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Global registry

Created on 18 November 2004, pursuant to Article 6 of the Agreement concerning the establishing of global technical regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles (ECE/TRANS/132 and Corr.1) done at Geneva on 25 June 1998

Addendum 13: UN Global Technical Regulation No. 13

Hydrogen and Fuel Cell Vehicles

Amendment 1 - Appendix 1

Proposal and report pursuant to Article 6, paragraph 6.3.7. of the Agreement

- Authorization to develop the Phase 2 of the global technical regulation (TRANS/WP.29/AC.3/49).
- Final progress report on Amendment 1 to UN Global Technical Regulation No. 13, Phase 2 (Hydrogen and Fuel Cell Vehicles) (ECE/TRANS/WP.29/2023/82).



UNITED NATIONS

Authorization to develop the Phase 2 of the global technical regulation

I. Background

1. The Informal Working Group (IWG) on Hydrogen and Fuel Cell Vehicles - Sub group safety (HFCV-SGS) was set up in 2007. The original schedule and scope were described in ECE/TRANS/WP.29/AC.3/17. This document outlines the HFCV-SGS activities and their timeframes divided into two phases. The IWG submitted the global technical regulation (gtr) on Hydrogen and Fuel Cell Vehicle and it was adopted by the Working Party on Passive Safety (GRSP) as well as established by the World Forum for Harmonization of Vehicle Regulations (WP.29) and the Executive Committee of the 1998 Agreement (AC.3) in June 2013.
2. After the establishment in the Global Registry as gtr No. 13 in June 2013, the provisions were transposed into UN Regulation No 134 annexed to the 1958 Agreement.

II. Proposal

3. An extension of the mandate for the HFCV-SGS IWG, sponsored by the European Union, Japan and Republic of Korea, shall tackle the development of the remaining issues. Phase 2 activities should be started immediately after the endorsement of this authorization by WP.29 and AC.3 at their March 2017 sessions.
4. Since hydrogen fuelled vehicles and fuel cell technologies are in early stages of development of commercial deployment, it is expected that revisions to these requirements may be suggested by an extended time of on-road experience and technical evaluations. It is further expected that with additional experience or additional time for fuller technical consideration, the requirements presented as optional requirements in the gtr (LHSS Section G of the preamble) could be adopted as requirements with appropriate modifications.
5. Scope of work in Phase 2 should cover:
 - (a) Original items described in ECE/TRANS/WP.29/AC.3/17 shall be kept;
 - (b) Potential scope revision to address additional vehicle classes;
 - (c) Requirements for material compatibility and hydrogen embrittlement;
 - (d) Requirements for the fuelling receptacle;
 - (e) Evaluation of performance-based test for long-term stress rupture proposed in Phase 1;
 - (f) Consideration of research results reported after completion of Phase 1 – specifically research related to electrical safety, hydrogen storage systems, and post-crash safety;
 - (g) Consideration of 200 per cent Nominal Working Pressure (NWP) or lower as the minimum burst requirement;
 - (h) Consider Safety guard system for the case of isolation resistance breakdown.
6. In addition, the following test procedure will be considered for long-term stress rupture:
 - (a) Three containers made from the new material (e.g. a composite fibre reinforced polymer) shall be burst; the burst pressures shall be within ± 10 per cent of the midpoint, BPo, of the intended application. Then,
 - (i) Three containers shall be held at > 80 per cent BPo and at $65 (\pm 5)$ °C; they shall not rupture within 100 hrs; the time to rupture shall be recorded;
 - (ii) Three containers shall be held at > 75 per cent BPo and at $65 (\pm 5)$ °C; they shall not rupture within 1000hrs; the time to rupture shall be recorded;

(iii) Three containers shall be held at > 70 per cent BPo and at 65 (± 5) °C; they shall not rupture within one year;

(iv) The test shall be discontinued after one year. Each container that has not ruptured within the one year test period undergoes a burst test, and the burst pressure is recorded.

(b) The container diameter shall be > 50 per cent of the diameter of intended application and of comparable construction. The tank may have a filling (to reduce interior volume) if >99 per cent of the interior surface area remains exposed;

(c) Containers constructed of carbon fibre composites and/or metal alloys are excused from this test;

(d) Containers constructed of glass fibre composites that have an initial burst pressure > 350 per cent NWP are excused from this test, in which case BP_{min} = 350 per cent NWP shall be applied in paragraph 5.1.1.1. (Baseline Initial Burst Pressure);

(e) There are carbon fibre containers that use glass fibre as the protective layer, and some of these containers contribute about 2 per cent of rise in burst pressure. In this case, it shall be demonstrated, by calculation, etc., that the pressure double the maximum filling pressure or above can be ensured by carbon fibre excluding glass fibre. If it can be demonstrated that the rise in burst pressure due to the glass fibre protective layer is 2 per cent or below and if the burst pressure is 225 per cent NWP $\times 1.02 = 230$ per cent NWP or more, the said calculation may be omitted.

