ISO/TC 197
Hydrogen technologies

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Secretariat: SCC (Canada)

ISO FDIS 19884 Collated Comments

Document type:	FDIS ballot
Date of document:	2019-09-25
Expected action:	INFO
Background:	Here are the collated comments resulting from the FDIS ballot of 19884. Please refer to N1092 for results of disapproved FDIS ballot. Please refere to N1085, N1086 and N1087 for documents related to the actions taken due to these ballot results.
Committee URL:	https://isotc.iso.org/livelink/livelink/open/tc197

Template for comments and secretariat observations

Date:2019-07-13	Document:	Project:

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
IT 001				Ge	Italy supports a positive vote, however, despite the great amount of work done, a revision process is recommended to consider some of the previous comments that were discussed in a dedicated WG meeting.		
AU 002	All			ge	A number of valid criticisms were raised at the DIS ballot, yet the responses provided (in ISO/TC 197, N 1034) seem rather dismissive.	Provide further justification why previous comments were not adopted.	
DE 003				ge	Germany disagrees for the following reasons:		
GB 004				ge	GB appreciate the work that has been done to address the majority of our previous concerns.		
NO 005		01		te	This standard is dedicated to stationary storage. The reference to Annex B in the scope is deleted, but Annex B remains in the document Introduction of an Annex B, allowing cylinder design qualified by other standards represents a fundamental change in how design standards for specific applications should be written. This document should be a self-standing document specifying all design and test requirements for this specific application. If similar design is used for other applications, it should be acceptable to reuse the documentation and test results if they fulfil the requirements set in this new document (exclusive the Annex B) The original comment from NO was to delete the Annex B option from the scope. The Annex B option is in the FDIS scope deleted, but Annex B and all references to Annex B remains in the document. This could have been clarified further if the convenor had called for a meeting in WG15 as requested and expected by several WG-experts.	Delete Annex B and all references in the document to Annex B	

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GB 006		01		ed	The broad scope of the standard cannot be achieved with all materials and product types.	Add note: Note this scope may not be applicable under all operating conditions for all cylinder types.	
NO 007		02		te	ISO 11119-3 is referenced in the standard, but not listed under normative references	Accepted and included in the FDIS document.	
US 04 008		03.01.11		Te	MAWP is not a correct term for stationary vessels. See comment on 3.1.17.	Use “Design pressure” instead of maximum allowable working pressure.	
US 05 009		03.01.17		Te	The term MAWP brings confusion and safety risk to a stationary application, particularly given the definition of stress ratio, as there is a conflict between the use of the term MAWP here vs. with transportable cylinders. In transportation service, MAWP is typically 1.25x the rated cylinder pressure, and occurs on a regular basis. However, this excursion is a transient condition, caused by heat of compression during fill or by temperature fluctuations due to environmental conditions. A full fill is based on a given mass of gas at a settled pressure, working pressure, at a defined temperature (15C). The working pressure is the basis for the safety factors of a transportable cylinder. In stationary service, Design Pressure is the maximum continuous pressure allowed. This is the basis for the safety factors. Filling processes, discharge, and temperature exposure are managed so that Design Pressure is not exceeded. MAWP in stationary service is generally limited to 1.10xMAWP only occurs during fault management. Use of MAWP for stationary service, defining normal conditions, should be avoided. Safety factors should not be referenced to MAWP.	Remove the term maximum allowable working pressure and MAWP. The definition is now: “Design Pressure – maximum pressure to which the component is designed to be subjected to and which is the basis for determining the strength of the component under consideration.” Replace <u>all</u> references to MAWP by a reference to Design Pressure. An alternative to “Design Pressure” could be “Component Pressure Rating (CPR)” as defined and discussed in ISO 19880-1 for filling stations.	
NO 010		03.01.18		te	This was 3.1.18 in DIS, now 3.1.16	Accepted and deleted in the FDIS document	

