GTR #13 (Phase 2)

Recommendations for Test Procedures

Task Force 3 Status

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TF 3 Objectives

- To correct editorial and technical errors in the original draft
- To make modifications to the test procedures based on industry experience
- To incorporate requirements for medium and heavy duty vehicles
- To incorporate requirements for new storage technologies

TF 3 Status

- Nearly completed addressing 88 pages of comments/proposed changes, with some exceptions (following slides)
- TF 0 currently entering revisions to the draft of the regulation
- Draw attention to a proposed change to the fire test procedure (5.1.4) which may affect certain CPs:

  ~~However, Contracting Parties under the 1998 Agreement may choose to use compressed air as an alternative test gas for certification of a container for use only within their countries or regions.~~

TF 3 Open Items

- HRS risk assessment (EIGA/Shell/WG 24)
  - Pressure ramp rate control failure could result in high flow and as a consequence, overheating of the hydrogen tank (up to 120°C liner temperature)
  - TF 3 undecided as to the validity of the failure mode
  - International CRADA proposed by Jay Keller, “Multi-lateral campaign to investigate type IV response to an HRS one-time fault”
  - Results not likely available until next phase of GTR
- TPRD outstanding items
  - Revised accelerated life test equation for review/approval
  - Revised drop test procedures

TF 3 Open Items

- Change of design table (OICA, Nikola)
  - Container change of design table proposed by Nikola (abridged) and expanded by OICA (full table per EC 79/EU 406) is under review
  - Concept allows for container designs that are sufficiently similar to an existing qualified design to be qualified through a reduced test program
  - The change of design table covers a wide range of possible container alterations including changes in diameter, length, fiber manufacturer, liner material, nominal working pressure, end boss design, fire protection system, etc.
  - Can this table be included as a CP option, or included as an Annex, or both?

GTR13 Phase2 TF3 Change of Design Proposal

■ Proposal

Changed Item		Required tests
Fiber manufacturer		- Initial burst, Initial pressure cycle life - sequential hydraulic tests
Metallic container or liner material		- Initial burst, Initial pressure cycle life - sequential hydraulic tests - fire test
Plastic liner material		- sequential hydraulic tests - sequential pneumatic tests
Fiber material		- Initial burst, Initial pressure cycle life - sequential hydraulic tests - fire test
Resin material		- sequential hydraulic tests
Diameter change	≤20%	- Initial burst, Initial pressure cycle life
	>20%	- Initial burst, Initial pressure cycle life - sequential hydraulic tests - fire test
Length change	≤50%	- Initial burst, Initial pressure cycle life
	>50%	- Initial burst, Initial pressure cycle life - sequential hydraulic tests - fire test
Nominal working pressure change		- Initial burst, Initial pressure cycle life - fire test
Dome shape		- Initial burst, Initial pressure cycle life - sequential pneumatic tests
Opening size		- Initial burst, Initial pressure cycle life
Coating change		- sequential hydraulic tests
End boss design		- sequential pneumatic tests
Change in manufacturing process		- Initial burst, Initial pressure cycle life
Fire protection system		- fire test

TF 3 Open Items

- Conformable Containers
  - Key definitions proposed for: Container, Container Attachments, Compressed Hydrogen Storage System (CHSS)
  - Modifications to key test procedures underway: flaw tolerance, chemical exposure, drop, etc.

Conformable Tank Subgroup: Definitions Proposal

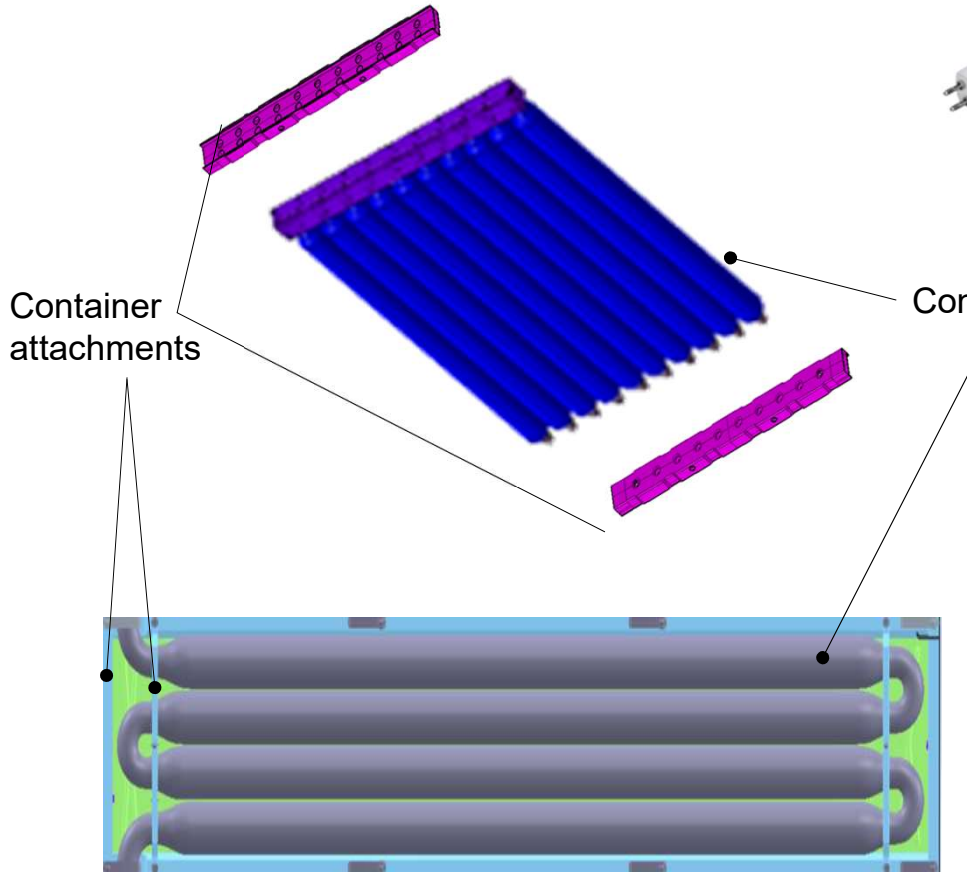
GTR 13 Phase 1	CT Subgroup proposal	Comments
3.6 "Container" (for hydrogen storage) is the component within the hydrogen storage system that stores the primary volume of hydrogen fuel.	**3.6 "Container"** means the component of the vehicle that forms the primary volume for hydrogen fuel storage in a single chamber or in multiple permanently interconnected chambers. * Two or more chambers connected by high pressure piping are subject to the requirements in this regulation with their assembled form as a single container or CHSS. **3.x "Container Attachments"** means non-pressure bearing parts directly attached to the container. Container attachments provide additional support and/or protection to the container.	Container attachments will be clarified further in the document to provide the description of what is considered a container attachment and to differentiate them from hardware needed for vehicle mounting. Container attachments are part of the CHSS and therefore they are to withstand test. Clarification could be included in: -C. Description of typical hydrogen-fueled fuel cell vehicle (HFCVs) -3. Hydrogen storage system -(a) Compressed hydrogen storage system (17 or 18)
3.29 "Hydrogen storage system" indicates a pressurized container, pressure relief devices (PRDs) and shut off device that isolate the stored hydrogen from the remainder of the fuel system and the environment.	**3.29 "Compressed hydrogen storage system (CHSS)"** means a system designed to store compressed hydrogen fuel for a hydrogen-fuelled vehicle, composed of a container, container attachments (if any), and all closure devices (such as shut-off valve, check valve, and TPRD) required to isolate the stored hydrogen from the remainder of the fuel system and the environment.	A FCV may have one or more CHSS and some of them may be identical

