			Comments to GTR Draft SGS-7-11	**Status: 06.01.2010**
Nr.	**Page**	**Paragraph/figure/table**	**Recommendation**	**Comment/Justification**
1	6	3	2. […] When the vehicle is started, the shut-off valve is opened and hydrogen ~~gas~~ is allowed to flow from the Hydrogen Storage System.	In case of LH2 extraction of liquid hydrogen should be also allowed. According to Figure 4 the coolant heat exchanger does not contain to the LH2 storage system.
2	7	3	3. […] As with gasoline tanks, hydrogen storage containers, whether compressed gas or liquefied hydrogen, are usually mounted ~~transversely~~ in the rear of the vehicle.	Both LH2 and CGH2 can also be mounted in driving direction in the middle tunnel of the vehicle
4	8	3.2	8. The hydrogen storage system consists of all components that form the primary pressure boundary of the stored hydrogen ~~gas~~ in the system.	Cover LH2
5	9	3.2.1	10. […] "d) the thermally-activated pressure relief device(s) (TPRD)"	In case of more than one container it should be devices
7	10	3.2.2	**3.2.2 LIQUEFIED HYDROGEN STORAGE SYSTEM (put in separate section)** 16. As noted previously, hydrogen gas has a low energy density per unit volume. To overcome this disadvantage, the liquefied hydrogen storage system (LHSS) maintains the hydrogen at cryogenic temperatures in a liquefied state. 17. A typical liquefied hydrogen storage system (LHSS) is shown in Figure 4. Actual systems will differ in the type, number, configuration, and arrangement of the functional constituents. Ultimately, the boundaries of the LHSS are defined by the interfaces which can isolate the stored liquefied	New section for LH2

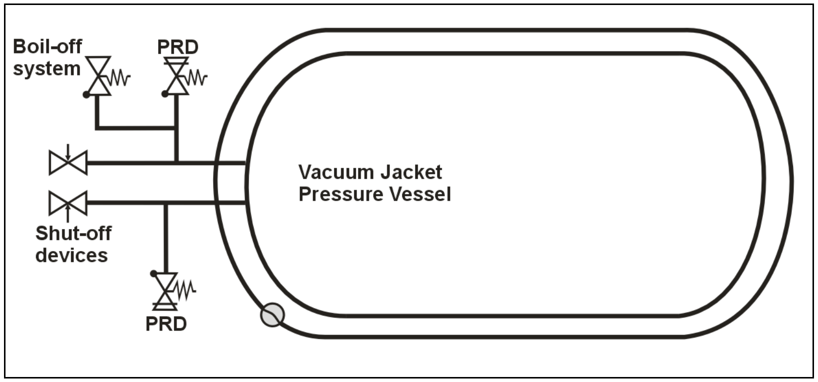
(or gaseous) hydrogen from the remainder of the fuel system and the environment. All components located within this boundary are subject to the requirements defined in this section while components outside the boundary are subject to general requirements in Section 4.

A typical liquefied LHSS shown in Figure 4 regulary consists of the following components:

a) liquefied hydrogen storage container(s),
b) shut-off devicess,
c) Pressure Relief Devices (PRDs),
d) a Boil-off system,
e) all components, fittings and fuel lines between the container(s) and the above components.

18. During fueling, liquefied hydrogen flows from the fuelling system to the storage container(s).

19. Liquefied hydrogen is stored at cryogenic conditions. In order to maintain the hydrogen in the liquid state, the container needs to be well insulated, including use of a vacuum jacket that surrounds the storage container. A boil-off system restricts heat leakage induced pressure rise in the hydrogen storage container(s) to a pressure specified by the manufacturer. In case of Boil-off system malfunction, vacuum failure or external fire the hydrogen storage container(s) and the vacuum jacket(s) are protected against overpressure by Pressure Relief Devices (PRDs).

			20. When hydrogen is released to the propulsion system, it flows from the LHSS through the shut-off valve that is connected to the hydrogen fuel delivery system. In the event that a fault is detected in the propulsion system, vehicle safety systems usually require the container shut-off valve to isolate the hydrogen from the down-stream systems and the environment.  **Figure 4. Typical Liquefied Hydrogen Storage System** **Delete Original Figure 4**	
8	12	3.5	27. […] As illustrated in Figure 2, many passenger fuel cell vehicles are front wheel drive with the electric drive motor and drive-train located in the "engine compartment" mounted transversely over the front axle.	Due to the small and compact size of electric engines electric drive trains should not be considered as front-wheel drive as standard concept.
9	15	5.1.2	5.1.2.2.2 […] "Expected" exposures (for a typical vehicle) include the fuel (hydrogen ~~gas~~), […]	Delete "gas":
10	15	5.1.2	Data bases for 5.1.2.2.2 test protocol include:	150% referred to which pressure?

