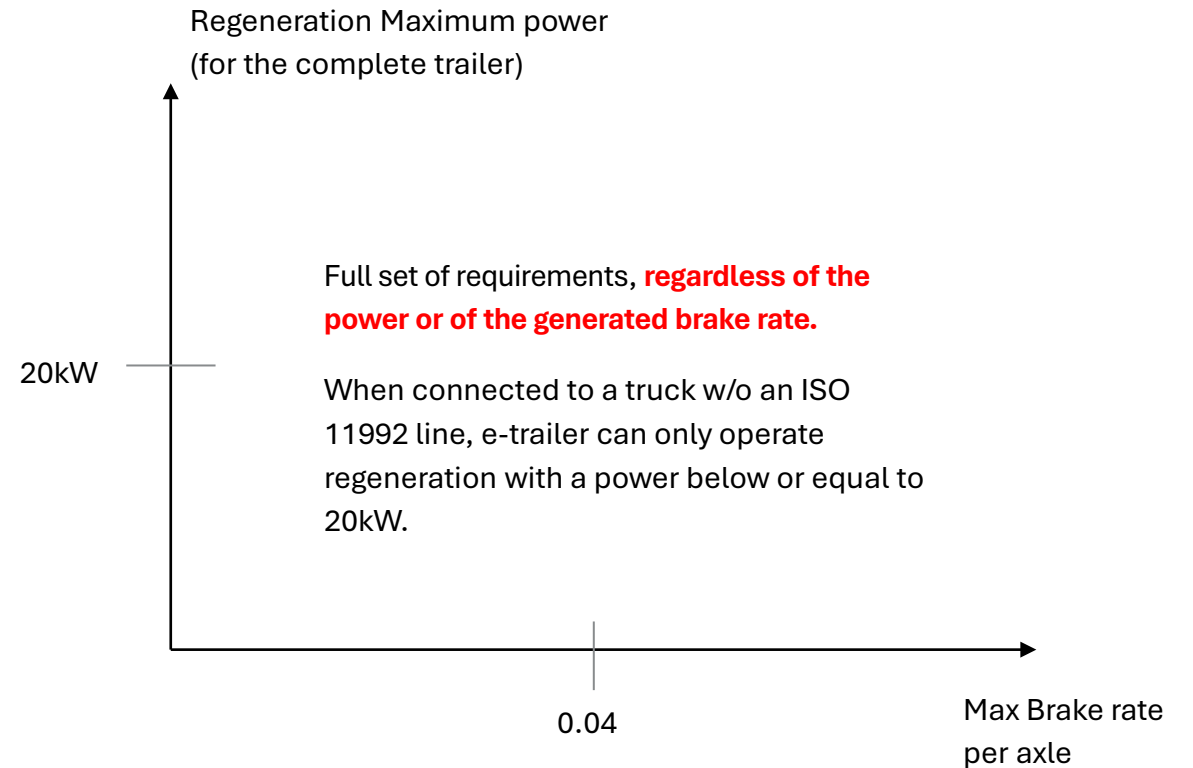
- **Without** a running data communication between motor vehicle and trailer
 - Retardation performance is limited to 20 kW
 - No propulsion shall be provided by the trailer
- **With** operational data communication between motor vehicle and trailer
 - Retardation performance > 20 kW only when the motor vehicle does not provide any traction torque to the wheels
 - Propulsion forces of the e-trailer are permitted only when the motor vehicle provides traction torque to the wheels
 - Propulsion forces of the e-trailer shall be limited to compensate up to a certain percentage for the rolling resistance + air resistance + effect of mass (inertia and gravity)

Thresholds

Dynamo trailer



E-trailer



Thresholds - Justifications

- **20 kW limit of regenerative performance:** systems already approved and in the market with good experience

Power	Velocity	Force = P / V	Axle weight		
			unloaded	loaded	
W	km/h	m/s	N	20000	65000
20000	90	25	800	0,04	0,01
20000	50	14	1440	0,07	0,02
20000	15	4	4800	0,24	0,07

- **max brake rate 0,04** ~ friction value of wet ice
- **At speed < 15 km/h** locking of wheels permitted: same threshold to be found in Reg 13, Annex 5 and Annex 13

Thank You !