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Progress on the development of new gtrs

and of amendments to established gtrs –

Draft gtr on Electric Vehicle Safety (EVS)

Third progress report of the Informal Working Group on Electric Vehicle Safety

Submitted by the representatives from China, Japan, the United States of America and the European Union*

The text reproduced below was prepared by the representatives of China, Japan, the United States of America and the European Union. It is based on informal document WP.29-166-19, distributed at the 166th session (ECE/TRANS/WP.29/1116, para. 116). This document, if adopted, shall be appended to the gtr in accordance with the provisions of paragraphs 6.3.4.2., 6.3.7. and 6.4. of the 1998 Agreement.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

Third progress report of the Informal Working Group on Electric Vehicle Safety

I. Introduction

1. This report provides an update on the progress in key technical areas of the Informal Working Group (IWG) and its nine task forces. Most recent developments pertain to the conclusions of the eighth IWG meeting that took place in Washington, D.C. in June 2015.

II. Objectives, scope and the mandate

2. The gtr will address the unique safety risks posed by Electric Vehicles (EVs) and their components. It will be performance-based to the extent possible so as not to restrict future technological development. It will be preceded by an exchange of information on current and future planned domestic regulatory safety requirements for electric vehicles based on section C of the official proposal, (ECE/TRANS/WP.29/2012/36 and Corr. 1) including the underlying scientific and technical basis and research.

3. The gtr will also set provisions and test protocols to ensure the vehicle system and/or electrical components perform safely, are appropriately protected, and are electrically managed while recharging from external electricity sources, whether at a residence or other charging location.

4. The gtr will cover high voltage electrical safety, electrical components such as electric inlets, and Rechargeable Electrical Energy Storage System (REESS), in particular those containing flammable electrolyte. The provisions will address the safety of electric vehicles, both in-use and post-crash. The IWG may consider other safety related topics, insofar as these topics prove to be relevant for the technical requirements to be developed. Under the current mandate (end of 2015), the adoption of the gtr is expected in November 2016, during the 170th session of WP.29.

III. Work set-up

5. The format of the IWG meetings had been modified in 2015, adding an additional, third IWG meeting on an annual basis. In October 2013, the IWG decided to form eight Task Force (TF) groups to address specific technical issues. This will provide a more efficient way to resolve technical issues. A ninth TF was added to address the REESS safety warning. The progress of these TF teams is described below.

IV. Update on ongoing and planned research

6. At the eighth IWG meeting, the expert from the United States of America presented an update on its research including short term and long term items.

V. Reports from Task Forces and key issues

A. Task Force 1 – Protection against water

7. TF1 has a broad agreement on the content and draft test procedures. TF1 agreed to remove the heavy rain test and keep the hose spray and water trough for vehicle level testing. The proposed test parameters are kept in square brackets for the time being while members evaluate the proposal. The members will continue the discussion at the next IWG.

B. Task Force 2 – Low electricity energy option

8. TF2 has assembled all the relevant material and reviewed the inputs of the involved experts.

9. A critical issue of TF2 is a consideration of the "barrier" option, the effectiveness of further discussion pending the review by National Highway Traffic Safety Administration (NHTSA) of a petition submitted by auto industries, which among others is essential for the certification of fuel-cell vehicles.

10. The expert from the United States of America provided a rationale for not accepting the low energy option. The main concern is that the option does not contain the same level of safety as the other options. TF2 will study the rationale and discuss further at the next IWG meeting.

C. Task Force 3 – Electrolyte leakage

11. Non-aqueous leakage for the in-use and post-crash scenarios, observation times, and evaporative emissions remain to be addressed by this task force. TF3 notionally agreed to step up the requirement for non-aqueous batteries in the post-crash situation, where no leakage in the passenger compartment is allowed.

12. The Joint Research Centre (JRC) presented the results of the experiment measuring electrolyte leakage volume from the opened cells of different types of batteries. While NHTSA recognized the importance of the work of JRC, the expert from OICA challenged the relevance of the experiment as it has not been performed at the system level and the result would not be representative of real conditions.

13. It has been agreed that TF3 will take over the discussion on gas management and venting and should come forward with a concrete proposal well ahead of the next IWG meeting.

D. Task Force 4 – REESS in-use testing

14. The TF4 team continued to discuss provisions for 48V vehicles. These vehicles have certain AC components that exceed the maximum voltage limit (30V) thus requiring provisions to ensure safe operation for in-use and post-crash. OICA will prepare a proposal for consideration at the next meeting.

15. The expert from the United States of America presented its proposal for functionality requirements of Battery Management Systems (BMS) for in-use which addresses events of over-charge, over-current, over-temperature and over-discharge. The proposal contains similar test procedures as the OICA proposed test procedures with

slightly different boundary conditions. The expert from the United States of America will prepare regulatory text for discussion at the next IWG meeting.

16. The expert also introduced a recommendation for shock, vibration test, and thermal cycling including pass/fail criteria. The recommendation resulted from research analysis and was put forth for discussion. The expert will prepare regulatory text as needed for discussion at the next meeting, drawing parallels with the current gtr text. The expert from China also suggested a proposal on a random vibration provision and will provide a text and data at the next meeting.

