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UN R13 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
- Trailers with EMB excluded from scope
- 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

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

Full Electric Vehicles

Electric Power Steering

Electric parking brake

Hybrid Electric vehicles

EBS in Commercial vehicles – (electronic control transmission)
UN R13 and Electro Mechanical Brakes (EMB)
Electrification Development

**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

E-APU → Pneumatic energy storage → EBS Modulator → Actuator → Caliper

EBS
Annex 7 part A

Energy supply → Energy storage → Actuation

EMB
Annex 7 new part D

Electric Energy

DC/DC → Electric energy storage → Drive and Motor → Gears → Caliper

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

**Energy Source**
- Fuel tank
- IC Engine
- Compressor
- Generator

**Others**
- 24 V battery
- Other user of electrical energy
- Other user of compressed air
- APU (Air Processing Unit)
- Front axle reservoir
- Rear axle reservoir

**Control Transmission**
- Foot Pedal
- EBS ECU
- ECU 1M Valve
- InLine Valves
- ECU 2M Valve

**Pneumatic Storage Device**
- P1 and P2: Pneumatic energy monitoring and warning if storage falls below a certain level.

**Pneumatic**
- Electric
System Description

Example EMB system in electric vehicle

**Vehicle functions**

**Energy Supply Device**
- Traction Battery 800V
- Traction Motor

**Energy Source**
- Electrical motor
- Compressor
- APU (Air Processing Unit)
- User of compressed air

**Other user of electrical energy**
- DC/DC 800V/48V
- 24 V battery

**Control Transmission** (example shown only front axle)

**Brake system functions**

**Electrical Storage Device**

- 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.
System Description

Energy content of electric storage device – example battery

- Usable capacity taking battery ageing into account.
- SOC reference (100%) remains constant.
- Minimum SOH defines usable capacity.
UN R13 and Electro Mechanical Brakes (EMB)
Status and open topics still to be discussed

Comments and feedback collected until December 2020 have been captured and incorporated in the informal document distributed.

Recent comments and feedback collected during January 2021 will be reviewed during the next coming months in separate workshops.

Main topics to review and define further:
- The principles for PTI.
- Clarification to open questions related to Electrical Energy Storage devices vs. a Pneumatic Reservoir.