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UN Regulation No. 134 (Hydrogen and Fuel Cell Vehicles)

Proposal for Supplement 4 to the original version [and Supplement 1 to the 01 series of amendments to UN Regulation No. 134 (Hydrogen and Fuel Cell Vehicles)

Submitted by the expert from the International Organization of Motor Vehicle Manufacturers *

The text reproduced below was prepared by the experts from the International Organization of Motor Vehicle Manufacturers (OICA), aiming to allow alternative test methods for heavy duty vehicles in order to improve applicability of the requirements to vehicles of categories M_2, M_3, N_2 and N_3. The modifications to the current text of the UN Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2021 as outlined in proposed programme budget for 2021 (A/75/6 (Sect.20), para 20.51), 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.

I. Proposal

Paragraph 2.7., amend to read:

"2.7. "*Enclosed or semi-enclosed spaces"* means the special volumes within the vehicle (or the vehicle outline across openings) that are external to the hydrogen system (storage system, fuel cell system and fuel flow management system) and its housings (if any) where hydrogen may accumulate (and thereby pose a hazard)~~, as it may occur in the passenger compartment, luggage compartment and space under the hood~~."

Paragraph 5., amend to read:

"5. Part I – Specifications of the compressed hydrogen storage system

This part specifies the requirements …

…

All new compressed hydrogen storage systems produced for on-road vehicle service shall have a NWP of 70 MPa or less and a service life of ~~15~~**20** years or less, and be capable of satisfying the requirements of paragraph 5.

…"

Paragraph 5.1.2., amend to read:

"5.1.2. Baseline initial pressure cycle life.

Three (3) containers shall be hydraulically pressure cycled at the ambient temperature of 20 (±5) °C to 125 per cent NWP (+2/-0 MPa) without rupture for 22,000 cycles **for a 15-year service life or 30,000 cycles for a 20-year service life** or until a leak occurs (Annex 3, paragraph 2.2. test procedure). **Upon the manufacturer's request, an increase of service life for vehicles of categories M_2, M_3, N_2 and N_3 may be verified with the increased number of cycles in which one year of service life requires an addition of 750 cycles with the maximum of 15,000 cycles for a 20-year service life.** Leakage shall not occur within 11,000 cycles for a 15-year service life **or 15,000 cycles for a 20-year service life**."

Paragraph 5.2., amend to read:

"5.2. Verification tests for performance durability (Hydraulic sequential tests)

If all three pressure cycle life measurements made in paragraph 5.1.2. are greater than 11,000 cycles **for a 15-year service life or 15,000 cycles for a 20-year service life**, or if they are all within ± 25 per cent of each other, then only one (1) container is tested in paragraph 5.2. Otherwise, three (3) containers are tested in paragraph 5.2.

…"

Paragraph 5.6., amend to read:

"5.6. Labelling

…

Date of removal from service shall not be more than ~~15~~**20** years after the date of manufacture."

Paragraph 7.1.1.4., amend to read:

"7.1.1.4. The fuelling receptacle shall not be mounted within the external energy absorbing elements of the vehicle (e.g. bumper) and shall ~~not~~ be installed in **such a way that access for refilling shall not be required in** the passenger

compartment, luggage compartment**, or in any other unventilated compartment.** ~~and other places where hydrogen gas could accumulate and where ventilation is not sufficient.~~ Test procedure is by visual inspection. "

Paragraph 7.2., amend to read:

"7.2. Post-crash fuel system integrity

The vehicle fuel system shall comply with the following requirements after the vehicle crash tests in accordance with the following **UN** Regulations by also applying the test procedures prescribed in Annex 5 of this **UN** Regulation.

(a) Frontal impact test in accordance with either **UN** Regulation No. 12, or **UN** Regulation No. 94; and

(b) Lateral impact test in accordance with **UN** Regulation No. 95.

In case that one or both of the vehicle crash tests specified above are not applicable to the vehicle, the ~~vehicle fuel system~~ **compressed hydrogen storage system** shall, instead, be subject to the relevant alternative accelerations specified below and the **compressed** hydrogen storage system shall ~~be installed in~~ **comply to** ~~a position satisfying~~ the relevant requirements in paragraph**s 7.2.3. and** 7.2.4. The accelerations shall be measured at the location where the **compressed** hydrogen storage system is installed. The ~~vehicle fuel system~~ **compressed hydrogen storage system** shall be mounted and fixed on the representative part of the vehicle. The mass used shall be representative for a fully equipped and filled container or container assembly.

…"

Paragraph 7.2.4.2., amend to read:

"7.2.4.2. Requirements on installation of the hydrogen storage system not subject to the lateral impact test:

The container shall be mounted in a position which is between the two vertical planes parallel to the centre line of the vehicle located 200 mm inside from the both outermost edge of the vehicle in the proximity of its container(s). **This requirement shall not apply to compressed hydrogen storage systems which are mounted in such a way that the lowest part of the system is higher than 1,000 mm above the ground.**"

Insert new paragraphs 7.2.4.3. to 7.2.5., to read:

"**7.2.4.3. Lateral impact test on compressed hydrogen storage system as alternative to 7.2.4.2.**

Upon the manufacturer's request, for compressed hydrogen storage systems installed in vehicles to which the vehicle crash test specified in 7.2. (b) is not applicable, the additional installation requirement under 7.2.4.2. does not apply if the compressed hydrogen storage system has passed the lateral impact test specified below:

7.2.4.3.1. Test conditions

The compressed hydrogen storage system must be filled with hydrogen or helium. The test pressure shall be agreed by the manufacturer together with the Technical Service. Tests shall be conducted on the compressed hydrogen storage system in the position intended for the installation in the vehicle including attachments, brackets and protective structures if applicable. At the manufacturer's discretion the compressed hydrogen storage system may be fixed to a representative part of the frame or on a complete vehicle. The protective structure shall be defined by the manufacturer.