E. Task Force 5 – Thermal propagation

17. TF5 continued to discuss issues of propagation from the cell to pack level.

18. The expert from the United States of America presented its research on propagation. A proposal will be submitted once the research is completed on developing a suitable ignition source to represent a credible cell thermal runaway event that would be repeatable. Completion is expected by the summer of 2016. The expert from the United States of America will prepare a regulatory text with some open items for discussion at the next meeting.

19. The experts from Japan and OICA both questioned the necessity of the multi-point initiation given a limited possibility for a multiple failure stemming from the internal short circuit.

20. The expert from Japan will provide a definition of thermal propagation by the next TF meeting.

21. TF5 will coordinate two meetings before the IWG meeting at September 2015.

F. Task Force 6 – State of Charge

22. The expert from the United States of America provided its recommendation for raising the State Of Charge (SOC) level to 97 per cent for in-use and post-crash tests. The expert from OICA expressed that maintaining the charge at that level could be problematic. NHTSA will review its recommendation considering the opinions from IWG participants by the next IWG meeting.

23. The IWG agreed on the proposed temperature condition.

G. Task Force 7 – Fire resistance

24. The TF7 continued to discuss the short-term and long term fire exposure tests. Open issues related to long term duration tests are a definition of the purpose of the test including setting the long term duration target

25. The current proposal allows the use of two different types of burners: (i) liquefied petroleum gas and (ii) gasoline pool fire. Members suggested instead of requiring the type of burner, the temperature profile should be used as the main parameter for the test. The exposure time for long-term fire test was not reached and remains to be discussed at future TF7 meetings.

26. The expert from Canada presented their research on fire exposure at vehicle level. Fire tests were conducted with electric vehicles and conventional gasoline vehicles. The test

results showed that electric vehicles did not exhibit higher safety hazard than conventional gasoline vehicles.

27. This contrasts the viewpoint of the expert from OICA, suggesting that the purpose of the test is to determine whether the fire test is performed at the vehicle or component level.

28. The expert from Japan reminded the IWG that these long term fire exposure requirements should not be confounded with those addressed by the first responders guide.

H. Task Force 8 – Bus and Truck Scope study

29. The TF8 members continued to discuss the scope of the gtr and whether to include buses and heavy commercial vehicles. Some members raised concerns with the complexity of combining provisions for heavy and commercial vehicles with passenger vehicles.

30. The expert from NHTSA indicated that commercial vehicles and buses would be most likely optional requirements in the United States of America.

31. The expert from OICA suggested consulting with WP.29 for guidance on this matter.

32. The group will continue discussions in future meetings.

I. Task Force 9 – REESS Safety Warning

33. The TF 9 members reached an agreement on its action plan and will begin to develop parameters for safety warning. A survey of current warning systems equipped in electric vehicles will be conducted. TF9 will coordinate a teleconference prior to the next IWG meeting.

1. Battery Venting

34. As much as the purpose of venting, preventing likely rupture or explosion of REESS remains incontestable, the treatment of venting, i.e. gas management needs to be further considered within IWG.

35. There are several main discussion points; one is whether venting is considered a pass/fail criterion for REESS in-use under the normal (as opposed to abnormal) conditions, in the context of the gtr which tests are considered normal/abnormal and another is how to verify that the concentration of vented gases does not reach hazardous levels inside the vehicle cabin.

36. Feedback from the European Union (EU) testing centre on the interpretation of Regulation No. 100, 02 series of amendments, and the recent proposal by the expert from Japan on gas management was presented. EU testing centres consulted by JRC considered venting from the REESS during some, or sometimes all, tests as a failure of the test however their rationale differed somewhat.

37. The expert from European Commission (EC) agreed that the venting mechanism should be recognized as a safety feature, however he still believes that the venting in the normal use condition should not happen, not only because of the high levels of toxicity of vented gas components, but equally because it is an indication of unwanted thermal processes occurring inside REESS.

38. The expert from Japan strongly requested the discussion on venting as a safety feature and toxicity of vented gases to be treated separately.

39. The experts from the United States of America and EC expressed that the toxicity of vented gases, as a REESS associated hazard, should be included in the scope of this gtr.
40. It has been agreed that the issue will be further discussed in the context of TF3.

VI. Drafting of the GTR and the timeline

41. The IWG agreed to develop the gtr in a two-phase approach, pending final agreement by the expert from China.
42. The IWG discussed and updated the gtr outline table. Items were categorized for phases 1 and 2. The group also discussed a possible request for extension of the IWG mandate. The request may be put forward at the WP.29 November 2015 session, depending on the progress of the IWG.

VII. Future meetings

- (a) Ninth IWG meeting: 14 to 18 September 2015 in China

In case of the extension of the mandate:

- (b) Tenth IWG meeting: 29 February to 4 March 2016 in Japan
- (c) Eleventh IWG meeting: June 2016 in North America
- (d) Twelfth IWG meeting: October 2016, in Europe
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