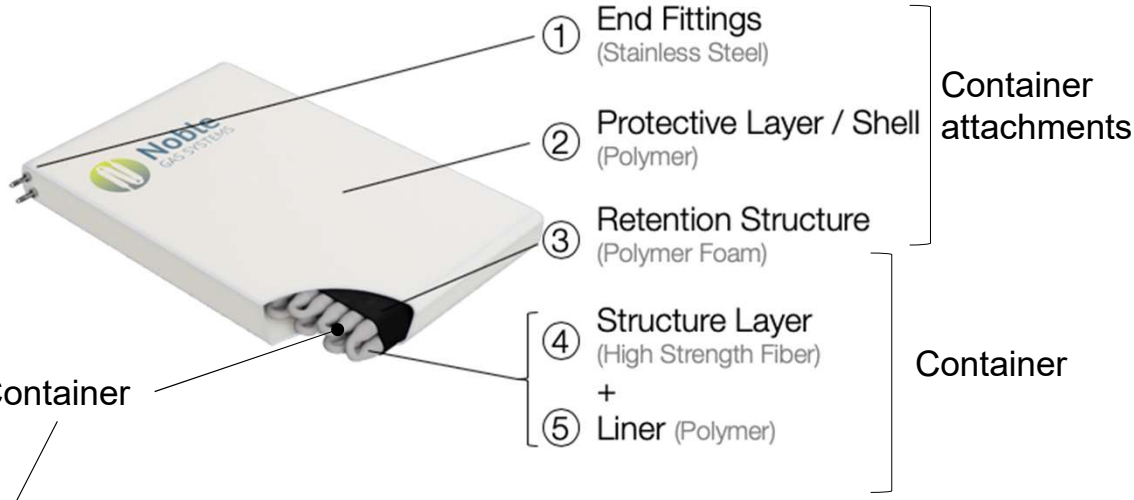
Conformable Tank Subgroup: Performance Requirements Proposal

GTR 13 Phase 1	CT Subgroup proposal	Comments
5.1 Compressed hydrogen storage system This section specifies the requirements for the integrity of the compressed hydrogen storage system. The hydrogen storage system consists of the high pressure storage container and primary closure devices for openings into the high pressure storage container. Figure 1 shows a typical compressed hydrogen storage system consisting of a pressurized container, three closure devices and their fittings. The closure devices include: (a) A TPRD; (b) A check valve that prevents reverse flow to the fill line; and (c) An automatic shut-off valve that can close to prevent flow from the container to the fuel cell or ICE engine. Any shut-off valve, and TPRD that form the primary closure of flow from the storage container shall be mounted directly on or within each container. At least one component with a check valve function shall be mounted directly on or within each container.	**5.1 Compressed hydrogen storage system** This section specifies the requirements for a compressed hydrogen storage system (CHSS): (a) The closure devices shall include the following functions, which may be combined: (i) TPRD; (ii) Check valve that prevents reverse flow to the fill line; and (iii) Automatic shut-off valve that can close to prevent flow from the container to the fuel cell or internal combustion engine. (b) The closure devices shall be mounted directly on or within each container (c) Disassembly of a container shall not be permitted and shall result in permanent removal from service of the container. (d) Temporary removal and reinstallation of container attachments shall require the use of tools and processes, specified by the manufacturer. (e) 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 years or less. (f) The CHSS shall meet the performance test requirements summarized in Table 1. The corresponding test procedures are specified in paragraph 6.	

Conformable Tank Subgroup: Why Container Attachments

Some containers may have non-pressure bearing attachments to provide additional structural support or protection to the container. For example:





Container attachments are analogous to dome protectors on traditional tanks.