PRELIMINARY REPORT OF VOTING ON **ISO/DIS 15869** *Gaseous hydrogen and hydrogen blends —Land vehicle fuel tanks*	
Closing date of voting **2011-12-07**	**ISO/TC 197 N 559**
Secretariat *SCC/BNQ*	

A report shall be returned to ISO/CS no later than 3 months after the closing date of voting on the DIS, whether or not comments have been reviewed and/or a new text has been prepared.

☒ **Preliminary report**

(submitted in those cases where comments are still to be considered and/or a decision has not yet been taken, or where it is decided that the nature of comments indicates a need for further consultation and/or reversion to a previous project development stage). To be followed by a 'Final report'. Any preliminary report is for ISO/CS for information, and is not circulated to member bodies)

☐ **Final report**

(submitted either immediately, when all comments have been reviewed and a decision can be taken, or following a 'Preliminary report'. The final report is circulated by ISO/CS to member bodies, and is distributed with any associated DIS or FDIS text)

1 Result of the voting

The above-mentioned document was circulated to member bodies with a request that the ISO Central Secretariat be informed whether or not member bodies were in favour of registration of the DIS as a Final Draft International Standard or for publication in the case of unanimous approval.

The vote closed on the date indicated above. The replies listed in annex A have been received.

2 Comments received

3 Observations of the secretariat See annex B

4 Decision of the Chairman

Preliminary report (no annexes required)

☒ The comments are under review and/or a decision on further procedure has not yet been taken

☐ The project is to revert to the Preparatory Stage (a new working draft will be developed)

☐ The project is to revert to the Committee Stage (a new committee draft will be developed)

Final report

☐ Having received 100% approval from the member bodies voting, the DIS is approved for direct publication without change other than editorial (no FDIS vote)
(*Option not applicable to projects progressing under the Vienna Agreement*)

☐ A revised text is to be submitted to ISO/CS for the approval procedure (FDIS vote)

☐ A revised text is to be submitted to ISO/CS for a further enquiry (DIS) vote

Remarks (e.g. observations on how comments were reviewed, date by which a decision is to be taken, date when a text is expected)

Please find attached the esults of voting on ISO/DIS 15869. As you will see, the DIS was not approved.

Please note that as agreed at the last plenary meeting on 15 December 2011 in Beijing, China, the comments received are to be returned to ISO/TC 197 WG 6 for consideration in preparation for a second DIS. However, to facilitate this next step and to gain broader consensus on the topic of onboard tanks, the organization of a workshop open to all stakeholders should be considered. Further details on this workshop will be discussed with the Chair and the convener and provided later.

Enclosures

☒ **Annex 1 - Voting results on DIS**

☒ **Annex 2 - Compilation of comments**

Signature of the Secretary	Signature of the Chairman
 Date **2012-07-24**	Date

Voting results on ISO/DIS 15869 *Gaseous hydrogen and hydrogen blends —Land vehicle fuel tanks*

Result of voting
P-Members voting: 11 in favour out of 16 = 69 % (requirement >= 66.66%)
(P-Members having abstained are not counted in this vote.)
Member bodies voting: 5 negative votes out of 16 = 31 % (requirement <= 25%)
Disapproved

Votes by members					
Country	**Member**	**Status**	**Approval**	**Disapproval**	**Abstention**
Argentina	**IRAM**	**P-Member**	X *		
Austria	**ASI**	**O-Member**			X
Brazil	**ABNT**	**P-Member**			X
Canada	**SCC**	**Secretariat**	X *		
China	**SAC**	**P-Member**	X		
Denmark	**DS**	**P-Member**			X *
Egypt	**EOS**	**P-Member**			
France	**AFNOR**	**P-Member**	X		
Germany	**DIN**	**P-Member**		X *	
India	**BIS**	**P-Member**	X		
Italy	**UNI**	**P-Member**		X *	
Japan	**JISC**	**P-Member**		X *	
Korea, Republic of	**KATS**	**P-Member**	X		
Netherlands	**NEN**	**P-Member**	X		
Norway	**SN**	**P-Member**	X		
Russian Federation	**GOST R**	**P-Member**	X		
Spain	**AENOR**	**P-Member**			X
Sweden	**SIS**	**P-Member**		X *	
Switzerland	**SNV**	**P-Member**	X		
United Kingdom	**BSI**	**P-Member**	X		
USA	**ANSI**	**P-Member**		X *	
P-Member TOTALS Total of P-Members voting: 16			11	5	3
TOTALS			11	5	4
(*) A comment file was submitted with this vote					