7.2.4.3.2. Movable deformable barrier

The movable deformable barrier (MDB) shall comply with the requirements of UN Regulation No. 95, Annex 5.

7.2.4.3.3. Lateral impact on compressed hydrogen storage system

The MDB speed at the moment of impact shall be 50 ± 1 km/h. However, if the test was performed at a higher impact speed and the compressed hydrogen storage system met the requirements, the test shall be considered satisfactory. The impact direction shall be in an angle of 90° to the longitudinal axis of the container and the height of the container shall be adjusted in a way that the middle of the front plate of the barrier matches the middle of the container in the horizontal and vertical.

After this lateral impact test the compressed hydrogen storage system shall comply with the requirements in 7.2.1. – 7.2.3.

7.2.5. A calculation method may be used instead of practical testing if its equivalence can be demonstrated by the applicant for approval to the satisfaction of the Technical Service."

Paragraph 9.3.2.2., amend to read:

"9.3.2.2. …

For the service life of 15 years, the cylinder shall not leak or rupture within the first 11,000 cycles**, or for the service life of 20 years, within the first 15,000 cycles**."

Paragraphs 9.3.2.3. to 9.3.2.3.3., amend to read:

"9.3.2.3. Relaxation provisions

…

9.3.2.3.1. One cylinder from each batch shall be pressure cycled with 11,000 cycles for the service life of 15 **years or with 15,000 cycles for the service life of 20 years** depending on the intended use of the container

9.3.2.3.2. On 10 sequential production batches of the same design, should none of the pressure cycled cylinders leak or rupture in less than 11,000 cycles x 1.5 for the service life of 15 years **or in less than 15,000 cycles x 1.5 for the service life of 20 years**, then the pressure cycling test can be reduced to one cylinder from every 5 batches of production.

9.3.2.3.3. On 10 sequential production batches of the same design, should none of the pressure cycled cylinders leak or rupture in less than 11,000 cycles x 2.0 for the service life of 15 years **or in less than 15,000 cycles x 2.0 for the service life of 20 years**, then the pressure cycling test can be reduced to one cylinder from every 10 batches of production."

Annex 5

Paragraph 3.2.1.3., amend to read:

"3.2.1.3. Prior to the test the vehicle is prepared to **simulate** remotely controllable hydrogen releases from the hydrogen system. **Hydrogen releases may be demonstrated by using external fuel supply without modification of the test vehicle fuel lines.** The number, location and flow capacity of the release points downstream of the main hydrogen shutoff valve are defined by the vehicle manufacturer taking worst case leakage scenarios into account. As a minimum, the total flow of all remotely controlled releases shall be adequate to trigger demonstration of the automatic "warning" and hydrogen shut-off functions."

II. Justification

1. The objective of this UN Regulation was the transposition of UN Global Technical Regulation No. 13, Phase 1. Contrary to this UN Regulation, the scope of UN GTR No. 13, Phase 1 does not cover heavy-duty vehicles requirements. Being aware of the ongoing work of UN GTR No. 13, Phase 2, this proposal is aiming at solving practical issues for the application to heavy-duty vehicles that is urgently needed, since the approval to this UN Regulation will become mandatory in the European Union as of July 2022.

2. Paragraphs 2.7. and 7.1.1.4.: Since not all vehicles have luggage compartment or space under the hood, these examples may be misleading and should therefore be deleted.

3. Paragraphs 5., 9.3.2.2 and 9.3.2.3.: The service lives of heavy-duty vehicles are in general much longer than 15 years. A service life of up to 20 years decreases the total cost of ownership, which is one of the key challenges to make hydrogen buses and trucks a viable alternative to diesel vehicles. The calculation of 750 cycles per year to increase the service life is based on the ISO 19881 and UN GTR No. 13 Phase 1.

4. Paragraph 7.2.: Is intended to clarify the requirements of the acceleration test for practical application to heavy-duty vehicles.

5. Paragraph 7.2.4.: Hydrogen storage systems that are installed higher than 1,000 mm above the ground (behind the cab or on the roof of the vehicle) are not at risk of being impacted in a lateral crash. As an alternative to the dimensional requirement of paragraph 7.2.4.2. a component-based lateral impact test is being proposed to demonstrate adequate protection.

6. Paragraph 7.2.5.: Where practical tests are very common for passenger vehicles, the heavy-duty vehicle industry has provided reliable results when showing compliance by calculation methods.

7. Annex 5 Paragraph 3.2.1.3.: "3.2. Hydrogen releases from the hydrogen system" requires alteration of the test vehicle. A test method without modification of fuel lines also should be provided. This is being discussed by the Informal Working Group on UN GTR No. 13 Phase 2 as well.