UN Regulation No. 13 and Electro Mechanical Brakes
UN Regulation 13 defines:

- **Transmission** means the combination of components comprised between the control and the brake and linking them functionally. *The transmission may be mechanical, hydraulic, pneumatic, electric or mixed.*
- **Control Transmission** - means the combination of the components of the transmission which control the operation of the brakes, including the control function and the necessary reserve(s) of energy.
- **Energy Transmission** - means the combination of the components which supply to the brakes the necessary energy for their function, including the reserve(s) of energy necessary for the operation of the brakes.

→ *The transmission may be mechanical, hydraulic, pneumatic, electric or mixed.*

UN R13 was updated in 1990s to account for an electronic “Control Transmission” but still assumes Pneumatic “Energy Transmission” in the service braking system.

- **Pneumatic Energy limitation is shown in two ways:**
  - Design Specifications – E.g. Where limits are in kPa.
  - Design Limitations – E.g. Where it is assumed air is the medium.

- **Electro Mechanical Brake Technology** is being developed by the industry using *Electric Energy Transmission* in the service braking system and the UN R13 needs to be updated accordingly.
UN R13 and Electro Mechanical Brakes (EMB)
Amendment scope and motivation

- Motor vehicle with EMB brakes on all axles (not mixed with Pneumatic Or Hydraulic systems)
- Motor vehicle with EMB brakes with “conventional” trailer interface according to UN R13
- UN R13-H not included but considered, in particular when creating new definitions

Advantages and possibilities by amending *Electric Energy Transmission* to UN R13
- Improved energy efficiency in EV’s (vs. air compressor)
- Improved braking control
- Elimination of noise emissions from pneumatics
UN R13 and Electro Mechanical Brakes (EMB) Electrification Development

- Improved Vehicle Dynamics Control
- Emission reduction
- Energy efficiency

EBS in Commercial vehicles – (electronic control transmission)

EMB in Commercial vehicles – (electronic control transmission and electric service braking)

1995

- Improved Vehicle Dynamics Control
- Emission reduction
- Energy efficiency

2025

- Improved Vehicle Dynamics Control
- Emission reduction
- Energy efficiency
**Improved Vehicle Dynamics Control**

- Reduced response time enhancing braking performance.
- Optimized control of safety functions like ABS, ESP, AEBS or Traction control.

**Emission reduction**

- Reduction of noise vs. pneumatic brake systems.

**Energy efficiency**

- Significant higher energy efficiency vs. pneumatic brake systems.
- Potential to reduce CO2.

**Other**

- Weight and space savings
- Easier packaging
2. Definitions

New paragraphs defining **Electric Energy Transmission** (e.g. **Energy Source**, **Electrical Storage device**, **Electrical Supply device**)

5.1.4.6 Reference Braking forces

**New paragraph 5.1.4.6.2.**
Reference braking forces for electro-mechanical braking system using a roller brake tester shall be defined according to the following requirements.

5.2 Characteristics of Braking Systems.

**New paragraph 5.2.1.34.**
Special additional requirements for service braking systems with electric control and energy transmissions.

Annex 7, (provisions relating to energy supply and storage)

**New Part D**
Electro-mechanical Braking system
UN R13 and Electro Mechanical Brakes (EMB)

Energy Transmission principles (Pneumatic vs. Electric)

**Pneumatic Energy**
- Compressor
- E-APU
- Pneumatic energy storage
- EBS Modulator
- Actuator
- Caliper

**Electric Energy**
- DC/DC
- Electric energy storage
- Drive and Motor
- Gears
- Caliper

**EBS**
- Annex 7 part A

**EMB**
- Annex 7 new part D

**New 5.2.1.34.**
UN R13 and Electro Mechanical Brakes (EMB)
Development steps comparison

Principal layouts shown
System Description

Example EBS system of today in vehicle with combustion engine

Principal layout

- **Fuel tank**
- **IC Engine**
- **Compressor**
  - Energy Source
- **Generator**
- **24 V battery**
  - Other user of electrical energy
- **APU (Air Processing Unit)**
  - Other user of compressed air

**Energy Source**

**Energy Transmission**

- **EBS ECU**
- **ECU**
  - Front axle reservoir
  - Foot Pedal
  - InLine Valves
- **1M Valve**
- **ECU**
  - Rear axle reservoir
  - Foot Pedal
  - 2M Valve

**Control Transmission**

(example shown only front axle)

**Electric**

**Pneumatic**

**Pneumatic Storage Device**

- **p1**
- **p2**

**p1 and p2:** Pneumatic energy monitoring and warning if storage falls below a certain level.
Example EMB system in electric vehicle

Vehicle functions

Principal layout

Energy Supply Device

Traction Battery 800V

DC/DC

24 V battery

DC/DC 800V/48V

Other user of electrical energy

Electrical motor

Compressor

APU (Air Processing Unit)

User of compressed air

Energy Source

Pw: Electric energy monitoring and warning if charging demand cannot be met and if below a certain level.

ew: Electric energy monitoring and warning if storage falls below a certain level.

Brake system functions

EMB ECU

Foot Pedal

Front axle brakes

Rear axle brakes

Electrical Storage Device

Electrical Transmission

Pw: Electric energy monitoring and warning if charging demand cannot be met and if below a certain level.

ew: Electric energy monitoring and warning if storage falls below a certain level.
Feedback in short from the delegates so far:

- Further comparison between Compressed Air braking system and Electro-Mechanical braking system requested for better understanding of the differences and need for specific requirements on an EMB system.

- Concerning Electrical Energy Storage devices, and in particular batteries, there is an uncertainty regarding the performance over lifetime vs. a pneumatic reservoir. A reliable and safe way of monitoring the energy level is requested.

- Unclear how the PTI actually will be performed. The boundary conditions as well as a general approach exist but needs to be further verified together with industry and Technical Service representatives.