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MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/ Table/ Note** (e.g. Table 1)	**Type of comment**[2]	Comment (justification for change) by the MB	Proposed change by the MB	**Secretariat observations** on each comment submitted
DE	Multiple	Multiple	Ed	Germany disagrees for the following reaons: Erreur ! Source du renvoi introuvable.	There are a number of incorrect links/references in the document that need to be corrected.	
DK				We abstain due to no response from those concerned.		
IT			ge	We hadn't a positive impression on this ISO DIS since it contains several problems and wrong statements. For this reason we disapprove its content.		0
IT			ge	Clarification is needed about using the BS PD7910.		
JP0			ge	Discussions at ISO/TC197/WG6 Tokyo meeting in March 2011 and following e-mail exchange between experts show there is no consensus to proceed current draft as DIS. There are several significant technical issues remained in this DIS document.	Disagree to this DIS.	
SE			ge	This draft need to be further checked against current EU/national legislation and further discussions are needed to ensure consensus between all parties involved.		
US 1		Multiple	ed	Multiple broken links: "**Erreur ! Source du renvoi introuvable"**	Correct.	0
IT	G		te	There is no rationale to justify a totally new design qualification procedure, that can be in contrast with the other one.	Rationale required.	
CA	General		TE	As this document progresses, it should consider changes to test procedures, particularly in the areas of Hydrogen Compatibility, Fire Testing and Stress Rupture Resistance qualification of new fibers/vessels, that are being developed for inclusion in a Global Technical Regulation.	Review test requirements for – 1) hydrogen materials compatibility 2) stress rupture resistance qualification 3) bonfire testing.	
DE	General		ge	The testing requirements differ greatly from the European regulations 79/2009 and 406/2010 that have to be followed for hydrogen fuel tanks.	Cross check with European regulations 79/2009 and 406/2010 and aim to harmonize requirements.	

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CA	Multiple	Multiple	Ed	Erreur ! Source du renvoi introuvable.	There are a number of incorrect links/references in the document that need to be corrected.	
AR	Scope		Ed	Correct In type 1 the expression: Type 1 – all - metal fuel tank;	Correct to read as follows: - Type 1 – all metal fuel tank;	
DE	1		TE	This document should not be promoted as an International Standard at this time. Comments regarding maintaining this document as a Technical Specification during the last ballot (15869-3) are still applicable. Changes to test procedures should be considered, particularly in the areas of Hydrogen Compatibility, Fire Testing and Stress Rupture Resistance qualification of new fibres/vessels. Research is still underway to evaluate the proposed changes and the work group should not advance this document to an International Standard until that information is considered.	Maintain the document as a Technical Specification and address the issues identified , particularly with regard to – 1) hydrogen materials compatibility 2) stress rupture resistance qualification 3) and bonfire testing. Do not advance the document to DIS until verification of methodologies and test methods is adequately complete.	
US 2	1			I think blend fuels should be removed from this standard.	There are too many open questions about blend fuels. For example, in paragraph 5.5, the composition of pure H2 is defined, but there is no definition of blend fuel. Blend fuel is defined in the appendix. Why the unequal treatment? Also, there are many open questions regarding the affects of blends on the performance of materials.	
JP1	2 Normative references	2-Page	ed	Typo	Change “ISO 14687-2[2)]” to “ISO 14687-2[1)] ”.	
US 10	F2			Why an ambient temperature of -40 °C ± 5 °C? The -45C will exceed the design temperature of the tank. Also, I’m not a materials expert, is a cold or warm liner more likely to have difficulties with hydrogen effects?		
AR	3.13		Te	Piping is not part of the storage system. It is part of the fuel delivery system.	Remove “and piping”	

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AR	3.17		Te	Even though the proposed definition is copied from other standards, the concept of full tank is not clear for a gas cylinder. Strictly speaking the cylinder will always be full, regardless of the internal pressure. The concept is that it would be the settled pressure at 15°C with the maximum allowable mass content, but it would introduce a definition that is difficult to grasp. We propose the following definition, which we judge clearer and that reflects the actual requirement. A settled pressure above the Nominal WP would indicate "overfilling" and a settled pressure below it would indicate it is "not full"	Maximum allowable settled pressure at 15°C	
IT	3.26		te	Definition of service life is needed	Add new clause 3.26: 3.26 service life life, in years, during which the cylinders may safely be used in accordance with the standard service conditions	
US 3	4.2			50 MPa should also be included in the table.	The H2 fuelling technology is too immature to lock out other pressure levels at this time.	
IT	5.X		te	Add requirement about service life specification.	Add new clause 5.2: 5.2 Service life The service life for which cylinders are safe shall be specified by the cylinder manufacturer on the basis of use under service conditions specified herein. The maximum service life shall be 20 years.	
IT	5.2 to 5.7		te	Reordering of clause numbers.	Modify all the clauses numbers from 5.2 ÷ 5.7 to 5.3 ÷ 5.8.	
DE	5.3		te	"The number of filling cycles shall be specified by the tank manufacturer in relationship with the manufacturer specified service life. In all cases, fuel tanks for service type A shall be designed for a minimum of 5500 cycles for a service life of 15 years. Fuel tanks of service type B shall be designed for a minimum of 11 250 cycles with a service	Clearly state allowable lifetimes for tanks type A and B.	