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					Note is confusing This comment has been taken into consideration and being deleted		
NO 011		03.01.18		te	This was 3.1.18 in DIS, now 3.1.16 Maximum allowable temperature should be defined independent of Annex B. This document must specify, without doubt, what the maximum allowable temperature can be, without confusing the definitions with reference to other standards for other applications. This comment is actually valid for all references to Annex B (see NO 1)	Comment rejected in the response to DIS comments Delete Annex B and all references in the document to Annex B	
US 06 012		03.01.18		Te	The text in parentheses is confusing, and could be unsafe. The wording could allow the "use" temperature to be greater than the manufacturer's "design" limit. There is no real need for the words in parentheses.	Remove the text in parentheses.	
US 07 013		03.01.25		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
US 08 014		03.01.28		Te	The note 1 to entry demonstrates that confusion arises from the use of Annex B, and does not provide guidance to resolve the confusion.	Delete Annex B. Delete this definition. Rely on 3.1.30 for test pressure definition.	
US 09 015		03.01.29		Te	This definition brings confusion and safety risk to a stationary application, particularly given the use of MAWP for transportable cylinders.	Refer to Design pressure instead of MAWP: Stress ratio – stress in fibre at specified design pressure (3.1.5) divided by stress at the design pressure (3.1.17). The change proposed for 3.1.17 must also be made.	
NO 016		03.01.31		te	This was 3.1.31 in DIS, now 3.1.28. In the FDIS definitions the difference between 3.1.28 Stationary test pressure and 3.1.30 Test pressure is unclear.	Original comment rejected Updated comments to the FDIS: Delete 3.1.28 stationary test pressure including the	

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					The original comment to DIS was: Introduction of a new definition for test pressure (TP) which seems to be different from the normal Ph for pressure vessels standards is confusing and may lead to misunderstandings/ misinterpretation of ISO 19884 It is still unclear why this document need a definition on stationary test pressure	Note 1 to the entry	
US 10 017		03.01.33		Te	This information is not appropriate for a note	Identify in the scope that such vessels are not addressed in this standard.	
US 11 018		03.01.33		ed	Correct the reference to ASME BPV	Change “ASME BPVC Section VII” to “ASME Boiler and Pressure Vessel Code, Section VIII Pressure Vessels”.	
US 12 019		03.01.38		Te	This definition causes confusion and safety risk.	Delete Annex B. Delete this definition. Rely on Design pressure (3.1.17) as a reference point, replacing all references to working pressure.	
US 13 020		04.01		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
NO 021		04.04		te	The pressure cycle life needs to be defined better, currently it is a very high level definition that can be interpreted in many ways.	Link the cycle life to a Miner sum calculation and everything will be well defined.	
NO 022		04.05		te	The definition is unclear. The proposed safety factor of 3 on number of cycles is too low.	Specify the mean stress and amplitude. Remove the safety factor 3 in the definitions and define it properly later.	

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NO 023		04.06.2		te	Reference to Annex B is wrong	Should be Annex E?	
US 14 024		04.06.2		Te	The reference paper with data used to generate the formula in Annex B indicates the formula may be unconservative, and therefore unsafe.	Reformulate the referenced equation so that it is conservative.	
NO 025		04.07		te	It is quite crude to just specify the service life without the expected pressure history.	It should be stated that if only the lifetime is specified it must be assumed that the cylinder is standing at maximum operating pressure for its entire lifetime. Otherwise a more detailed approach is needed.	
DE 026		04.07, B.6, E.6, I		te	There is a live time frame up to 30 years. In combination with the automotive figures, this means a significant lower safety level.		
NO 027		05.01		te	This is a vague description of environmental compatibility.	Be more specific on which environments are excluded and what has to be specified. Also specify which material properties have to be checked for the permissible environments and how these properties are used in the design and approval process.	
NO 028		05.02, general		te	The fire scenario requires a system evaluation by the operator. The ISO certificate is usually issued to the manufacturer. It is unclear how this should be handled. This is also a general problem in the document.	Make clear what is the responsibility of the manufacturer and the operator. State that beyond the certificate given to the manufacturer a second certificate needs to be given to the operator for a proper system analysis.	
GB		06.02		ed	Amend to be more specific.	'f) a specification for the support methods, external	

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029						protection, protective coatings and any other items required, but not provided with the pressure vessel;' change to: 'f) a specification for the support methods, external protection, protective coatings and any other items specified by the manufacturer, but not provided with the pressure vessel;'	
US 15 030		06.02 h)		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
NO 031		06.02g		te	Not specific enough, since cycles can be counted in many different ways.	State clearly how the cycles are counted, what is the minimum pressure difference to be counted as a cycle. How mean and amplitude are counted.	
NO 032		06.02h		te	UV protection may be provided during operation, but it may not be provided during storage and transport before use.	Specify that storage and transport before use need to be included.	
US 16 033		06.03 b)		Te	MAWP is an incorrect term for stationary pressure vessels	Replace "MAWP" with "Design Pressure".	
US 17 034		06.03 d)		Te	MAWP is an incorrect term for stationary pressure vessels	Replace "MAWP" with "Design Pressure".	
US 18 035		06.06		Te	MAWP is an incorrect term for stationary pressure vessels	Replace "MAWP" with "Design Pressure".	

