

		<b>Comments to GTR Draft SGS-10-01</b>	<b>Status: 20.08.2010</b>
	<b>Paragraph/ figure/table</b>	<b>Recommendation</b>	<b>Comment/Justification</b>
	General	...hydrogen- <del>powered</del> <b>fuelled</b> vehicles..	Change “powered” into “fuelled” in the whole document
	General	Ambient temperature is variously referred to throughout the document as “(15-25C)” or “ambient temperature” or a combination of both. Recommendation: In Section B3 provide a definition of ambient temperature, e.g. a typical indoor temperature within the range of 15 to 25°C.	Consistency within the GTR.
	General	The symbol “C” is incorrectly used throughout the document to refer to degrees Celsius. In the SI system “C” refers to the unit Coulomb, a measure of electric charge. Recommendation: Throughout the text use the correct SI symbol for degrees Celsius which is °C.	See Table 3 of <a href="http://www.bipm.org/utis/common/pdf/si_broc_hure_8_en.pdf">http://www.bipm.org/utis/common/pdf/si_broc_hure_8_en.pdf</a>
	General, e.g. A5.3.2.1	The symbol “m” is incorrectly used to refer to minutes. In the SI system. Recommendation: Throughout the text use the correct SI symbol for minutes which is “min”, )	See Table 6 of <a href="http://www.bipm.org/utis/common/pdf/si_broc_hure_8_en.pdf">http://www.bipm.org/utis/common/pdf/si_broc_hure_8_en.pdf</a>
	General	Full scientific reference citations should be provided for the papers and reports referenced. Recommendation: Include full scientific style references either in text or cross-referenced in the normal academic	Full references lend validity to the justifications, and also provide readers with an easy means of following up the justification and arguments used.

		fashion e.g. [1] or (Koubek, 2004), to a specific “Reference” section of the GTR.	
	General	In some sections symbols such as “≥” are used in the text, whereas, in a few sections the full text version is shown. The full text version should be used throughout unless the symbol is used in an equation.	Consistency within the GTR.
	General	A separate section, similar to Section A4, providing the full title of the standards referenced in the text should be included, similar to the sections incorporated into ISO and SAE standards.	
	A.2.4	i. Performance requirements for fuel containers, pressure relieve devices, <del>fuel cells</del> , fuel lines, etc.	delete “fuel cells”, since there is no explicit requirement for fuel cells.
	General (A5.1.1 to A5.3.2.2)  A5.1	A number of the sections appear to have been written with the use of a minimum number of words as the target, rather than providing text that provides an adequate rationale and justification of the requirements.  In A5.1 an explanation of the structure of ,and reasoning behind, the of the main test groups, e.g. baseline metrics, hydraulic and pneumatic, would significantly increase the readability of the entire section.	
	A.3.3.1.3	... and a resin-impregnated carbon fiber composite that is wrapped over a gas sealing inner <del>liner</del> for structural integrity	Correction: add “liner”
	A3  A3.3.1	Delete “hydrogen” from the title.  Replace the opening sentence with “Fuel cell vehicles (FCV) fuelled by hydrogen have an electric....”	During the early development of the GTR, the term “hydrogen fuel cell vehicles” was used to cover vehicles with FC or ICE propulsion systems, effectively meaning hydrogen or fuel

A3.4.1	From the last sentence delete “either ICE or”	cell vehicles. In section A3 it now seems to have been taken literally to mean fuel cell vehicles fuelled by hydrogen. However, section A3.4.1 still refers to ICE.
A3.4.1	... The fundamental purpose of a hydrogen fuel delivery system is therefore to reliably deliver hydrogen fuel to either ICE or fuel cell stack at a specified pressure and temperature for proper <b>engine or</b> fuel cell operation over the full range of vehicle operating conditions.	Correction  Ensure reference consistence
A4.1.2	<b>Hydrogen quality (SAE J2719, ISO xxxx)</b>	Add reference
A4, A4.1.2, A4.2.2 & A4.3.2	Delete “voluntary” and “industry” from the titles as they should not be necessary. If the words are considered necessary include short opening sentences such as “National regulations having the force of law in the appropriate jurisdictions include:”in A4.1.1/4.2.1 and “International standards, the application of which is voluntary unless referenced in regulations or directives, include:” in A4.1.2/4.2.2	-
A4.2.1	Add “European Union -- Regulation 406/2010 implementing EC Regulation 79/2009”	The 2 EU regulations also apply to the storage system.
A5.1.1.1	The text could be written more clearly. For example the tests referred could be written rather than only providing numerical references.	
A5.1.2g & A5.1.3b	A better way of accessing the referenced data should be considered, perhaps by giving the location and year information in addition to the web address in case the address changes.	Webs addresses often change.
A5.1.2h	The entire section could be clarified with an introduction.	
A5.1.2.h.iv	In the last sentence insert “filled prior to long holidays or illness,” between “at all times,” and “abandoned vehicles”	Additional common examples