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				life of 15 years, or a minimum of 15 000 cycles with a service life of 20 years". It is not clear whether the tanks type A can only be used for 15 years and no other lifetime. It is not clear whether the tanks type B can only be used for 15 or 20 years and no other lifetime.		
DE	5.7		te	"Pressure relief devices shall meet the requirements of the CSA HPRD-1 standard." Check if equivalent ISO standard is available.	Insert equivalent ISO standard if available	
IT	5.7	1st paragraph	te	CSA standard for PRDs may be not accepted worldwide.	Amend as follows: "… function. Pressure relief devices shall be approved to a standard acceptable to the Inspector in the country of use."	
CA	6.2.c		TE	Clarify dimensions	a description of the fuel tank design, including external diameter (mm), external length (mm), internal volume (l), empty weight (kg), and valve thread type;	
DE	6.2.c		TE	Clarify dimensions	a description of the fuel tank design, including external diameter (mm), external length (mm), internal volume (l), empty weight (kg), and valve thread type;	
US 4	6.2c			Diameter and length are ambiguous	"including external diameter (mm), external length(mm)"	
AR	6.4		Ed	The final paragraph of the note is incomplete. NOTE Verification of the stress ratios may be performed using strain gauges, or an equivalent method. An example of an acceptable method is provided in Erreur ! Source du renvoi introuvable..	The sentence should be completed correctly as follows: "An example of an acceptable method is provided in Annex D."	
DE	6.4	Note	ed	"is provided in **Erreur ! Source du renvoi introuvable.**. » missing reference	amend	

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JP2	7.2 Steel		te	ISO9801-1 and ISO9801-2 includes materials not suitable for hydrogen use.	Delete this paragraph. ~~Steels for fuel tanks and liners shall conform to the materials requirements of 6.1 to 6.4 of ISO 9809-1:2010, or 6.1 to 6.3 of ISO 9809-2:2010, as appropriate. Welds shall not be permitted.~~	
DE	7.3		te	"Welds shall not be permitted." What is the rationale for excluding welded stainless steel? See EIHP draft and previous ISO 15869. Also see reference to EN 13322-2 in section 2 and 9.2 last paragraph (..welding)	Include welded stainless steel	
DE	7.3		ed	1,4435 not correct	Change to 1.4435	
CA	7.3 10.2.4		TE	The nickel content of austenitic stainless steel must be held at 12.5% or higher in order to resist hydrogen embrittlement per the leading industry research and literature. C. San Marchi, T. Michler, K.A. Nibur, B.P. Somerday, International Journal of Hydrogen Energy Volume 35, Issue 18, September 2010, Pages 9736-9745.	In all cases, stainless steel shall have a nickel mass fraction equal to or higher than 12.5 %	
DE	7.3 10.2.4		TE	The nickel content of austenitic stainless steel must be held at 12.5% or higher in order to resist hydrogen embrittlement per the leading industry research and literature. C. San Marchi, T. Michler, K.A. Nibur, B.P. Somerday, International Journal of Hydrogen Energy Volume 35, Issue 18, September 2010, Pages 9736-9745.	In all cases, stainless steel shall have a nickel mass fraction equal to or higher than 12.5 %	
IT	7.4	1st paragraph	Te	Welded aluminium liners shall not be permitted.	Amend as follows: "Aluminium alloys shall conform to the materials requirements of 6.1 and 6.2 of ISO 7866:1999. Aluminium alloys … ."	
JP3	7.4 Aluminium alloy		te	Hydrogen compatibility at 70MPa of 6351A, 6082A, 5283A and 7060A are not investigated. At this moment, A6061 and A6066 are compatible for high pressure hydrogen gas up to 100 MPa. "Aluminium alloys shall conform to the materials requirements of 6.1 and 6.2 of ISO 7866:1999. Welded aluminium alloys shall conform to the materials	Change sec. 7.4. 7.4 Aluminium alloys The hydrogen compatibility of aluminium alloys in contact with hydrogen shall be demonstrated in accordance with F.2. Only 6061A is exempted from	

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				requirements of 4.2 and 4.3 of EN 12862:2000. Aluminium alloys not covered by the materials requirements of ISO 7866:1999 may be used provided that hydrogen compatibility is demonstrated according to the method specified in F.2."	this test. 7.4 Aluminium alloys ~~Aluminium alloys shall conform to the materials requirements of 6.1 and 6.2 of ISO 7866:1999. Welded aluminium alloys shall conform to the materials requirements of 4.2 and 4.3 of EN 12862:2000.~~ ~~Aluminium alloys not covered by the materials requirements of ISO 7866:1999 may be used provided that hydrogen compatibility is demonstrated according to the method specified in F.2.~~	
AR	7.7		Te	The polymeric material used for plastic liners shall be compatible with the service conditions specified in Clause 5, and shall demonstrate compatibility with hydrogen according to the method specified in B.18.	Hydrogen compatibility cannot be demonstrated in agreement with B.18. Write the proper reference to the method.	
DE	7.7		ed	"Annex B.18" not correct	Change to F.18	
JP4	7.7 Plastic liners		ed	Typo	Change "B.18" to "F.18".	
DE	7.8		te	"The metal end bosses connected to a non-metallic liner shall be made of material compatible with the service conditions specified in Clause 5." Are there no defined material requirement for the end boss materials exposed to hydrogen	Reference to the requirements in 7.1 to 7.4 is necessary	
US 5	8.1		te	How is safety assured based on the following statement: "This International Standard does not provide design formulae nor list permissible stresses or strains, but requires adequacy of design to be demonstrated by testing to show that the fuel tanks are capable of consistently passing the material, type, production and batch tests specified in this International Standard." There does not		