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NO 036		06.07, general		te	Some places information should be stored for the lifetime of the product, other places it is the lifetime plus 5 years. Other places it may not be specified at all.	Check carefully that the retention requirements are consistent and defined everywhere. Lifetime + 5 years is probably best.	
US 19 037		07.01		Te	The referenced documents do not address all materials used in the pressure vessels. This is a restraint of trade. This violates ISO requirements for performance-based standards. Therefore, additional guidance is required.	Add: “Materials known to be compatible with hydrogen, or tested to confirm compatibility with hydrogen, shall also be allowed for use.”	
US 20 038		07.01	Note	Ed	The documents are not referenced, they are in the bibliography.	“Guidance on hydrogen compatibility can be found in Bibliography items [10], [12], [14], [21], [25].”	
US 21 039		07.03		Te	The referenced documents do not address all materials used in the pressure vessels. ISO 11114-1 is limited in scope. ISO 11114-4 does not address stainless steels. This is a restraint of trade. This violates ISO requirements for performance-based standards. Therefore, additional guidance is required.	Remove the reference to ISO 11114-4. Add: “Materials known to be compatible with hydrogen, or tested to confirm compatibility with hydrogen, shall also be allowed for use.”	
US 22 040		07.04			ISO 11114-4 does not address aluminium alloys. This is a restraint of trade. This violates ISO requirements for performance-based standards. Therefore, additional guidance is required.	Remove the reference to ISO 11114-4. Add: “Aluminium alloys known to be compatible with hydrogen, or tested to confirm compatibility with hydrogen, shall be allowed for use.”	
NO 041		07.06		te	The Tg requirement is OK for thermosets. It does not make sense for thermoplastics. For example, PE is usually operated above its Tg.	Specify differently for thermoplastics.	
NO 042		07.07		te	New requirement making reference to ISO 11114-2 has been inserted by convenor without any discussion/consultation with WG 15 experts. This requirement excluded commonly used materials already in use for years, as they are not listed in ISO 11114-2	Delete reference to ISO 11114-2.	
NO		07.07		te	The temperatures should not be given as absolute	Give the temperature values relative to the	

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043					numbers. This is too strict if the service temperature is only 50 C.	specified extreme use temperatures.	
US 23 044		07.07		Te	ISO 11114-2 does not address all materials used in the pressure vessels. This is a restraint of trade. This violates ISO requirements for performance-based standards. The qualification test requirements adequately address compatibility of liner materials with hydrogen, particularly given that the plastic liner material is a non-structural material.	Remove the requirement that “Plastic liner materials shall be compatible with requirements listed in ISO 11114-2.”	
DE 045		08 8.01.2		te	The stress ratios are not appropriate for long time high temperature and high level use. Fibre types as glass and aramid uploaded with autofrettage pre-stress should not be accepted in combination with a steel liner.		
NO 046		08.01.1		te	Requirement related to stress analyses has been changed by convenor without any discussion/consultation with WG 15 experts.	First sentence Replace “should” with “shall” back to what it was in the DIS version.	
US 24 047		08.01.1	pp.1	Te	It has been seen that cylinder manufacturers have violated stress ratio requirements by choice of materials, thicknesses, and autofrettage pressure in order to improve metal liner cyclic fatigue. Analysis to confirm that stress ratio requirements are met is required for safety.	In the first line, change “should” to “shall”: For all design types, a stress analysis <u>shall</u> be performed…	
US 25 048		08.01.1	pp.2	Te	While it may be acceptable for methods in ISO 9809 or ISO 11120 for Type 1 steel vessels to be used to calculate wall thicknesses, inclusion of the first sentence of the second paragraph is inappropriate, at least in this place. Stress analysis of a metal cylinder is not difficult. Standard and accepted equations could be used. To this extent any equations in ISO 9809 or ISO 11120 might be acceptable. ISO 9809 and ISO 11120 address steel cylinders. No supporting information is given that the methods in these standards are valid for stainless steel or aluminium alloy Type 1 cylinders.	Remove the first sentence of the second paragraph. Consideration could be given to modifying the first sentence of the first paragraph as follows: “For all design types, a stress analysis should be performed using finite element analysis or a similar validated numerical method<u>, or accepted stress equations in the case of Type 1 designs,</u> that includes geometric and material non-linearities as required to establish the minimum design wall thickness and confirm the required stress ratios specified in 8.1.2.1 are met.”	