A5.1.2.h.v	The data given in the last sentence (ref. black pickup truck) should be referenced.	Data used as a justification in a GTR should be referenced.
A5.1.2.i.i & A5.1.3.d.i	The fuelling pressure constraint should be referenced.	Data used as a justification in a GTR should be referenced
A5.1.3.b.ii. (a)(2)	Reference should be provided.	
A5.1.3.b.ii. (a)(5)	It could be useful to provide an estimate of the relationship of the effect on the container life of partial fills compared with full fills to demonstrate this point.	
A5.1.3.b.ii. (b)	References required	
A 5.3.1.2.1	... Therefore, <b>during test procedure according to 6.1.3.</b> the 3-second rolling average requires a sensor response (90% of reading) and recording rate of less than 300 milliseconds.	
A 5.3.1.5	<b>Rationale for B.5.3.1.5 Tell-Tale. A telltale/warning system is to alert the driver</b> when hydrogen leakage results in concentration levels at or above 4% by volume within the passenger compartment, luggage compartment, and spaces with unprotected ignition sources within the vehicle. The <b>driver telltale</b> should also alert <del>the driver</del> in case of a malfunction of the hydrogen detection system. Furthermore, the system shall be able to respond to either scenario and instantly warn the driver. The shut-off telltale shall be inside the occupant compartment in front of and in clear view of the driver. There is no data available to suggest that the warning function of the telltale would be diminished if it is only visual. <del>In case of the detection system failure, the telltale warning light should be yellow.</del> In case of the emergency shut-off of the valve, the telltale	Delete the requirement for the warning tell-tale colour and the requirement for a warning tell-tale

		light should be red	
A 5.1.1.2	<p>... While there are no reports of taxi usage at the highest levels (1.5 – 2 fuelings per day) that are sustained through 5 years of service, the worst-case limit on the number of fuelings could be projected from such usage sustained for 7 years. Then the worst-case projected limit of the number of fuelings could be 3800 – 5200. The minimum number of full pressure hydraulic qualification test cycles for hydrogen storage systems is set at 5500, <b>if no counter or controlling device for filling cycles is used in the vehicle.</b> An additional factor of 2 worst-case margin, or alternatively, consideration of 15 years of sustained high usage service give 11,000 as the extreme upper limit for the number of full pressure hydraulic qualification test cycles for hydrogen storage systems. Alternatively, considering a worst-case limit of 1.5 fuelings per day sustained over 15 years would yield 7500 as the worst-case upper limit of fueling cycles <b>or equally 20 years with 11000 fueling cycles.</b></p>	<p>Possibility for lower cycle numbers in general (e.g. test- or special vehicle)</p> <p>20 year (at 11000 cycles) is congruent with life time of 20 years in 2009/79/EU (2.7, implementing measures) =&gt; linear extrapolation from 15/7500 to 20/11000</p>	
A5.3.1.7 1 <sup>st</sup> sentence	Add “by volume” after “air”.		
A5.3.1.7 last sentence	<p>References should be given to justify this claim. Possible refs include:</p> <p>Coward, H.F. et al, “Limits of flammability of gases and vapors”, Bureau of Mines Bulletin 503; 1952, USA.</p> <p>Benz, F.J. et al, “Ignition and thermal hazards of selected aerospace fluids”, RD-WSTF-0001, NASA Johnson Space Center White Sands Test Facility, Las Cruces, NM, USA, October 1988.</p> <p>Houf, W.G. et al, “Predicting radiative heat fluxes and flammability envelopes from unintended releases of</p>		

