



INLAND TRANSPORT COMMITTEE



UNECE



EXPERT WORKSHOP

# Mapping standards for low- and zero-emission electric heavy duty vehicles

17-18 February 2020 – Paris, France



## Overview of regulations and planned activities regarding electric heavy duty Vehicles

Activities in the World Forum for the harmonization of vehicle regulations (WP.29)

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UNECE, Secretary of the Working Party on Pollution and Energy (GRPE)

17 February 2020, Paris

# Harmonized regulation for Electrified vehicles

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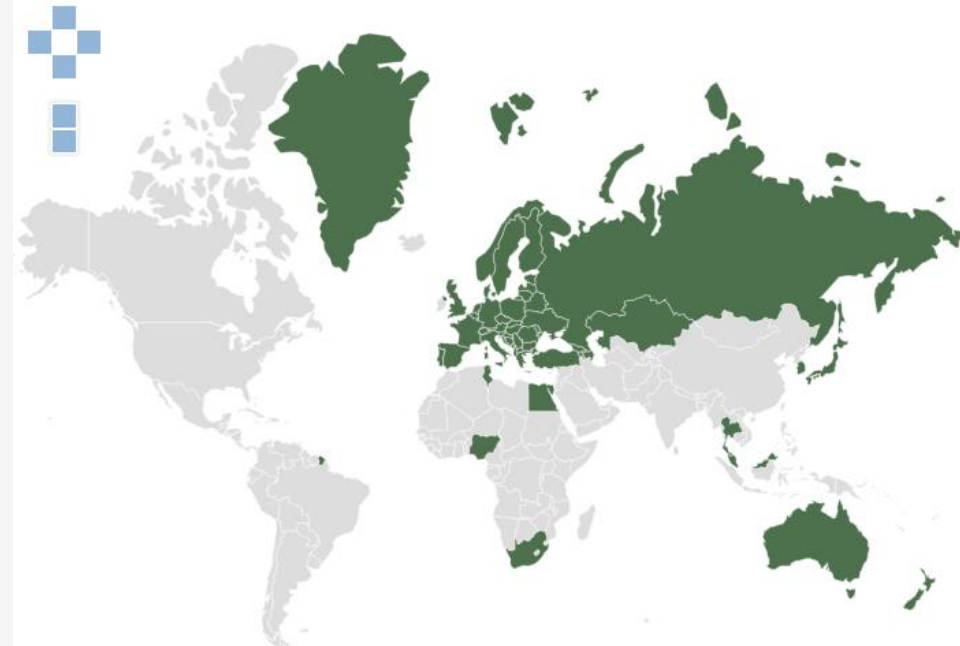
- What is WP.29 : the 3 global agreements on harmonized vehicle regulations
  - 1958 Agreement and UN Regulations
  - 1998 Agreement and UN GTRs
  - 1997 Agreement and UN Rules on periodic technical inspections – not covered here
- Activities on low- and zero-tailpipe emissions electrified vehicles
  - Energy stored in batteries:
    - UN GTR No. 20 and UN regulation No. 100
    - Other activities of interest
  - Energy stored in hydrogen:
    - UN GTR No. 13 and Un Regulation No. 134
- Conclusions and Next steps

# the World Forum for the harmonization of vehicle regulations

WP.29



- The unique worldwide regulatory forum for the automotive sector
- Administrating three Multilateral UN Agreements :
- 1. The 1958 Agreement -> UN Regulations
  - 53 contracting parties
  - Last country joining : Nigeria in 2019
  - Reciprocal recognition of Type Approval  
Approved once and accepted everywhere(CPs)
  - Elimination of barriers to trade
  - Administrative provision + E marking



# the World Forum for the harmonization of vehicle regulations

WP.29



## ■ 2. The 1998 Agreement -> UN Global Technical Regulations (GTRs)

- 38 contracting parties
- Most major automotive markets
- Commit themselves to implement a GTR into national legislation, when voting in favour
- Need a system/agency for market surveillance and enforcement of production compliance

## ■ 3. The 1997 Agreement -> UN Rules

- Legal framework for Periodic Technical Inspection (PTI) of vehicles in use
- Reciprocal recognition of certificates of such inspections for cross-border use of vehicles



# Regulations on electrified vehicle safety

## Vehicles with batteries



- UN GTR No. 20 on Electric Vehicle Safety (EVS)
  - Established in the Global Registry on 14 March 2018
  - Scope including both light and heavy-duty vehicles (with performance requirements and test procedures)
- Main topics covered - Better safety for all users :
  - Performance based and technology neutral.
  - Not design specific requirements that might prevent future technologies
  - Address potential safety risks of EVs either of vehicles in use or after a crash event
  - Electrical shocks associated with the high voltage circuits of EVs
  - Potential hazards associated with lithium-ion batteries and/or other
  - Rechargeable Electrical Energy Storage Systems (REESS) (in particular, containing flammable electrolyte)

# UN GTR No. 20 on Electric Vehicle Safety (EVS)



- Background information and motivation
  - Harmonise (avoid diversification of) the technical requirements of China and emerging markets with internationally agreed ones (UN-R or GTR)

	Electrical safety		REESS safety
	In-use	Post crash	
EU	R100	R12, R94, R95	R100
Japan	R100	R12, R94, R95	R100
US	None	FMVSS305	None
China	(GB/T18384-3)	(New GB/T)	(New GB/T)
S. Korea	KMVSS	KMVSS	KMVSS
(others)	???	???	???