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					It is inappropriate to reference these standards without specific instructions as to the sections referenced.		
US 26 049		08.01.1	pp.2 pp.4 d)	Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
IT 050		08.01.2.1		Ed	In this sub-clause one cylinder per manufacturing lot should be subjected to burst. Clause 8.3.3.3 requires 3 vessels to be tested.	A clarification text is needed.	
NO 051		08.01.2.1	Table 1	te	The safety factors for glass and aramid should be related to the lifetime of the pressure vessel. It also makes no sense why the factors should change for Type 2, 3 and 4 vessels. In principle this applies to carbon fibers too, but assuming that stress rupture is minimal for carbon fibers is OK, at least for the well-established fibers used today.	Link the safety factors to the stress rupture (creep rupture) characteristics of the fibers and the specified lifetime.	
US 27 052		08.01.2.1	Table 1	Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
GB 053		08.01.3		te	It is unclear whether the test pressure should be greater than or equal to 1.25 times the MAWP for a transportable vessel as assessed using Annex B.2.2.1.	The test pressure in B.2.2.1 must be aligned with the test pressure in 8.1.3.	
US 28 054		08.01.3		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
AU 055		08.01.6		ge	If the cylinder is to always remain under cover, then this clause seems unnecessary or could be relaxed.	Specify that this clause is only required for vessels exposed to UV emissions.	

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NO 056		08.01.7		te	Why is the limit 13.8 MPa.	Require that the saturated wet properties are used in the design calculations in addition to dry properties.	
NO 057		08.01.7		te	Properties of a wet laminate should be measured on a saturated laminate. Whether this is achieved by boiling for 24 hours is not clear, it will depend on the dimensions of the test specimen. Further, boiling may create post-curing giving better properties than the real laminate.	Specify that the specimens should be saturated with water and saturation should be done at temperatures below the post curing temperature.	
GB 058		08.02.1		ed	Edit to separate types.	Amend heading to 'Materials' (i.e. remove 'Liners') Insert: '8.2.1.1 Type 1 designs shall be of seamless construction using carbon steel, stainless steel or aluminium alloys that comply with the materials requirements in 7.2, 7.3, or 7.4, as appropriate. 8.2.1.2 Type 2 liners shall be of seamless construction using carbon steel, stainless steel or aluminium alloys that comply with the materials requirements in 7.2, 7.3, or 7.4, as appropriate. 8.2.1.3 Type 3 liners shall be constructed from aluminium alloys, carbon steel or stainless steels, and shall be seamless. They shall comply with the materials requirements in 7.2, 7.3 or 7.4, as appropriate. For Type 3 liners subjected to cold-forming or cryo-forming processes, heat treatment of the pre-form	

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						component is not required. Liners that have been cold-formed or cryo-formed shall not be subjected to any subsequent heat treatment or to additional heat application, such as welding, or possibly elevated temperature curing of the composite, which degrades the liner properties. 8.2.1.4 Type 4 liners shall meet the requirements of the materials requirements in 7.7 and may be of seamless or welded construction.	
NO 059		08.02.2		te	Should high-pressure composite cylinders have opening in the cylindrical section???	Composite cylinders should not have any openings except for the bosses.	
US 29 060		08.02.2		Te	The first sentence does not adequately state the requirements.	“Pressure vessels may be designed with one or two openings, which shall only be located in the ends along the central axis.”	
NO 061		08.02.4		te	Control of the potlife of the resin during manufacturing is missing.	Add	
US 30 062		08.03.2.4		Te	ISO 9809-4 states that allowed materials are recognized cylinder stainless steels. There are materials suitable and safe for bosses for Type 4 cylinders that might not be suitable as Type 1 cylinders. Therefore, the requirement limiting to 9809-4 materials is inappropriately restrictive, and violates ISO requirements for performance-based standards. This is a restraint of trade. The requirements for qualification testing are adequate to ensure suitability and safety.	Remove the requirement that Type 4 boss materials must meet the requirements of ISO 9809-4.	
US 31		08.03.2.6		Te	ISO 11114-2 does not address all materials that are currently in use, or are suitable for use. This is	Remove the reference to ISO 11114-2.	