		hydrogen”, International Journal of Hydrogen Energy, 3, pp136-141, 2007.	
	A5.3.1.8.e)	Delete the example	
	A5.3.2.2 Last sentence	The word “explosive” should be replaced by “detonation”.	The term “explosive limit” is misleading as the value quoted refers to the lower detonation limit in air by volume ( ISO/TR 15916:2004)
	Section A	Justification should be provided for using a mixture of air and hydrogen with 4% or lower concentration as a test gas (procedure B6.1.2.1.1.b)	
	General, e.g. A 6.1.2 & B3.5	As the term “non-return valve” is used in the EU regulation instead of check valve, it is proposed that the term is included in the rational in the form of : “i.e. a non-return valve”	
	B 5.1	<p><b>COMPRESSED HYDROGEN STORAGE SYSTEM</b></p> <p>This section specifies the requirements for the integrity of the compressed hydrogen storage system. As illustrated in Figure B.5.1.1, the hydrogen storage system consists of the high pressure storage container(s) and closures of openings into the high pressure storage container(s). Closures include the temperature-activated pressure relief device(s) (TPRD), check valve(s), shut-off valve(s) and all components, fittings and fuel lines that isolate the high pressure storage system from the remainder of the fuel system and environment. The <del>check valve</del>, shut-off valve and TPRD(s) shall be mounted directly on or within each container <b>as well as at least one component with a check valve function.</b></p>	Check valve directly on the container is not necessary, if the automatic valve can be over pushed during fueling, while the automatic valve is not in open modus (and will not, during fueling).
	A5.1.1.2, A6.1.3.2, B5.1.1.2	“but not lower than 5,500 cycles for 15 years service life” does this mean that if the service life is less than 15 years the number of cycles may be lower?	

B 5.1.1.2	<p><b>Baseline Initial Pressure Cycle Life</b></p> <p>Three (3) randomly new vessels are hydraulically pressure cycled to 125% NWP without rupture for 22,000 cycles or until leak occurs (B.6.2.2.2 test procedure). Leak may not occur within the initial #Cycles. The number of cycles required, #Cycles, cannot be greater than 11,000 <b>for 20 years service life</b>, and it could be set by the Contracting Party at a lower number but not lower than 5,500 cycles for 15 years service life <b>without prescribing a counter or control device for the number of filling cycles. With such a device, the cycle number can be lowered down to 1000.</b></p>	See rationale for proposal A 5.1.1..2
B2	The scope appears to have been written only for conventional CGH2 systems. Suggest that it is redrafted to include LH2 systems.	
Fig.B5.1.1	Add the labels “From fuelling receptacle” and “To propulsion system” on the appropriate lines.	
B5.1.3.2	The procedure should be clarified	
B 5.3.1.3.4	During operation, a warning shall be provided (per B.5.3.1.3.5) if the main shutoff is closed (per B.5.3.1.3.3) or if leakage causes the concentration, <b>which can be assumed</b> to be greater than 4% in the passenger, luggage, or cargo compartments	Ensure, that measurement of hydrogen concentration is not necessarily located in the passenger / luggage compartment.
B 5.3.1.5	<p><b>Tell-tale warning to driver</b></p> <p>... c. <b>Tell-tale or display text</b> shall be yellow or amber in color if the detection system malfunctions and <b>tell-tale</b> shall be red <b>at the latest</b> in the event a 4% concentration is detected...</p>	<p>Requirement for tell-tale not in the case of warnings below 4%</p> <p>red warning should be possible below 4%, if requested by the manufacturer</p>
B 6.1.1	<p>a) Compressed Gaseous Hydrogen Storage:</p> <p>The gas container shall be filled with helium <b>or hydrogen</b> to minimum 90% of the nominal working</p>	Cash tests with hydrogen shall be possible, if requested by the manufacturer

		pressure. The main stop valve and shut-off valves, etc. for hydrogen gas, located in the downstream hydrogen gas piping, shall be kept open immediately prior to the impact.	
B6.1.1 a) 3 <sup>rd</sup> & 6 <sup>th</sup> paras		The text should be written more clearly: 3 <sup>rd</sup> para: The helium gas pressures immediately before the impact and 60 minutes after the impact shall be converted to pressures at 0°C using equation 1. The pressures shall be those measured upstream of the first pressure-reducing valve either within the gas container or the one located downstream of the gas container.  6 <sup>th</sup> para: The gas densities calculated from equation 2 both before the impact and 60 minutes after the impact shall be calculated using the pressures at 0°C obtained from equation 1.	
B6.1.2.1 & B6.1.2.2		i) The layout of the test descriptions should be standardized. ii)	
B6.1.2.2		A reference should be provided for the quoted document.	
B 6.1.3		<b>Compliance Test for Fuel Cell Vehicle Exhaust System</b> ...The <b>external</b> measurement device must have a measurement response time of less than 300 milliseconds	Clarify, that no on board sensor has to fulfil the response time requirement
B6.1.3 & B6.1.4		The warning statement from B6.1.2 v) should be repeated.	
B6.1.3 a & b		Add “to the normal operating temperature to the end of each sentence”	
B6.1.4		Standardise use of “detector liquid”, “detecting agent”, etc	
B6.2.2.1 &		Should these be in a separate section B6.2.x Test	

	2	Procedures for Baseline Metrics?	
	B6.2.2.3	Include “hydraulic” before “fluid” for clarification.	
	B6.2.2.4	Reference the figure in the text and provide a figure title.	