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				seem to be any allowance for manufacturing variability. How is the quality of the manufacturing process preserved in relation to the tested prototypes? (Often the stress/strain formulas include multipliers to account for the inspection rigor during manufacture.)		
JP5	8.1 General		ed	Typo	Change “formulae” to “formula”.	
JP6	8.1 General		te	"This International Standard does not provide design formulae nor list permissible stresses or strains, but requires adequacy of design to be demonstrated by testing" can be understood that following stress analysis in 8.4 is not essential.	What does this chapter intend to?	
DE	8.3	Table 1	TE	Prescriptive Burst Pressure Ratios should not be specified in this standard. The requirements should include a performance based test to evaluate stress rupture.	Specify a qualification performance test for stress rupture resistance for new fibres as being developed at SAE.	
AR	8.3.1		Ed	Example should be correctly referred: An example of an acceptable method is provided in Erreur ! Source du renvoi introuvable..	As previously suggested the sentence should be completed correctly as follows: “An example of an acceptable method is provided in Annex D.”	
AR	8.3.1	Point g)	Ed	The following sentence is not written properly: “when analyzing fuel tanks with hybrid reinforcement (two or more different fibres), consideration of the load share between the different fibres based on the different elastic moduli of the fibres.”	It is suggested to replace the sentence by: “when analyzing fuel tanks with hybrid reinforcement (two or more different fibres), consider the load share between the different fibres based on the different elastic moduli of the fibres for calculation.	
DE	8.3.1	Table 1	te	“Carbon (nominal working pressures less than 35 MPa)” -there are only 3 permitted working pressures…	As there are only 3 permitted working pressures, change to: Carbon (nominal working pressure 25 MPa)	
DE	8.3.1	Table 1	te	“Carbon (nominal working pressures greater than or equal to 35 MPa)”	As there are only 3 permitted working pressures, change to: Carbon (nominal working pressure 35 or 70 MPa)	

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DE	8.3.1	Below table	ed	is provided in **Erreur ! Source du renvoi introuvable.**. - missing reference	amend	
IT	8.3.1	Table 1	te	There is no rationale to justify the new values of stress ratio and burst ratio that have been included in this version. For discussion and conclusion about stress ratio and burst ratio see ISO TR 13086-1:2011		
US 6	8.3.1	Table 1		I'm not an expert in this area, but the burst ratio of 2.0 sounds unsafe	The relief valve on the fuelling station is set to Nominal *1.25*1.1 = 1.375, so the ratio of relief valve release pressure to burst pressure can be less than 1.5 to one. Further, it is not clear why higher pressures merit lower safety margins. If anything, I would think that higher pressures deserve higher safety margins due to higher consequences of failure.	
SE	8.3.1 Page 11	Last sentence	ed	reference missing: "Erreur ! Source du renvoi introuvable"	Add refrence	
AR	8.5		Ed	There is an error in this note: "NOTE An example of a suitable method for establishing the maximum defect size is given in Erreur ! Source du renvoi introuvable.. "	The sentence should be completed correctly as follows: "NOTE An example of a suitable method for establishing the maximum defect size is given in Annex E."	
DE	8.5	note	ed	is given in **Erreur ! Source du renvoi introuvable.**. - missing reference	amend	
DE	8.6	2nd paragraph	te	"Provided that the finished fuel tank with its fire protection system has passed the requirements of the fire test in F.9, alternative installation configurations for the fire protection system can be used if it can be demonstrated to provide the same or an improved level of safety. The final fire protection system used for vehicle installations involving multiple fuel tanks may require a different arrangement or number of non-reclosing thermally activated pressure relief devices."	Add detailed instructions how to demonstrate the level of safety of the alternative installation (bonfire test? etc.)	