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063					a restraint of trade. Further, it is not clear what guidance or use can be found. The requirements for tensile testing and softening temperature, along with qualification testing, is sufficient for safety and suitability for service.		
JP 064 12		08.03.3	08.3.3.4 and Table 3	te	It is not reasonable to require hydraulic cycle test to Type 1 and Type 2 pressure vessels that have established design standards for calculating their cycle lives.	Exclude the Type 1 and Type 2 pressure vessels from the testing requirements under 8.3.3.4 and remove ticks on Type 1 and Type 2 in Table-3 on the line of 8.3.3.4.	
US 32 065		08.03.3.1	Table 3	Te	Table 3 requires LBB for aluminium alloys (ISO 7866) or steel (ISO 9809-2), but allows ISO 9809-1 cylinders to be used without LBB testing. No basis is given for this decision. It is expected that the aluminium alloys would be better in LBB than steel cylinders. This is further complicated in that 8.3.3.5 now states that LBB testing is not required if the material UTS is less than 950 MPa. This would exempt all aluminium cylinders and liners from testing. Further, ISO 9809-1 scope includes tensile strength materials up to 1100 MPa. An added problem is that a "liner" is addressed, but not a "cylinder" in this wording, even though it states it is for Type 1 and Type 2 designs. Clearly, no technical basis is given for the requiring LBB for some cylinders, and not for others. Clearly, these requirements are in conflict. The current wording violates ISO requirements for a performance-based standard.	All designs shall be tested: Remove note "b" from Table 3. Remove "For Type 1 and Type 2 designs, this test is not required if the ultimate tensile strength (UTS) of the liner is less than 950 MPa."	
NO 066		08.03.3.10		te	Why is impact testing limited to designs with less than 150 litre volume?	Make it dependent on the application and use – risk analysis.	
US 33 067		08.03.3.2		Te	Given the use of filler materials is accepted, it should also be allowed for subscale vessels.	"~~Full scale pressure~~ Pressure vessels containing a filler material to reduce the internal volume may also be used."	
US 34 068		08.03.3.3		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	

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IT 069		08.03.3.4		Ed	Two to five pressure vessels shall be pressure cycle in accordance with requirements in A.7.1. A.7.1. does not specify the number of tests to be conducted.	A single number is recommended.	
US 35 070		08.03.3.5		Te	Table 3 requires LBB for aluminium alloys (ISO 7866) or steel (ISO 9809-2), but allows ISO 9809-1 cylinders to be used without LBB testing. No basis is given for this decision. It is expected that the aluminium alloys would be better in LBB than steel cylinders. This is further complicated in that 8.3.3.5 now states that LBB testing is not required if the material UTS is less than 950 MPa. This would exempt all aluminium cylinders and liners from testing. Further, ISO 9809-1 scope includes tensile strength materials up to 1100 MPa. An added problem is that a "liner" is addressed, but not a "cylinder" in this wording, even though it states it is for Type 1 and Type 2 designs. Clearly, no technical basis is given for the requiring LBB for some cylinders, and not for others. Clearly, these requirements are in conflict. The current wording violates ISO requirements for a performance-based standard.	All designs shall be tested: Remove note "b" from Table 3. Remove "For Type 1 and Type 2 designs, this test is not required if the ultimate tensile strength (UTS) of the liner is less than 950 MPa."	
NO 071		08.03.4		te	The design drivers are fatigue and stress rupture, at least for glass and aramid fibers. These fiber properties should be added. They should also be added for new carbon fibers, to make sure they are as good as the old ones for these properties.	Add that stress rupture and fatigue properties of the fibers should change less than 5%.	
US 36 072		08.03.4	Table 1	Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
NO 073		08.03.4	Table 4	te	The diameter range specification for no additional testing seems hard to justify. It is not only the thickness that needs to remain proportional, but	Take out this requirement or make it much more	