			Proof Pressure Test – routine production of pressure vessels includes a verifying, or proof, pressure test at the point of production, which is 150% as industry practice.	NWP, MAWP?
11	15	5.1.2	4. Number of fueling/de-fueling cycles ii. Expected vehicle range per full fueling is taken to be 300 mi (483km) based on 2006-2007 market survey of Nissan, Daimler, Chrysler, General Motors, Ford, Honda, and Toyota products. iii. Therefore, the expected number of full fuelings in the ~~worst-case~~ (only full fuelings in vehicle lifetime) is taken to be 500 ~ 155 000/300.	Delete "worst case".
12	16	5.1.2	7. Leak/permeation iv. Since the miniature burner configuration is considered a conservative "worst case", the maximum leakage criteria is selected as 0.005 mg/sec.	Conditions for leakage should be specified (NWP?)
14	19	5.1.2.4	3. Nominal (average) pressure cycle life is required to be > minimum number of test cycles in 5.1.2.2.1 and is set to ~~highest~~ value measured during performance testing if variability is high (>25%) to assure that tested units are not stronger than manufactured units.	Not clear, why in the case of high variability the value is set the highest one. To be clarified!
16	20	5.2.1	xy Emergency hydrogen valve shut-off warning In cases where the hydrogen leak results in a concentration level in air of four percent or higher, the ~~pressure relief valve~~ shut off valve shall be immediately activated to shut off the flow of hydrogen from the storage container.	Correct to shut off valve:
17	26	B 3 3.7	Lower Flammability limit (LFL): Lowest concentration of fuel at which a gaseous fuel mixture is flammable at normal temperature and pressure.	Provide value for LFL.

		3.12	**New Definition for** "Enclosed or semi-enclosed spaces": Volumes within the vehicle that are external to the hydrogen system and its housings (if any) where hydrogen may accumulate (and thereby pose a hazard) such as the passenger compartment, luggage compartment, cargo compartment, and space under the hood of the vehicle.	See also comment on 5.2.1.2
18	27	5.1.	Change to: 5.1.1. CGH2 Storage System And renumerate the rest under 5.1.	Numbering incorrect
19	41	5.1.2.	Add: 5.1.2. LH2 Storage System	Add: 5.1.2. LH2 Storage System BMW provided a proposal for the Ottawa meeting and will adopt it after an agreement on the OICA Proposal for CGH2 Storage system is obtained at the Geneva meeting.
		5.2.1.2	**Replace the old 5.2.1.2.1 and 5.2.1.2.2 with the following text** 1. Hydrogen leakage and/or permeation from the hydrogen storage system shall not be allowed to directly vent to the passenger, luggage, or cargo compartments. 2. Any single failure downstream of the main hydrogen shut off valve shall not result in a hydrogen concentration greater than 4% by volume in the passenger compartment. 3. If a single failure downstream of the main hydrogen shutoff results in a hydrogen concentration greater than 4%, by volume in air in the enclosed or semi-enclosed spaces of the vehicle then the main shutoff shall be closed. 4. A warning shall be provided (per 5.2.1.2.3) if the main shutoff is closed (per item 3 above) or if leakage can cause the concentration to be greater than 4% in the passenger, luggage,	The new proposal considers the discussion between TUV (Judith), SAE (Glenn) and OICA members,

			or cargo compartments.	
		6.2	**Add the new OICA proposal:** Test for hydrogen gas leakage detection system 6.2.1 Test condition 6.2.1.1. Test vehicle Start the fuel cell system of the test vehicle, warm it up to its normal operating temperature and leave it operating for the test duration. If the vehicle is not a fuel cell vehicle, warm it up and keep it idling. If the test vehicle has a system to stop idling automatically, measures shall be taken so as to prevent the engine from stopping. 6.2.1.2. Test gas Mixture of air and hydrogen gas with 4% hydrogen or a lower concentration shall be used. 6.2.2. Test method 6.2.2.1 Preparation for test If necessary for blowing the test gas to the hydrogen gas leakage detector without fail, the following measures be taken. • Attach a test gas induction hose to the hydrogen gas leakage detector. • Enclose hydrogen leak detector with a cover to make gas stay around hydrogen leak detector. 6.2.2.2. Execution of test • Blow test gas to the hydrogen gas leakage detector.	The old 6.2 test procedure could not be validated because of non-practicable and not repeatable test execution. After discussion it could be agreed to delete this old proposal. The new OICA proposal is based on the Japanese Regulation Attachment 100, this procedure is sufficiently validated.

			• Confirm the warning provided. • Confirm the main shut-off valve closed. To confirm the operation of the main shut-off valve of the hydrogen supply, the monitoring of the electric power to the shut-off valve or of the sound of the shut-off valve activation may be used. **Keep the old 6.2 proposal in brackets**		