III. Timeline

7. The work of the IWG on HFCV-SGS Phase 2 should be completed by 2020. The work may continue until the end of 2020 without a formal modification of this mandate, unless otherwise needed due to circumstances.

8. A prolongation and extension of the mandate of the IWG on HFCV-SGS may be considered by GRSP in due time.

Final Report on the Development of Amendment 1 to UN Global Technical Regulation No. 13, Phase 2 (Hydrogen and Fuel Cell Vehicles)

I. Introduction

1. During the 171st session of WP.29 in March 2017, the Executive Committee of the 1998 Global Agreement (AC.3) adopted the proposal for authorizing the development of Phase 2 of United Nations Global Technical Regulation (GTR) No. 13 (ECE/TRANS/WP.29/2017/56) submitted by the representatives of Japan, the Republic of Korea and the European Union.

2. During the 175th session of WP.29 in June 2018, the terms of reference (TOR) of informal working group on the UN GTR No. 13 (Hydrogen and Fuel Cell Vehicles) - Phase 2 (ECE/TRANS/WP.29/2018/75) were endorsed by AC.3.

3. The mandate was extended until June 2023 by WP.29 and AC.3. at their November 2020, March and November 2022 sessions.

II. Objectives of the Informal Working Group

4. The main IWG objectives were: (a) to tackle the development of the remaining issues described in clause I of UN GTR No. 13, Part I, (b) to reflect the on-road experience and technical evaluations experienced after the establishment of the UN GTR No. 13, Phase 1, and (c) to adapt the requirements to new technologies.

5. Although it was expected that with additional experience or additional time for fuller technical consideration, the requirements of Liquefied Hydrogen Storage System (LHSS) presented as optional requirements in the GTR could be adopted as requirements with appropriate modifications, there was very limited information available on LHSS during the activities of IWG. Accordingly, after a brief consideration, IWG agreed to maintain LHSS provisions as they are as an option for contracting parties.

III. History of the Informal Working Group Activities

6. First meeting of IWG (17–19 October 2017; Brussels, Belgium). The organization of the IWG was confirmed:

Co-Chair: N. Nguyen (United States of America/National Highway Traffic Safety Administration (NHTSA)), M. Takahashi (Japan/Ministry of Economy, Trade and Industry (METI))

Co-Vice-Chair: Y. He (CATARC (China/China Automotive Technology and Research Center)), S. Hyeong-Woo (Republic of Korea/ Korea Testing and Research Institute (KATRI))

Secretary: Y. Fujimoto (Japan/ International Organization of Motor Vehicle Manufacturers (OICA))

The draft TOR was developed. The contracting parties and other stakeholders provided updates on the research and rulemaking activities related to this GTR. The technical issues in UN GTR No. 13, Phase 1 were identified.

7. Second meeting of IWG, 5–7 February 2018 (Torrance, United States). Related standardization organizations introduced the progress of development of the standard and research institutes presented related activities. IWG set up five task forces and appointed leaders to facilitate the in-depth technical discussions on each topic by relevant experts.

- Task Force 1 - Heavy duty vehicles and buses
- Task Force 2 - Fuelling receptacle requirements
- Task Force 3 - Recommendations for test procedures
- Task Force 4 - Fire test
- Task Force 5 - Recommendations from Hydrogen technologies - International Standard Organization/Technical Committee 197 (ISO/TC197)

8. Third meeting of IWG (26–28 June 2018; Seoul, Republic of Korea). Each task force and stakeholder updated on the progress. With reference to the test procedure for material compatibility, the outcome of the work by Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles of the Society of Automotive Engineers (SAE J2579) will be the basis for consideration in this GTR. The need to adapt the requirement and test procedure to accommodate new conformable containers (non-axisymmetric) was recognized.

9. Fourth meeting of IWG (16–18 October 2018; Brussels, Belgium). H. Ito (Japan/METI) succeeded in the role of co-Chair. Each task force made their progress report. IWG exchanged views on the change of the initial burst pressure requirement to 200 per cent Nominal Working Pressure.

10. Fifth meeting of IWG (5–7 March 2019; Surrey, Canada). Each task force made their progress report. Discussion advanced on how material compatibility requirements would be included into the GTR.