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					also the layup needs to be “proportional”, which is impossible. Further the shoulder region and boss region need to have the same stresses.	detailed.	
IT 074	2	08.03.5		Ed	As per clause title, cycle life can be defined by fracture mechanics.	Modify as: “If the pressure vessel cycle life is determined in accordance with the rules in 8.3.5, clauses 8.3.2 8.3.3 and 4.6 shall be ignored”.	
NO 075		08.03.5		ed	Add to the heading that this section applies only for Type 1 cylinders.	Add “for Type 1”	
JP 076 13		08.03.5 Design qualification and cycle life definition by facture methods		te	Cycle life of a pressure vessel shall not be determined by the fracture mechanism design that validates crack propagation of existing defects. Cycle life of a pressure vessel shall be determined by fatigue life of the material exposed to hydrogen, which validates not only crack propagation but also crack inhibition.	Rewrite 8.3.5 applying the process to determine the cycle life by fatigue life of the material exposed to hydrogen.	
GB 077		08.03.5.1		ed	Change for clarity.	‘If the pressure vessel cycle life is determined in accordance with the rules in 8.3.5, 8.3.2 and 8.3.3 shall be ignored.’ Change to: ‘If the pressure vessel cycle life is determined in accordance with the requirements in 8.3.5, then the requirements in 8.3.2 and 8.3.3 shall be ignored.’	
US 37 078		08.03.5.1		Te	This states that for Type 1 vessels, for all new design qualifications, if fracture mechanics is used, sections 8.3.2 (Material tests) and 8.3.3 (pressure vessel tests) are not required. There is no technical basis to say that by performing a fracture mechanics approach, there is	Remove section 8.3.5.	

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					no need for coatings tests, burst tests, or bonfire tests as required by 8.3.2 and 8.3.3. The technical basis is questionable to say that by performing a fracture mechanics approach, there is no need for tensile strength tests, elongation tests, hydrogen compatibility tests, cycle tests, or LBB tests as required by 8.3.2 and 8.3.3. It is obvious that insufficient thought was given to this section, which brings into question all of its requirements. A thorough review and assessment of all requirements must be performed before this fracture mechanics approach can be used as an alternative to the performance-based requirements of sections 8.3.2 and 8.3.3.		
US 38 079		08.03.5.2		Te	Note 1 implies the requirements for materials other than ferritic steels are not known. This uncertainty could affect safety. This needs to be addressed before a fracture mechanics approach is used. The paragraph above Note 2 was previously a note, and is now normative test. This paragraph also indicates uncertainty in how to use a fracture mechanics approach.	Remove section 8.3.5	
US 39 080		08.03.5.2		Te	The requirement for hydrogen gas should be included in this standard rather than by referencing to ISO 11114-4. Noting that ISO 11114-4 applies only to ferritic steel cylinders, it is not clear if the requirements for hydrogen gas are the same for stainless steel and aluminium alloys. The requirements for purging and cleaning are not specific. Without specific requirements on contaminants, the results may not be useful or safe.	Remove section 8.3.5	
US 40 081		08.03.5.3		Te	This states that for Type 1 vessels, if fracture toughness testing is used, sections 8.3.1 (general), 8.3.2 (material tests) and 8.3.3 (pressure vessel tests) are not required. There is no technical basis to say that by using fracture toughness testing, there is no need for coatings tests, burst tests, or bonfire tests as required by 8.3.2 and 8.3.3. The technical basis is questionable to say that by	Remove section 8.3.5	

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					performing fracture toughness testing, there is no need for tensile strength tests, elongation tests, hydrogen compatibility tests, cycle tests, or LBB tests as required by 8.3.2 and 8.3.3. It is obvious that insufficient thought was given to this section, which brings into question all of its requirements. A thorough review and assessment of all requirements must be performed before this fracture mechanics approach can be used as an alternative to the performance-based requirements of sections 8.3.2 and 8.3.3.		
IT 082	1	08.03.5.4		Ed	Allowable number of cycles is equivalent to specified pressure cycle life	Modify as: "The allowable number of cycles is half the number of cycles to reach the final crack depth defined as the crack size at which the stress intensity factor reaches the material fracture toughness. The allowable number of cycles is the pressure cycle life".	
US 41 083		08.03.5.6		Te	This section has been added and has not been reviewed by WG experts. No basis or explanation for the values have been given. It appears that these are intended to replace fracture mechanics testing, meaning no testing would be done on the subject steel cylinders. This could result in safety problems, and is not consistent with ISO requirements for a performance-based standard.	Remove section 8.3.5	
US 42 084		08.04.2.3		Te	The first two paragraphs have added the phrase "except for pressure vessels designed according to 8.3.5". As discussed above, there is no technical basis for exempting cylinder meeting 8.3.5 to be exempted, in general from any further testing. This will lead to unsafe cylinders.	Remove the phrase "except for pressure vessels designed according to 8.3.5" from the first two paragraphs.	
NO 085		08.04.2.5		te	This section seems to apply only for metal parts.	Add requirements for composites failing during batch tests.	
GB 086		08.05		ed		Move the date of manufacture '2012-03' to a new line in the example.	

