Submitted by the Chair of IWG EVS

Informal document
ECE/TRANS/WP.29/GRSP/2022/17-Rev.2
(74th GRSP, 4 – 8 December 2023
agenda item 4)

Technical Report on the Development of Amendment 1 to UN Global Technical Regulation No. 20, Phase 2 (Electric Vehicle Safety)

Submitted by the Chair of the Informal Working Group on Electric Vehicle Safety, UN Global Technical Regulation No. 20, Phase 2 (Electric Vehicle Safety)

The text reproduced below was prepared by the Chair of the Informal Working Group (IWG) on Electric Vehicle Safety (EVS), UN Global Technical Regulation No. 20, Phase 2 (GTR20-PH2) pursuant to article 6, paragraph 6.2.7. of the Agreement.

Technical Report on the Development of Amendment 1 to UN Global Technical Regulation No. 20, Phase 2 (Electric Vehicle Safety)

I. Background

1. In 2018, the UN Global Technical Regulation (GTR) No. 20 on Electric Vehicle Safety (EVS) was established in the Global Registry. The objective of the Informal Working Group (IWG) on EVS was to seek regulatory convergence on the global scale via the framework of the 1998 Global Agreement. GTR No. 20 Phase I contains a significant set of critical safety provisions. Some technical areas were not fully addressed in Phase I due to the necessarily long lead time of research and testing. The EVS IWG sought approval at the November 2017 session of AC.3 to start Phase II immediately after the establishment of UN GTR No. 20 Phase I, to work on the remaining technical items.

2. During the 173rd session of WP.29 in November 2017, AC.3 endorsed GTR No. 20 Phase II. Phase II began immediately after GTR No. 20 Phase I was established in 2018, and its mandate was extended until December 2023 due to the COVID-19 pandemic.

3. GTR No. 20 Phase II worked to address the following technical areas: single-cell thermal runaway and propagation due to an internal short circuit (henceforth abbreviated to "thermal propagation"), water immersion, and vibration profile. In addition, Phase II work included the verification of the visual inspection method, considering whether it was still adequate for the pass/fail criteria agreed in Phase I in relation to "no electrolyte leakage" and "no venting" requirements. Extensive research efforts of REESS emissions suggest that more robust methods of verifying and analysing the occurrence of electrolyte release and of venting of gases and particles need to be discussed. Considering the initial research results were not conclusive, co-sponsors agreed to leave the Phase I requirements unchanged.

In relation to upgrading the existing 'protection against water effects' requirements, the EVS IWG extensively discussed the issue. IWG agreed to temporarily suspend the discussion until more research results and consistent field data are available, and given that China, Japan, and Korea supported the inclusion of new requirements, while the EU, Canada, and the US opposed it.

With respect to the Phase I vibration profile, participants re-examined the existing Phase I requirements and because China and Japan supported the amendment, the EU and Korea wanted the current requirements intact, and Canada and the US wanted it deleted , the decision was made and agreed on to leave the requirement unchanged from Phase I.

4. The core activity of Phase II was centred on strengthening the Phase I thermal propagation requirements in line with the provision 23A.1 of the Statement of technical rationale and justification of GTR No. 20: "Thermal propagation - In order to ensure the overall safety of vehicles equipped with a REESS containing flammable electrolyte, the vehicle occupants should not be exposed to the hazardous environment resulting from a thermal propagation (which is triggered by a single cell thermal runaway due to an internal short circuit)."

The IWG considered two approaches: (1) a test method, which was, although improved during Phase II, already extensively discussed in Phase I, and (2) a strengthened Documentation method, which was based on Phase I. The IWG participants preferred to call "risk management approach" method "RIMA" for short, to reflect more accurately the nature of the method.

4.a. Summary of the Test Method – In the test method, a test procedure is carried out based on the ISO-6469-1:2019/AMD1(2022) standard and contains thermal runaway

detection criteria and factors in new research findings by Canada, China, Japan, and the EU (e.g., dP/dt, etc.). The initiation methods under discussion and consideration include localized rapid external heating method (primary), nail penetration (possible alternative), and internal heater method (possible alternative). The proposal on the selection of the initiation cell, which was prepared by Canada, gathered support from majority of CPs with Japan and OICA proposing some improvements. The test would be performed while the vehicle is in the temporary parking mode (Battery Management System (BMS) and native cooling strategy are "ON"). The performance criteria require the vehicle to provide an advance warning indication to allow egress or 5 minutes prior to the presence of a hazardous situation inside the passenger compartment caused by thermal propagation which is triggered by an internal short circuit leading to single cell thermal runaway such as fire, explosion, or smoke. The requirement is deemed to be satisfied if the thermal propagation does not lead to a hazardous situation for the vehicle occupants.

4.b. Summary of the risk management approach (RIMA), formerly referred to as the Documentation method – In this approach, presented initially by OICA, a risk reduction analysis is performed to document the risk of thermal propagation and the reduction of risk resulting from implementation of risk mitigation functions or characteristics in the cell, REESS, or vehicle. The risk reduction analysis is performed for all vehicle operational modes (usual parking, temporary parking, external charging, and active driving possible mode), specifies a four-part report structure, and applies to all types of REESS and EVs (regardless of chemistry, construction, and applies to EV platforms, REESS families, light and heavy vehicles). This approach leverages risk mitigation strategies by design, manufacturing control, and other means to facilitate the systematic management and mitigation/prevention of the potential causes and risks of non-abuse and non-crash related internal short circuits. In RIMA, information is provided on how each risk mitigation strategy was validated (including the validation results), and how each identified risk was verified to be addressed by at least one risk mitigation strategy.

II. Overview of the Positions held by CPs

5. Summarized below are the respective positions of the co-sponsors and contracting parties:

China

Favours a test method which includes alternative initiation methods (e.g., internal heater method or nail penetration) and component level test options.

European Union

Favours a default test at the vehicle level using the localized rapid external heating method as the primary initiation method.

Japan

Supports a test approach, which includes component level testing and three initiation methods (which are ranked from default to alternative).

United States of America

Favours the Phase II risk management approach (RIMA) and does not view this test method in the temporary parking mode as representative of field events in the US, Canada, or South Korea.

Canada

Canada fully supports the RIMA approach and believes that if the test procedure is sufficiently robust, repeatable and reproduceable it would be acceptable as an alternative method to RIMA to demonstrate compliance. Canada only supports testing at the full vehicle/system level using the localized rapid external heating method as the primary initiation method. Canada does not view the existing active drive mode scenario nor the proposed temporary parking mode scenario as representative of real world events that need to be addressed via a thermal propagation requirement within GTR 20.

Korea

Favours a default test at the vehicle level using the localized rapid external heating method as the primary initiation method, but allows for alternative initiation methods.

6. At the 27th IWG in Tokyo, Japan, the IWG attempted to reach consensus on one or a technically appropriate combination of the positions outlined above.

III. Conclusion

7. For the reasons mentioned, the IWG was not able to prepare a draft unified proposal for amendment to GTR 20 to meet its mandate (set to expire in December 2023 unless extended.)

8. The results will be reported to and discussed in WP.29/AC.3 Sessions and 74th Meeting of GRSP, in November and December 2023.