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				-vague requirement		
DE	8.6	3rd paragrarph	te	"..It is not necessary to subject the extra fuel tank(s) that contain this additional hydrogen to the fire test of F.9, provided that a single fuel tank has already passed the fire test with its own PRD." - The requirement for multiple tanks seems to be not stringent enough. If Multiple fuel tanks are connected to one PRD, then the increased flow of hydrogen has to be taken into account with regard to safe venting .	Review and amend	
IT	9.2		te	Welded liners shall not be permitted. Delete references to welded liners.	Amend as follows: "… method for design. For type 3 liners subjected to cold forming or cryo-forming processes, heat treatment of the pre-form component is not required. Liners that have been cold-fomed or cryo-formed shall not be subjected to any subsequent heat treatment."	
DE	9.3	Last paragraph	te	"Openings with tapered or parallel threads may be used. NOTE A parallel thread is recommended for hydrogen use." - The note confuses, as this standard is for hydrogen only. It contradicts with the first sentence.	Delete note and/or change first sentence.	
JP16	F9.4		te	ISO15869 determines the requirement for hydrogen tank itself therefore engulfing fire test should be appropriate.	To be discussed.	
AR	9.5	Point b)	Ed	Change the expression "manner of impregnation"	It is suggested to use "impregnation method" instead of "manner of impregnation"	
IT	9.8		Te	Please define when the coating is considered to be "part of the design"		
AR	10	10.2.1 10.3.1 10.4.1	Te	An error remains in several paragraphs of theses sublauses.	The sentences should be completed correctly indicating where the tests are described.	

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JP10	A 10.1 General	Para-2, 3	ed	In main document, Annex A is not referred.	Add “Tanks used for hydrogen blends service shall comply with all requirements in this standard, except as modified in Annex A A.2 through A.6.” between Para 2 and Para3 in main document of 10.1 General. Delete the sentence “Tanks used for hydrogen blends service shall comply with all requirements in this standard, except as modified in Annex A A.2 through A.6.” from Annex A.	
DE	10.2.1		ed	is described in **Erreur ! Source du renvoi introuvable..** reference is missing	amend	
IT	10.2.2	2nd paragraph	te	Add a sentence to indicate that steels conforming to ISO 9809-1:2010 para. 6.3 and 7.2.2 are exempted from this test.	Amend as follows: “… in accordance with F.2. Steels that conform to para. 6.3 and 7.2.2 of ISO 9809-1:2010 are exempted from this test.”	
IT	10.2.3	3rd paragraph	te	Welded aluminium liners shall not be permitted.	Delete 3rd paragraph	
JP7	10.2.3	2 para	te	Materials tests as required in ISO 7866 Annex B are not proper for the material used in hydrogen. For Type 3 liners using aluminium alloy, materials tests as required in ISO 7866:1999, 10.2 and Annex B shall be carried out on one liner.	Change this paragraph as described below: For Type 3 liners using aluminium alloy, materials tests as required in ISO 7866:1999, 10.2 ~~and Annex B~~ shall be carried out on one liner.	
DE	10.2.4		ed	1,4435	Change to 1.4435	
IT	10.2.4	2nd paragraph	te	UNS S31600 and UNS S31603 (and equivalents) are exempted from F.2 tests. Rationale is required.	Rationale is required.	
DE	10.3.1	1st paragraph	ed	is described in **Erreur ! Source du renvoi introuvable..** reference is missing	amend	
DE	10.3.5		te	For all designs, one or two fuel tanks as appropriate shall be tested in accordance with F.9 and meet the requirements therein. What is the rationale for one or two fire tests? Also see table 3 (1 test)	Decide 1 or 2 tests and add explanation	

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DE	10.3.6		te	"High strain rate impact test" Confusing term	Use term as in other standards (e.g. bullet test)	
JP8	10.3.6		te	Current requirement of High strain rate impact test in DIS15869 different from that of gtr. We need harmonize with gtr.	To be discussed.	
DE	10.4.1		ed	is described in **Erreur ! Source du renvoi introuvable.**. Testing of **Erreur ! Source du renvoi introuvable.**. 2 times missing reference	amend	
DE	10.4.8		te	"Fuel tank designs that are not used in permanently mounted on-road vehicles designed and constructed primarily for the carriage of persons (e.g., cars and buses), and will only be used in a dedicated hydrogen slow fill (greater than 5 minutes) operation, need not to perform this hydrogen cycle." 1. Misleading: Not permanently mounted tanks that are transported with (residual) gas filled need to follow UN Orange book and ADR /ISO11119 for gas transport. 2. If exemptions for slow filling are to be made, then requirements to ensure/control hydrogen slow fill throughout the cylinder lifetime are necessary.	Review	
DIN	10.4.8		TE	Test should apply to all types of containers, not just Type 4.	~~For Type 4 designs,~~ ~~o~~One fuel tank, of any type, shall be tested in accordance with F.18 and meet the requirements therein.	
IT	10.4.8	2nd paragraph	te	There is no identification of fuel tanks that will be permanently installed on road vehicles and will only be used in dedicated hydrogen slow fill.	Delete second paragraph.	
US 7	10.4.8			Why is this requirement limited to Type 4 tanks?	I would apply this requirement to all tank designs, or at least type 3 and type 4 tanks since both experience significant heating effects during filling with hydrogen.	
DE	10.6	1st paragraph	ed	As per **Erreur ! Source du renvoi introuvable.**. Reference missing	amend	