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GB 087		08.05		ed		Add ‘stationary use’ to the marking example.	
US 43 088		08.05		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
GB 089		09		te	There are elements of the text that suggest Annex B is supplementary to the main text, for example 8.3.1, and others that suggest it replaces it, for example 9.	Make it clear that Annex B is supplementary to the main text.	
US 44 090		09		Te	Annex B is unsafe, and therefore unacceptable. Accordingly, this reference to Annex B should be removed.	Remove section 9	
NO 091		A 6		te	The burst results are dependent on the loading rate.	The loading rate should be specified and it should match fatigue testing done in other test requirements.	
US 64 092		A.10		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 66 093		A.11		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 67 094		A.12		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 68		A.12		Te	Point a), final sentence identifies 85C as a test	“…held at not less than 85C.”	

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095					temperature, but with no tolerance. A tolerance should be added.		
US 69 096		A.12		Te	Points c) and d) identify -40C or the minimum allowable temperature as a test temperature, but with no tolerance. A tolerance should be added.	"…at no greater than -40C…"	
US 70 097		A.13		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
US 71 098		A.15		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
US 72 099		A.17		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
US 73 100		A.18		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	
NO 101		A.2		te	How is hydrogen compatibility addressed for composites? No problem?		
NO 102		A.2		ed	Add to the heading that this section applies only for metal cylinders.	Add "for metals"	
US 45 103		A.2.02.2		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	

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IT 104	2	A.2.02.4		Te	Except for the minimum number of cycles, there are no indications on how to setup the test and which force should be used.	Italy does not have a clear proposal available at the present time, but this issue should be brought and registered for the next revision.	
US 46 105		A.2.02.5		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 47 106		A.2.03		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
NO 107		A.3		te	Properties should match “requirements by the manufacturer” is a meaningless requirement.	Properties should not change relative to the full-scale test temperature. If strains to failure are lower at low temperatures, full scale testing should be done at low and high temperatures	
NO 108		A.4		te	Properties should match “requirements by the manufacturer” is a meaningless requirement.	See also comment to Section 8.1.7	
NO 109		A.7.01		te	No fatigue factor is given for composites. This approach is potentially unsafe.	Replace Fhs by a factor appropriate for composites. Depending on the cycling pattern it should be between 5 and 50. The factors should be applied to the characteristic SN curve, not the mean curve. This needs more discussions and explanations than can be provided here.	
NO 110		A.7.01		te	Why is metal fatigue related to the hydrogen sensitivity factor? For most metal structures a fatigue safety factor of 10 is used. This approach is potentially unsafe.	Replace Fhs by 10, maybe a factor 2 can be used in some special loading cases. The factors should be applied to the characteristic SN curve, not the	

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						mean curve. This needs more discussions and explanations than can be provided here.	
JP7 111		A.7.01		te	Because the factor Kn is removed from the N1 equation, N1 results in far lower number of cycles than the number of cycles calculated having the factor Kn, which was listed in the former Table A.1, and that significantly degrades safety of pressure vessels in terms of their cycle life.	Reinstate Kn in the N1 equation and provide appropriate Kn values according to the number of pressure vessels tested.	
US 48 112		A.7.01		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 49 113		A.7.01		Te	A term in the equation, Kn, and two subsequent tables, have been removed, and no discussion of this has been held amongst WG experts. The items removed addressed scatter in data if a limited number of test specimens are used, which will affect confidence levels in the data, and therefore safety. Note that A.7.4 allows the Kn to be removed if the upper cycle pressure is increased from Design pressure (MAWP in the text) to Test pressure (1.5x). This further shows that the removal of Kn, with no further consideration, decreases safety.	The issue of returning Kn needs to be addressed. Note that in ASME Section X, which was used in developing this requirement, has reduced the value of Kn, which needs to be considered by the WG experts.	
NO 114		A.7.02		te	The same formula as in A.7.1 is given, but judging from the explanations of the symbols, a different formula should have been used. Kn is not defined.	Similar solution as for A.7.1. In addition, fatigue life should be calculated as a Miner sum.	
JP8 115		A.7.02		te	Because the factor Kn is removed from the N2 equation, N2 results in far lower number of cycles than the number of cycles calculated having the factor Kn, which was listed in the former Table A.2, and that significantly degrades safety of pressure vessels in terms of their cycle life.	Reinstate Kn in the N2 equation and provide appropriate Kn values according to the number of pressure vessels tested.	
US 50		A.7.02		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum	