11. Sixth meeting of IWG (18–20 June 2019; Tianjin, China). M. Koubek (NHTSA) succeeded the role of co-Chair and S. Kim (KATRI) co-Vice-Chair. Each task force made their progress report. IWG began sharing the overview of the status of each discussion topic and the expected time schedule to reach consensus. Task Force 5 concluded its activity.

12. Seventh meeting of IWG (6 and 7 November 2019; Stuttgart, Germany). Each task force made their progress report. IWG continued discussion on the regulatory framework of material compatibility requirement. Consensus was reached on the change of initial burst

pressure to 200 per cent NWP for 70 MPa containers other than glass fibre. IWG agreed to set up an editorial team as TF0.

13. Eighth meeting of IWG (23, 26 and 27 October 2020 (virtual)). Y. Sakamoto (Japan/METI) succeeded in the role of co-Chair. Due to the COVID-19 outbreak, the in-person meeting planned for March 2020 in Tokyo was cancelled, which significantly impacted the progress of related experimental works. IWG agreed to request an extension of the mandate. Nevertheless, TF0 started preparing the draft GTR and compiling the outcomes of the activities of the task forces and stakeholders.

14. Ninth meeting of IWG (23, 25 and 26 March 2021 (virtual)). The progress of each issue was reviewed and the remaining areas of work were identified. The study on the service life was introduced where 11,000 cycles as prescribed in GTR No. 13, Phase 1 for 15 years of service might be conservative enough to cover 25 years of service. For receptacles, it was agreed to reference ISO17268 so that all contracting parties will refer to this ISO even with future revisions. IWG agreed that conformable containers should be covered by GTR No. 13, Phase 2.

15. Tenth meeting of IWG (28 and 29 June 2021 (virtual)). The progress of each issue was reviewed and IWG could have consensus on several issues that are to be reflected in the draft. Information related to material compatibility would be included in Part I of GTR No. 13 so that each contracting party could use them for their national/regional requirements.

16. Eleventh meeting of IWG (12, 13 and 15 October 2021 (virtual)). K. Sato (Japan/METI) succeeded in the role of co-Chair. Remaining issues were intensively discussed so that the draft proposal could be submitted to GRSP in December 2021. However, since there were several pending issues, it was decided to postpone the submission to the May 2022 session of GRSP.

17. Twelfth meeting of IWG (24 and 27 January 2022 (virtual)). A six-month extension of the mandate was requested. IWG was able to reach consensus on all issues to be included in the Phase 2 proposal and started brushing up the document.

18. Thirteenth meeting of IWG (15–17 March 2022 (virtual)). IWG extensively reviewed the items concluded as contracting party options, to see whether these can be reduced in order to maximize the harmonization benefits and ensure convergence of the technical requirements among contracting parties.

19. Fourteenth meeting of IWG (25–26 April 2022 (virtual)). IWG reviewed and updated the draft for submission as an informal document to GRSP in May 2022.

20. Fifteenth meeting of IWG (29 and 30 June 2022 (virtual)). IWG reviewed the feedback from GRSP experts and the matters following submission to GRSP. IWG endorsed the draft for submission to GRSP in December 2022 as an official working document.

21. Upon establishment of the task forces, each task force had numerous in-person and virtual meetings, and provided effective input to IWG based on their highly technical expertise.

22. IWG submitted the following reports or proposals to GRSP:

<i>Reference</i>	<i>Title</i>
GRSP-62-25-Rev.1	Terms of Reference for the informal working group of Phase 2 of GTR No.13, Hydrogen and Fuel Cell Vehicles
GRSP-62-26	1st Meeting of the Informal Working Group on Hydrogen and Fuel Cell Vehicles Global Technical Regulation No. 13 (Phase 2)
GRSP-67-38	Progress Report on the Informal Working Group (IWG) for the GTR 13 on Hydrogen and Fuel Cell Vehicles (HFCV)
GRSP-70-35	Summary Report by Chair of IWG for GTR 13 (Hydrogen-Powered Vehicles) to the seventieth meeting of GRSP

<i>Reference</i>	<i>Title</i>
GRSP-71-09	Proposal for Amendments 1 to Global technical regulation No. 13, Phase 2 (Hydrogen and Fuel Cell Vehicles)
GRSP-71-21	Overview of Hydrogen Fuel Cell Vehicle Phase 2 Project Global Technical Regulations No.13 GRSP-71-09
ECE/TRANS/WP.29/GRSP/2022/16	Proposal for Amendments 1 to Global technical regulation No. 13, Phase 2 (Hydrogen and Fuel Cell Vehicles)
ECE/TRANS/WP.29/GRSP/2022/17	Final report on the development of Amendment 1 to UN Global Technical Regulation No. 13, Phase 2 (Hydrogen and fuel cell Vehicles)
