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Item 14 of the provisional agenda

UN Regulation No. 134 (Hydrogen and Fuel Cell Vehicles)**Proposal for Supplement 1 to the 02 Series of Amendments to the UN Regulation No. 134 (Hydrogen and Fuel Cell Vehicles)****Submitted by the Task Force amending UN Regulation No. 134^{*,**}**

The text reproduced below was prepared by the task force involving France, Japan, the Netherlands, the European Commission, the European Association of Automotive Suppliers (CLEPA) and the International Organization of Motor Vehicle Manufacturers (OICA) as well as related industry experts on transposing amendment 1 to UN Global Technical Regulation No. 13, Phase 2 (GTR13-PH2) into the UN Regulation under the 1958 Agreement. This document is based on informal document GRSP-72-17, distributed at the seventy-second session of the Working Party on Passive Safety (GRSP) and incorporates further amendments that have been addressed in the task force. The modifications to the existing text of UN Regulation No. 134 are marked in bold for new or strikethrough for deleted characters.

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

** In accordance with the programme of work of the Inland Transport Committee for 2024 as outlined in proposed programme budget for 2024 (A/78/6 (Sect. 20), table 20.5), 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

Paragraphs 2.3. to 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 container, container attachments (if any), **[supply lines of additional Thermally activated Pressure Relief Device (TPRD) (if any),]** and all primary closure devices required to 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 that stores the primary volume of hydrogen fuel in a single chamber or in multiple permanently interconnected chambers.

Note: The high-pressure fuel lines interconnecting the multiple chambers and/or connecting to the primary closing device(s) are considered as part of the container as long as those parts hold the same pressure level as the chamber(s) and the permanent connections are ensured. Such fuel lines are tested as integral elements of the container.

Permanent interconnections are any physical solutions to pneumatically connect chambers, e.g. welded or screwed tubing, manifolds, etc., to allow a permanent flow passage with an invariable flow section for hydrogen between chambers during the entire CHSS service life]. Any disassembly of a container after manufacturing shall be visually detectable, e.g. by use of seals, and result in permanent removal of the CHSS from service. "

Paragraph 5., amend to read:

"5. Part I – Specifications of the Compressed Hydrogen Storage System

This part specifies the requirements for the compressed hydrogen storage system.

- (a) The primary closure devices shall include the following functions, which may be combined:
 - (i) TPRD;
 - (ii) Check valve; and
 - (iii) Shut-off valve
- (b) The primary closure devices shall be mounted directly on or within each container. **[If needed, manufacturers may choose to locate additional TPRDs in alternative locations on the container. However, any high-pressure supply lines for such additional TPRDs shall have demonstrated mechanical integrity and durability as part of qualification tests for the CHSS (hydraulic sequential test in paragraph 5.2., pneumatic sequential test in paragraph 5.3. and fire test in paragraph 5.4.) as well as the specific loads related to the integration of this components to the vehicle (crash, vibration).]**

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Table 2
Overview of Performance Requirements

<i>Requirement section</i>	<i>Test article</i>
5.1. Verification tests for baseline metrics	Container or container plus container attachments, as applicable
5.2. Verification test for performance durability	Container or container plus container attachments [and supply lines,] as applicable
5.3. Verification test for expected on-road performance	CHSS
5.4. Verification test for service terminating performance in fire	CHSS
5.5. Verification test for closure durability	Primary closure devices

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, 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.

Unless otherwise specified, the tests in paragraph 5.2. shall be conducted on the container equipped with its container attachments (if any) **[as well as supply lines for additional TPRDs (if any) through appropriate adaptors]** that represents the CHSS without the primary closures."

Annex 3, paragraphs 3.3. to 3.4., amend to read:

"3.3. Surface damage test (unpressurized)

The surface damage tests and the chemical exposure tests (Annex 3, paragraph 3.4.) shall be conducted on the surface

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Otherwise, the tests shall be conducted on the surface of the container attachments as indicated in Figure 2.

Note: In case, the CHSS contains more than one chamber design (e.g. different size or material) the Technical Service shall determine whether to conduct the test on each design or whether to use the worst-case approach.

3.4. Chemical exposure and ambient-temperature pressure cycling test

Each of the 5 areas of the unpressurized container

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Table 3
Pressure Cycles and Conditions - Chemical Exposure and Ambient Temperature
Pressure Cycling Test

<i>Purpose</i>	<i>Number of cycles</i>	<i>Target Pressure</i>	<i>Temperature</i>	<i>Rate</i>
Chemical exposure and ambient temperature pressure cycling test (paragraph 5.2.4.)	60 per cent the specified number of cycles determined in paragraph 5.1.2.	≥ 125 per cent NWP	Environment: 20 ± 15 °C Hydraulic fluid: 20 ± 15 °C	≤ 10 cycles per minute
	of which the last 10 cycles	≥ 150 per cent NWP		

Note: In case, the CHSS contains more than one chamber design (e.g. different size or material) the Technical Service shall determine whether to conduct the test on each design or whether to use the worst-case approach."

II. Justification

1. Definitions:

(a) In order to allow for remote TPRDs and the required supply lines, a phrase was added to the definition of compressed hydrogen storage system;

(b) A note was added to the definition of container to clarify the text, in particular for containers with multiple interconnected chambers.

2. Paragraph 5. – Remote TPRD: Remote TPRDs are design features that might be added to CHSS to ensure safety in fire (especially for large CHSSs). Remote TPRDs are allowed as long as the mechanical integrity and durability of the supply lines are demonstrated, based on the following test matrix:

(a) Container and CHSS, including remote TPRD supply lines:

(i) Durability of the supply lines mounted directly on the container will be validated based on the hydraulic sequential test. The test setup in paragraph 5.2. may be performed by replacing the On Tank Valve/End plug by suitable adapters representative for the connection of the remote TPRD supply lines. The drop test is intended to account for a potential internal damage to the container during handling operations. Actually, if the supply lines are dropped directly to the ground, surface damage will be visible and the part will not be used in the final product. As foreseen by paragraph 5.2.2., any additional support and/or protection to the container can be used in the drop test. Thus, any protection to the supply lines can also be used in the test as part of the container attachments.

(ii) The leak tightness, over accelerated vehicle lifetime usage, of remote TPRDs with their supply lines, will be validated using the pneumatic sequential test of paragraph 5.3.

c. Fire test of paragraph 5.4.

(b) The risk related to vibration loads:

At component level, the additional TPRDs are submitted to the drop and vibration test in paragraph 6.1.(g). The performance of the core and the glass part of the TPRDs is assessed to qualify the performance of the closure.

It is recognized that no specific requirement can be made for vibration testing of supply lines in the Regulation as vibration profiles are always specific to the vehicle and the CHSS installation.

However, a non-specific wording was added in paragraph 5.(b). This mandates the vehicle manufacturer to address this risk but allows to apply realistic vibration profiles for specific vehicle and CHSS installation.

3. Annex 3 – Multiple interconnected chambers: containers with multiple interconnected chambers are a more recent development for hydrogen storage systems. In case the development progresses to a design with more than one chamber design within the container, the technical services could find it necessary to test individual designs. Therefore, phrases have been added to paragraphs 3.3. and 3.4. to address this need.