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DE	10.6	Last paragraph	te	"A design approved by a reduced series of tests (a design change) shall not be used as a basis for a second design change approval with a reduced set of tests **(i.e. multiple changes from an approved design are not permitted)**. If a test has been conducted on a design change (X) that falls within the testing requirements for a second design change (Y) then the result for (X) can be applied to the new design change (Y) test program. However design change (X) cannot be used as the reference for determining the testing required for any new design change " Unclear: - To current understanding a design variant of a variant shall not be allowable (e. g. increasing the pressure by another 20% in a design variant that was already increased by 20%) - multiple design changes of different types should be possible such as change in the pressure + change in end boss.	Wording unclear: Allow multiple changes of different kinds under the condition that all design change tests required acc. to table 5 are made. Do not allow multiple changes of the same kind (e.g. multiple changes of pressure; multiple changes of length etc.) Review and clarify	
DE	10.6		te	Definitions for liner materials and resins changes as done for the fibre are missing	Add equivalent definitions for liner materials and resins as done for the fibre (define what is definitely a new design that cannot be covered by design change testing)	
DE	10.6	Table 5	te	Where is the reduction compared to initial type testing for a change of fibre or metal liner?	Section 10.6 and Table 5 need definitions regarding limits of allowable design changes for fibres, resins and liner material so that design changes can be approved with a clearly reduced testing programme.	
JP9	10.6		te	Qualification of design changes of Type-A container is not described .	To be discussed.	
US 8	10.6		ed	Bad link "**Erreur ! Source du renvoi introuvable**"	Fix link	
DE	11.1	a	te	"NDE of metallic fuel tanks and liners in accordance with Annex B of ISO 9809-1:2010, or Annex C of EN 1964-3:2000, or Annex B of EN 13322-2:2003 as appropriate, **or a demonstrated equivalent method**, to confirm that the	Outline requirements for equivalent methods and by whom these have to be approved.	

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				maximum defect size does not exceed the size specified in the design as determined in accordance with 8.5." 1. EN 13322-2 refers to welded stainless steel cylinders (see 2. and 7.3) 2. What are the requirements for an equivalent method? Who approves this?		
DE	11.1	h	te	"For Type 4 designs the manufacturer shall define the appropriate limit of elastic expansion for the test pressure used, but in no case shall the elastic expansion of any fuel tank exceed the average batch value by more than 10 %; " This procedure holds strong disadvantages for type 4 cylinders as the complete batch of cylinders has to be manufactured and tested before the average can be derived and it can be decided whether all cylinders can be certified.	Amend: Type 4 tanks shall meet the requirements of the manufacturer with regard to the elastic expansion. All results shall lie within the specified tolerance range.	
IT	11.1	a)	te	Welded steel is not permitted.	Delete references to EN 13322-2:2003	
IT	11.1	b)	te	Welded aluminium liners shall not be permitted.	Delete b) paragraph	
IT	11.1	i)	te	Leakage test should be performed at the nominal working pressure.	Amend to read: "leak test on Type 4 fuel tanks or liners in accordance to F.21."	
IT	11.1 And F.20	h)	Te	This standard has to consider also the "Proof pressure test" as alternative to "volumetric expansion test" (see ISO 11439 and ISO 9809 series as example)	Modify F.20 as per Clause A.11 of ISO 11439 (2000)	
IT	11.2.2.	3rd paragraph, b)	te	Welded aluminium liners shall not be permitted.	Amend as follows: b) … of EN 1964-3:2000. The test results shall satisfy the requirements of the design."	
IT	11.2.2.	4th paragraph, b)	Ed	Wrong reference to F.1, instead of to F.3	Replace reference from F.1 to F.3.	
IT	11.2.2.	d)	te	Welded aluminium liners shall not be permitted.	Delete d) paragraph	

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DE	11.2.3		te	"11.2.3 Periodic ambient temperature pressure cycling test" -Term "periodic" is misleading	Change title Proposal: Frequency of ambient temperature pressure cycling batch test	
DE	11.2.3	Complete chapter	te	- the definition of design family is to vague, -the definition of a minor design change is missing in 10.6 - Question: is a cycle test on a 200 bar design change cylinder sufficient for the batch testing of 250 bar cylinders?	Add definition of minor design change Do not allow the reduced testing procedure for marked design changes such as s working pressure	
US 9	12a			A pure hydrogen tank should be good for blend service as well.	"H2 or H2 blends Only" or better yet, just remove all discussion of blends from this document.	
AR	A.2		Te	It is expressed that: Fuel tanks shall be designed to be filled with compressed gaseous hydrogen blends containing more than 2 % hydrogen by volume, combined with dry natural gas. The gas composition shall comply with the following: a) compressed hydrogen gas shall comply with the composition specified in ISO 14687-1 or ISO 14867-2; b) compressed natural gas used in hydrogen blends may vary as stated in the dry gas composition limits specified in ISO 11439. There is a contradiction between the first paragraph and the requirements arising from point b. Gas composition in a mixture prepared as a hydrogen blend cannot accomplish with the requirements of individual specifications of both standards for pure hydrogen and natural gas, respectively. The content of impurities established as limiting characteristics in ISO 14687 1 or 2 for pure hydrogen has no meaning when hydrogen is blended with natural gas. In other hand, if we consider natural gas composition in a dry basis according to ISO 11439, the maximum hydrogen content in volume percent is limited to 2 %. Of course this is not practical for commercial applications where hydrogen	There should be a directory of limiting characteristics for the blend, a combination based on the standards previously cited in A.2 or something different that harmonizes both sources of information. Another possibility to solve this problem is to add a note or a table to clarify this A.2 point. If no action is taken, there will be a grey zone for the case of blends. At least, this point needs more discussion.	

