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**Economic Commission for Europe****Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Passive Safety****Seventy-third session**

Geneva, 15–19 May 2023

Item 18 of the provisional agenda

**UN Regulation No. 153 (Fuel system integrity and electric power train safety at rear-end collision)****Proposal for the Supplement 3 to the Original Version of UN Regulation No. 153 (Fuel system integrity and electric power train safety at rear-end collision) \*,\*\*****Submitted by the expert from the International Organization of Motor Vehicle Manufacturers**

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA). The proposal aims to introduce requirements for the post-crash safety of hydrogen-fuelled vehicles based on the Amendment 1 to UN GTR No. 13 (Hydrogen and Fuel Cells Vehicles). It is based on GRSP-72-32 distributed at the seventy-second session of the Working Party on Passive Safety (GRSP). The modifications to the current text of the UN Regulation are marked in bold for new characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2023 as outlined in proposed programme budget for 2023 (A/77/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

\*\* This document was scheduled for publication after the standard publication date owing to circumstances beyond the submitter's control.

## I. Proposal

Paragraph 2.2., amend to read:

- "2.2. *"Passenger compartment with regard to occupant protection"* means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, outside glazing, and front bulkhead and the plane of the rear compartment bulkhead or the plane of the rear-seat back support, **as well as by the electrical protection barriers and enclosures provided for protecting the occupants from direct contact with high voltage live parts.**"

Paragraph 2.4., amend to read:

- "2.4. "Tank" means the tank(s) designed to contain the liquid fuel, as defined in paragraph 2.6. ~~or compressed hydrogen gas~~, used primarily for the propulsion of the vehicle excluding its accessories (filler pipe, if it is a separate element, filler hole, cap, gauge, connections to the engine or to compensate interior excess pressure, etc.);"

Insert new paragraphs 2.32. to 2.36, to read:

- "2.32. *"Compressed hydrogen storage system (CHSS)"* means a system designed to store compressed hydrogen fuel for a hydrogen-fuelled vehicle and composed of a container, container attachments (if any), and all primary closure devices required to isolate the stored hydrogen from the remainder of the fuel system and the environment.
- 2.33. *"Container"* (for hydrogen storage) means the pressure-bearing component on the vehicle that stores the primary volume of hydrogen fuel in a single chamber or in multiple permanently interconnected chambers.
- 2.34. *"Container Attachments"* mean non-pressure bearing parts attached to the container that provide additional support and/or protection to the container and that may be only temporarily removed for maintenance and/or inspection only with the use of tools.
- 2.35. *"Hydrogen-fuelled vehicle"* means any motor vehicle that uses compressed gaseous hydrogen as a fuel to propel the vehicle, including fuel cell and internal combustion engine vehicles. Hydrogen fuel for the vehicles is specified in ISO 14687:2019 and SAE J2719\_202003.
- 2.36. *"Shut-off valve (for hydrogen-fuelled vehicles)"* means a valve between the storage container and the vehicle fuel system that can be automatically activated; which defaults to the "closed" position when not connected to a power source."

Annex 4, paragraph 2.1., amend to read:

- "2.1. *"Enclosed spaces"* ~~means indicates~~ the special volumes within the vehicle (or the vehicle outline across openings) that are external to the hydrogen system (storage system, fuel cell system, **internal combustion engine (ICE)** and fuel flow management system) ~~and its housings (if any) where hydrogen may accumulate (and thereby pose a hazard), such as the passenger compartment, luggage compartment and space under the hood.~~"

Annex 4, paragraph 3.1.4., amend to read:

- "3.1.4. The main stop valve and shut-off valves for hydrogen gas, located in the downstream hydrogen gas piping, are in **the** normal driving condition **kept open** immediately prior to the impact."

Annex 6, paragraph 2 4.2. and 4.3., amend to read:

- "4.2. The initial mass of hydrogen in the storage system can be calculated as follows:  
 $P_0' = P_0 \times 288 / (273 + T_0)$   
 $\rho_0' = -0.0027 \times (P_0')^2 + 0.75 \times P_0' + 1.070.5789$ "

$$M_o = \rho_o' \times V_{CHSS}$$

- 4.3. Correspondingly, the final mass of hydrogen in the storage system,  $M_f$ , at the end of the time interval,  $\Delta t$ , can be calculated as follows:

$$P_f' = P_f \times 288 / (273 + T_f)$$

$$\rho_f' = -0.0027 \times (P_f')^2 + 0.75 \times P_f' + 1.0705789$$

$$M_f = \rho_f' \times V_{CHSS}$$

where  $P_f$  is the measured final pressure (MPa) at the end of the time interval, and  $T_f$  is the measured final temperature ( $^{\circ}\text{C}$ )."

## II. Justification

1. The post-crash safety requirements for hydrogen powered vehicles specified in UN Regulation No. 153 (fuel system integrity and electric power train safety at rear-end collision) are based on UN GTR No. 13 where certain definitions were not included without any specific reasons.
2. During the development of UN GTR No. 13, Amendment 1 (GTR13, Phase 2), several clarifications and corrections are made on the existing part of UN GTR No. 13 that are transposed into UN regulation No.153.
3. Such amendments for clarifications and corrections should be applied to existing versions of UN Regulation No.153 as early as possible, while those amendments do not affect the validity of existing approvals.