Electric Vehicles Safety
Global Technical Regulation

Nha Nguyen
On behalf of the EVS-GTR IWG
Background

- In 2012, under the United Nations World Forum for Harmonization of Vehicle Regulations (WP.29) and the 1998 Agreement, China, Japan European Union and the United States are co-sponsoring to establish 2 working groups to address environmental and safety issues associated with electric vehicles (EVs)

- EV and Environment (EVE): focusing on the information exchange and joint research concerning the related impacts of the development of EVs to the environment such as CO₂ emissions, energy consumption and efficiency, energy storage (batteries, capacitors, etc.) and infrastructure.

- EV Safety (EVS): establishing a Global Technical Regulation (GTR) for EVs ensuring high voltage electrical safety, safety of electrical components, and rechargeable electric energy storage systems (REESS)
EVS-IWG

- EVS-informal working group (IWG): comprised of over 50 members from government regulators, industry standard organizations and vehicle and battery manufacturers.

- IWG has conducted 13 meetings. The meetings and development process are transparent. Documents and reports are posted on the UN website: https://www2.unece.org/wiki/pages/viewpage.action?pageId=3178628

- Goal: WP.29 vote to establish the GTR is November 2017
Terms of Reference:

- To the extent possible, GTR will be science-based, data driven and performance based - avoiding design-specific requirements
- IWG will investigate, conduct research and establish provisions at vehicle and system levels to address vehicle safety issues for EVs:
  - **In-use:**
    - Occupant protection: protection against electric shock
    - Performance and safety requirements for Li-Ion based rechargeable energy storage system (REESS) including battery management system for conditions of low and high temperature, over-charge, over current, over discharge, external short circuit, and environment conditions such as extreme temperature, vibration, mechanical shock and fire resistance
  - **Post crash:**
    - Electrical isolation; protection against electric shock
    - Battery integrity: battery management system, robustness and survivability
    - Battery discharge procedure
  - **End-of-life:**
    - Disposal of battery
2-Phase Approach

- **Phase 1:** near-term critical safety requirements
  - Based on a proposal from OICA which is comprised of mostly requirements from R94, R95 and R100

- **Phase 2:** safety requirements that require long-term research as well as further improvement of the GTR
Task Force Teams

- TF-1: Protection Against Water – China
- TF-2: Low Electrical Energy/Physical Barriers – OICA
- TF-3: Electrolyte Leakage – OICA
- TF-4: REESS Protocol BMS, environment exposure – OICA
- TF-5: Thermal Propagation – China
- TF-6: State of Charge (SOC) – Japan
- TF-7: Fire Resistance – Korea
- TF-8: Heavy Vehicles and Buses – China
- TF-9: Warning systems – U.S.
BMS functionality at vehicle and pack levels

Battery safety and Low charge warnings

Water exposure

Post-crash: Electric shock Battery integrity

Heavy trucks and buses

Functional safety and markings

Environmental exposure (In-use): Vibration; shock; extreme temperature

Propagation

Prevention of electric shock

Prevention of electric shock

BMS functionality at vehicle and pack levels
Performance Requirements

5. Performance requirements (light duty/passenger vehicles)

5.1. Requirements of a vehicle with regard to its electrical safety - in-use
   5.1.1. Protection against electric shock
   5.1.2. Functional safety

5.2. Requirements of a vehicle with regard to its electrical safety - post-crash
   5.2.1. General principle
   5.2.2. Protection against electric shock

5.3. Requirements with regard to installation and functionality of REESS in a vehicle
   5.3.1. Installation of rechargeable energy storage system (REESS) on a vehicle
   5.3.2. Warning in the event of operational failure of vehicle controls that manage REESS safe operation (e.g. BMS)
   5.3.3. Warning in the case of a thermal event within the REESS
   5.3.4. Warning in the event of low energy content of REESS
Performance requirements (cont.)

5.4. Requirements with regard to the safety of REESS - in-use

5.4.1. General principle.
5.4.2. Vibration
5.4.3. Thermal shock and cycling
5.4.4. Fire resistance
5.4.5. External short circuit protection
5.4.6. Overcharge protection
5.4.7. Over-discharge protection
5.4.8. Over-temperature protection
5.4.9. Overcurrent protection
5.4.10. Low-temperature protection
5.4.11. Management of gases emitted from REESS
5.4.12. Thermal propagation

5.5. Requirements with regard to the safety of REESS - post-crash

5.5.1. Vehicle based test
5.5.2. REESS-component based test
Performance Requirements (cont.)

- Based on the requirements of the light duty vehicles

7. Heavy duty vehicles and buses

7.1. Requirements of a vehicle with regard to its electrical safety - in-use
   - 7.1.1. Protection against electric shock
   - 7.1.2. Functional safety

7.2. Requirements with regard to installation and functionality of REESS in a vehicle
   - 7.2.1. Installation of rechargeable energy storage system (REESS) on a vehicle
   - 7.2.2. Warning in the event of operational failure of vehicle controls that manage REESS safe operation
   - 7.2.3. Warning in the case of a thermal event within the REESS
   - 7.2.4. Warning in the event of low energy content of REESS
Performance requirements (cont.)

7.3. Requirements with regard to the safety of REESS - in-use

7.3.1. General principle
7.3.2. Vibration
7.3.3. Thermal shock and cycling
7.3.4. Fire resistance
7.3.5. External short circuit protection
7.3.6. Overcharge protection
7.3.7. Over-discharge protection
7.3.8. Over-temperature protection
7.3.9. Overcurrent protection
7.3.10. Low-temperature protection
7.3.11. Management of gases emitted from REESS
7.3.12. Thermal propagation
Timeline for Phase 1

- **December 2016**: Submit draft GTR to GRSP
  - January-February 2017: Possible EVS meeting and editorial meeting
- **May 2017**: Submit formal GTR to GRSP
- **June 2017**: Submit GTR to WP.29
- **November 2017**: Possible vote to establish GTR
Phase 2

- The exact scope and timeline for Phase 2 of the GTR will be clarified after the completion of the Phase I. Some possible items:
  - In-use:
    - Protection during charging: AC and DC
    - Propagation/enclosure thermal containment
    - Water immersion
  - Post-crash:
    - REESS safety assessment
    - Battery discharge
    - Toxicity
  - Update phase 1 requirements
Thank you