

Proposal for Supplement **21** to the 02 Series of Amendments to UN Regulation No. 135 (Pole Side Impact)

Submitted by the expert from OICA

The text reproduced below was prepared by the expert from the International Organization of Motor Vehicle Manufacturers (OICA). It replaces ECE/TRANS/WP.29/GRSP/2023/19 to resolve editorial issues. 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). The modifications to the current text of the UN Regulation are marked in bold for new characters and the modifications from ECE/TRANS/WP.29/GRSP/2023/19 are given in red fonts.

I. Proposal

Paragraphs 2.3. and 2.4., amend to read:

- "2.3. "Compressed hydrogen storage system (CHSS)" means a system designed to store compressed hydrogen fuel for a hydrogen-fuelled vehicle and composed of a ~~pressurized~~ container, **container attachments (if any), and all primary closure devices required to** ~~pressure relief devices (PRDs) and shut-off device that~~ isolate the stored hydrogen from the remainder of the fuel system and the environment.
- 2.4. "Container (for hydrogen storage)" means the **pressure-bearing component on the vehicle** ~~within the hydrogen storage system~~ that stores the primary volume of hydrogen fuel **in a single chamber or in multiple permanently interconnected chambers."**

Insert new paragraph 2.4.1., to read

- "2.4.1. "***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."

Paragraph 2.10., amend to read:

- "2.10. "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 ~~passenger~~ vehicles is specified in **ISO 14687:2019 and SAE J2719_202003**. ~~ISO 14687 2:2012 and SAE (Sep 2011 Revision).~~

Paragraph 2.14., amend to read:

- "2.14. **Passenger compartment**

2.14.1 "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.~~

~~2.14.2.2-15~~ "Passenger compartment for electric safety **and/or hydrogen safety** assessment" means the space for occupant accommodation, bounded by the roof, floor, side walls, doors, outside glazing, front bulkhead and rear bulkhead, or **back door rear-gate**, as well as by the electrical protection barriers and enclosures provided for protecting the occupants from direct contact with high voltage live parts. "

Paragraph 2.15., shall be deleted

Paragraphs 2.16. to 2.~~56~~20. (former), renumber as paragraphs 2.15. to 2.~~55~~19.

Paragraph 2.21 (former), renumber as paragraph 2.20 and amend to read:

~~"2.2021.~~ "Shut-off valve (for hydrogen-fuelled vehicles)" means a valve between the ~~storage~~ container and the vehicle fuel system that **must default can be** automatically activated; ~~which defaults to the "closed" position when not connected to a power source. "~~

Paragraphs 2.22. to 2.26. (former), renumber as paragraphs 2.21. to 2.25.

Paragraph 2.27 (former), renumber as paragraph 2.26 and amend to read:

~~"2.2627.~~ "Vehicle type" means a category of vehicles, the design characteristics of which do not differ, **in so far as they have an adverse effect on the result of the impact test prescribed in this Regulation**, in such essential respects as:

- (a) The type of protective system(s);
- (b) The type of front seat(s);
- (c) The vehicle width;
- (d) The wheelbase and overall length of the vehicle;
- (e) The structure, dimensions, lines and materials of the side walls of the passenger compartment, including any optional arrangements or interior fittings within or about the side walls of the passenger compartment;
- (f) The type of door latches and hinges;
- (g) The type of fuel system(s);
- (h) The unladen vehicle mass and the rated cargo and luggage mass;
- (i) The sitting of the engine (front, rear or centre);
- (j) The locations of the REESS ~~in so far as they have a negative effect on the result of the impact test prescribed in this Regulation.~~

Paragraphs 2.28. to 2.56. (former), renumber as paragraphs 2.27. to 2.55.

Annex 6, 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 6, 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, paragraphs 4.2. and 4.3., amend to read:

"4.2. The initial mass of hydrogen in the storage system can be calculated as follows:

$$P_o' = P_o \times 288 / (273 + T_o)$$

$$\rho_o' = -0.0027 \times (P_o')^2 + 0.75 \times P_o' + 1.070.5789$$

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

4.3. Correspondingly, the final mass of hydrogen in the storage system, M_f , at the end of the time interval, Δt , can be calculated as follows:

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

$$\rho_f' = -0.0027 \times (P_f')^2 + 0.75 \times P_f' + 1.070.5789$$

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

where P_f is the measured final pressure (MPa) at the end of the time interval, and T_f is the measured final temperature (°C)."

II. Justification

1. The post-crash safety requirements for hydrogen-powered vehicles specified in UN Regulation No. 135 (pole side impact) are based on UN GTR No. 13.
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.135.
3. Such amendments for clarifications and corrections should be applied to existing versions of UN Regulation No.135 as early as possible, while those amendments do not affect the validity of existing approvals.
4. The definition of "passenger compartment" is aligned to other crash regulations.
5. In the 02 series of amendment, there is an editorial error in paragraph 2.27. for the definition of "vehicle type" where the "in so far as they have a negative effect..." should be valid for bullet points (a) to (j). For clarity we moved the sentence "**in so far as they have an adverse effect on the result of the impact test prescribed in this Regulation,**" to the beginning of the paragraph.