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				concentrations close to 15 % or even 20% by volume in natural gas are commonly investigated to be used.		
IT	A.4		te	It is not possible to know at the design level, with which gas the cylinder will be filled. The cylinder should be compatible with any blend from pure hydrogen to pure natural gas. Gas test should be performed with natural gas and with hydrogen.	Amend as follows: "… the nominal working pressure with hydrogen and with compressed natural gas complying with the composition specified in ISO 11439.	
JP11	A.4		ed	Typo	Change "E.9" to "F.9" and "E.9.2" to "F.9.2".	
DE	A.4ff		ed	"he bonfire test shall be carried out as per **E.9** except that under **E.9.2**, the fuel tank shall be pressurized to the nominal working pressure with a hydrogen blend applicable to the design." - reference to wrong annex	All testing references need to be changed from E to F	
AR	A.5		Te	For the High strain rate impact test it is indicated that the fuel tank shall be pressurized to the nominal working pressure ± 1 MPa with compressed natural gas complying with the composition specified in ISO 11439. Revise this statement because this is only for natural gas not for hydrogen blends	It is suggested to rewrite the text as follows making reference to F.10 instead of E.10: "The high strain rate impact test shall be carried out as per F.10, except that the fuel tank shall be pressurized to the nominal working pressure ± 1 MPa with a hydrogen blend applicable to the design or compressed natural gas complying with the composition specified in A.2.	
JP12	A.5		ed	Typo	Change "E.10" to "F.10".	
AR	A.6		Te	The title of this subclause is Natural gas Cycling Test, which is not appropriated. Review the title.	Consider the convenience to change the title of this subclause by: Hydrogen blend Cycling Test	
AR	A.6		Te	The text is not entirely correct because the cycling test is shown in F.18: The hydrogen gas cycling test in E.18 shall instead be conducted using compressed natural gas complying with the composition specified in ISO 11439.	Correct the resulting text changing E 18 by F.18	

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AR	A.6	A.6.	Te	For the Natural gas cycling test The hydrogen gas cycling test in E.18 shall instead be conducted using compressed natural gas complying with the composition specified in ISO 11439.	It is suggested to rewrite the text as follows: “The hydrogen gas cycling test in F.18 shall instead be conducted using a hydrogen blend applicable to the design or compressed natural gas complying with the composition specified in A.2.	
IT	A.6		te	It is not possible to know at the design level, with which gas the cylinder will be filled. The cylinder should be compatible with any blend from pure hydrogen to pure natural gas. Gas test should be performed with natural gas and with hydrogen.	Amend as follows: “… shall be conducted using hydrogen and with compressed natural gas complying with the composition specified in ISO 11439.	
JP13	A.6		ed	Typo	Change “E.18” to “F.18”.	
IT	A.7		te	Sulfide stress cracking test required for materials in contact with CNG.	Add new test A.7 “Sulfide stress cracking test for steel”, same as ISO 11439:2000, A.3	
AR	Annex E			There is no reference for the standard cited below: In all cases, the reduction of cycle life due to the effect of hydrogen exposure should be considered. This could involve using the hydrogen gas cycle test procedure in 10.4.8 or a calculation approach using material data and BS PD7910.	Add the proper reference to BS PD7910 in bibliography: BS 7910: 2005. Guide to methods for assessing the acceptability of flaws in metallic structures, London, British Standards Institution (BSI).	
IT	F.2		te	We have concern on the availability, timing and costs of the testing for conduction of hydrogen pressure cycle test with the complete fuel tank. This test in the present text is mandatory when nominal pressure is greater than 25 MPa	To find an alternative test performed on a sample from a fuel tank instead of a test on a complete fuel tank	
IT	F.2		te	It is not clear the duration of the test. If it is the number of filling cycles as per 5.3 or if it is the number of cycles as per 5.3 plus 4 times this number of cycles.	Please clarify why the test should continue for up to 4 times the number of cycles as per 5.3.	
IT	F.2 a)		te	Rationale required for the 25MPa test pressure. This limitation should be justified.		
IT	F.2 c)		te	Add a clause to specify that materials known to be resistant to hydrogen embrittlement as specified in ISO 11114-1 are not required to perform other tests for	Add a new clause c): c) using a material known to be resistant to hydrogen embrittlement under the prevailing service	