# UN GTR No. 20 on Electric Vehicle Safety (EVS)



- Requirements for Electric Vehicle Safety
  - Electric shock protection (in use and post crash)
  - Electrolyte spillage after a crash;
  - Fire protection
  - Functional requirements
- Requirements for REESS Safety (in use and post crash)
  - Thermal shock and cycling
  - Mechanical shock/integrity/vibration
  - Fire resistance
  - External short circuit/overcurrent/overcharge/over-discharge protection
  - Over-temperature protection
  - Thermal propagation (to be updated in phase 2)
  - Water exposure resistance
  - Gas management
- Text of the UN GTR :  
<http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a20e.pdf>

# UN GTR No. 20 on Electric Vehicle Safety (EVS)



- Phase 2 underway (led by Korea and EU), to be delivered in 2021. main topics include:
  - Water immersion test;
  - Long-term fire resistance test;
  - Rechargeable Electrical Energy Storage System (REESS) rotation tests;
  - REESS vibration profile;
  - Flammability, toxicity and corrosiveness of vented gas (i.e. detection and quantification of venting for tests addressing safety of REESS post-crash, potential risk of "toxic gases" from non-aqueous electrolyte);
  - Thermal propagation and methods of initiation in battery system;
  - Post-crash REESS safety assessment and stabilization procedures;
  - Light electric vehicles (e.g. categories L6 and L7, low speed vehicles);
  - Protection during Alternating Current and Direct Current charging and feeding process;
  - Overcurrent requirements plus tests (component based) – discussions for application to HDV.
  
- For more information on Phase 2: <https://wiki.unece.org/pages/viewpage.action?pageId=3178628>



# Regulations on electrified vehicle safety

## Vehicles with batteries



- Other activities of interest regarding electrified vehicles with batteries
- Determination of electrified vehicle power
  - Draft UN GTR to be submitted to the next session of GRPE in June 2020
  - Approved by the end of 2020
  - Limited to light duty vehicles, procedure expected to potentially be extended to heavy duty vehicles
- Battery durability requirements
  - For range of pure EVs, range/emissions of plug-in hybrids
  - Work initiated, draft phase 1 UN GTR expected by end of 2021.
  - Light duty vehicles only at the moment

# Regulations on electrified vehicle safety

## Vehicles with hydrogen



- UN GTR No. 13 and UN regulation No. 134 on Hydrogen and fuel cell vehicles (HFCEV)
  - Established in the Global Registry on 27 June 2013 (UN GTR No. 13)
  - Light duty vehicles only
- Main topics covered :
  - Hydrogen storage system
  - Vehicle fuel system
  - Electrical safety
- Text of the UN GTR:  
<http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a13e.pdf>

# UN GTR No. 13 - Hydrogen storage system

## Verification tests for baseline metrics

- Baseline initial burst pressure
- Baseline initial pressure cycle life

## Verification test for performance durability (sequential hydraulic tests)

- Proof pressure test
- Drop (impact) test
- Surface damage
- Chemical exposure and ambient temperature pressure cycling tests
- High temperature static pressure test
- Extreme temperature pressure cycling
- Residual proof pressure test
- Residual strength Burst Test

## Verification test for expected on-road performance (sequential pneumatic tests)

- Proof pressure test
- Ambient and extreme temperature gas pressure cycling test (pneumatic)
- Extreme temperature static gas pressure leak/permeation test (pneumatic)
- Residual proof pressure test
- Residual strength burst test (hydraulic)

## Verification test for service terminating performance in fire

## Verification test for closure durability

# UN GTR No. 13 - Hydrogen and fuel cell vehicles (HFCV)



- Phase 2 started in March 2017 – led by Japan, Korea, EU - Main topics covered :
  - Potential scope revision to address additional vehicle classes; (**Specific task force on heavy duty vehicle – TF1**)
  - Requirements for material compatibility and hydrogen embrittlement;
  - Requirements for the fuelling receptacle;
  - Evaluation of performance-based test for long-term stress rupture proposed in Phase 1;
  - Consideration of research results reported after completion of Phase 1 – specifically research related to electrical safety, hydrogen storage systems, and post-crash safety;
  - Consideration of 200 per cent Nominal Working Pressure (NWP) or lower as the minimum burst requirement;
  - Consider Safety guard system for the case of isolation resistance breakdown.
- Updated UN GTR expected by the end of 2020
- More information : <https://wiki.unece.org/display/trans/HFCV-GTR13-Phase+2+session>

# Conclusions and next steps

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- Safety aspects for Low- and zero-emission enabling vehicles (LZEEVs) on the vehicle side well covered by international harmonized vehicle regulations
- Heavy duty vehicles to be covered soon for both vehicles with REESS and hydrogen storage system
- Environmental impacts of those vehicles less covered by international harmonized vehicle regulations :
  - Ad-hoc expert group created in Jan 2020 to work on harmonization of Heavy Duty Fuel Economy standards measurement procedures
  - Joint task force between Transport (Informal Working Group on Electric Vehicle and the Environment) and Energy division (Group of Expert on Energy Efficiency) of UNECE to work on WTW emissions of EVs



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**Thank you!**