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				cylinders up to and including 25 MPa.	conditions, for example as specified in ISO 11114-1	
IT	F.2 c)		te	Add a clause to specify that materials known to be resistant to hydrogen embrittlement as specified in ISO 11114-1 are not required to perform other tests.	Add a new clause c): c) using a material known to be resistant to hydrogen embrittlement under the prevailing service conditions, for example as specified in ISO 11114-1	
JP14	F.2 Hydrogen compatibility tests		te	Hydrogen compatibility test described in b) of F2 is not proper for material hydrogen compatibility test.	To be discussed.	
DE	F.2.b		TE	Hydrogen compatibility test criteria should not be only a pressure cycling test as proposed, but should also allow qualification through material level tests as being developed at both SAE and CSA by international materials experts.	Add F.2.c specifying a Slow Strain Rate Test, Fatigue Life Test and Fatigue Crack Growth Test for unrestricted use of materials as well as specify the requirements for qualification based upon specific usage.	
DE	F.3		te	"For Type 4 designs, the tensile yield strength and ultimate elongation of plastic liner material shall be determined at □□40 °C in accordance with ISO 527-2."	Use same testing temperature as in ISO 11439 (-50°C)	
DE	F.6		TE	Specify the maximum rate of pressurization	The rate of pressurization shall be < 0.5 MPa/s.	
JP15	F.8 Leak-before-break (LBB) test		te	1.5 times NWP for LBB test will cause change in failure mode. It is too much. Shall be harmonized with gtr (1.25 times)	Change “1.5 times” to “1.25 times”.	
DE	F.9		te	Completely different procedure than in other similar standards such as EU 79/2009 and ISO 11439. What is the rationale for this?	Strive to harmonize	
DE	F.9		TE	The time/temperature profile should not be finalized until the issues surrounding this topic are harmonized at the UNGTR and SAE.	Section F.9 should be harmonized with the UNGTR and SAE.	
IT	F.9		te	Replace with test procedure as ISO TS 15869:2009, B.9	Replace with test procedure as ISO TS 15869:2009, B.9	

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DE	F.9.4		te	"he temperature outside the localized fire exposure area is not specified during the first 8 minutes of ignition. **Then within the next 2-minute interval, the fuel tank shall be exposed to a minimum temperature of 800 °C,.."** this does not correspond to Figure F1	Amend: Then within the next 2-minute interval, the temperature shall be raised to 800 °C,..	
DE	F.9.5		te	"The fuel tank content shall vent through the non-reclosing thermally activated pressure relief device, part of the fuel tank manufacturer specified fire protection system, continually (without interruption) until the pressure falls to less than 1 Mpa" Acceptance criteria not clear: When shall the TPRD open (in part 1 or part2 of the test). Is there minimum time of fire exposure?	Review and amend	
DE	F.9.5		te	"Alternatively, the fuel tank shall be held at temperature (engulfing fire condition) for 30 minutes. In both cases, the fuel tank shall not rupture." - Not clear: is this a regular ISO 11439 bonfire test except for T = 800°C instead of 590°C min? - May leakage occur at any time? - Vague criteria regarding acceptable gas leak (see last sentence, applied flame is the measure)	And further instructions to this alternative method	
DE	F.10		te	"High strain rate impact test" Description of test too short and unclear. What distance? What are reasons for choosing a greater bullet diameter if no penetration is required? What is to be done a pre-damaged non-leaking cylinder? For how long may it not rupture? When can the test be concluded?	Review (rename to bullet test)	

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DE	F.14		te	Extreme temperature pressure cycling	Add following final sentence to paragraph: For type 4 designs, prior to the hydrostatic burst test, the cylinder shall be leak test in accordance with F.21	
JP17	F.14 Extreme temperature pressure cycling	d)	te	It is too much to require nominal working pressure for pressure cycling at - 40 °C,	Add “0.8 times of” before "the nominal working pressure”. --- Pressurize from not more than 2 MPa to not less than 0.8 times of the nominal working pressure for 0,5 times the number of filling cycles as specified per 4.5, at - 40 °C or lower.	
DE	F.15.2		te	First sentence is not acceptance criteria	Move first sentence to F.15.1	
DE	F.18	2nd paragraph		"Every 100 cycles, there shall be a 24-hour hold period at the nominal working pressure” What is the rationale for increasing the duration of the test with these holding periods (duration approx. 50 days!)?	Remove sentence	
**	Annexes		ed	It is not clear which annexes are normative and which are informative.	Specify which annexes are normative and which are informative by referring to them in the main body of the document, for example using the verb "shall".	