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116						allowable working pressure.	
US 60 117		A.7.02		Te	A term in the equation, Kn, has been removed, and no discussion of this has been held amongst WG experts. The items removed addressed scatter in data if a limited number of test specimens are used, which will affect confidence levels in the data, and therefore safety. Note that A.7.4 allows the Kn to be removed if the upper cycle pressure is increased from Design pressure (MAWP in the text) to Test pressure (1.5x). This further shows that the removal of Kn, with no further consideration, decreases safety.	Return the Kn term to the equation and related requirements and tables.	
JP9 118		A.7.03 Alternative tests to A.7.1 and A.7.2		te	The technical basis for having A.7.3 in addition to A.7.1 and A.7.2 is not clear. A.7.3. shall have a clear technical basis for having it.	Remove A.7.3.	
NO 119		A.7.04.1		te	The factors CL and SCL in the equations are not explained.	Please provide the explanations. The same comments as to A.7.2 also apply.	
JP 120 10		A.7.04.1 Pressure cycling to 1.5 MAWP			Each element of CL and Fsh in the N1' equation and SCL and Ksh in the N2' equation is not defined and unable to determine the number of cycles to be achieved.	Define each of the elements in the equations to enable calculating the number of cycles or Remove A.7.4.1	
US 61 121		A.7.04.1		Te	MAWP is not a correct term for stationary vessels.	Use "Design pressure" instead of maximum allowable working pressure.	

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NO 122		A.7.04.2		te	How a “representative” SN curve is obtained is unclear and would lead to much uncertainty.	Specify test samples, scaled pressure vessels, etc. that can be used for obtaining SN curves.	
US 62 123		A.7.04.2		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
JP 124 11		A.8 Leak-before-break (LBB) test		te	The relationship between a change of pressure range and a change of cycle numbers varies depending on the design type of the pressure vessel. It is more meaningful to carry out the cycle test under A.7.1 until the pressure vessel leaks to confirm the LBB regardless of the pressure cycle life of the pressure vessel rather than having the test under A.8. This will serve to reduce cost for testing.	Remove A.8.	
US 63 125		A.8		Te	MAWP is not a correct term for stationary vessels.	Use “Design pressure” instead of maximum allowable working pressure.	
US 65 126		A.xx		Te	The former A.11 chemical exposure test was removed, without discussion of WG experts, saying that it applied to transportation service, not stationary service. The chemicals identified were chosen as “worst case” from common classes of chemicals and fluids found in general use. They are not specifically limited to the transportation service. This chemical exposure test will identify materials that are attached by acids (which may even form from water in a crevice geometry), bases, and other common fluids. This test is essential to	Return the former A.11, Chemical exposure test, to the standard.	

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					ensure safety.		
NO 127		A11		te	A stress rupture survival test at 1.25 MAWP for 2000 h is meaningless. It is much too short.	A stress rupture curve should be established for representative laminates (see also comments to A.7.4.2). The full-scale test should then be designed to check whether the representative curve is applicable. This needs more discussions and explanations than can be provided here.	
NO 128		A12		te	Cycling to 50% of the lifetime at maximum working pressure is meaningless. This does not proof anything.	The test needs to be much tougher. See discussions related to A7.	
JP6 129		Annex A A.2 Hydrogen sensitivity tests	Test methods	te	The test methods under A.2.2 and A.2.3, which determine the hydrogen sensitivity factor (Fhs), should not apply to all design types of pressure vessels. The Value of Fhs is affected by the material, the mechanical properties (UTS) of the material, the stress at working pressure, etc., of a pressure vessel. The stresses and the failure mode on each pressure vessel should be considered as well. Therefore, it is not safe and not appropriate to determine the Fhs uniformly for all types of pressure vessels using the methods under A.2.2 and A.2.3.	Remove A.2.	
JP2 130		Annex B		Te	Annex B is not appropriate to apply for qualifying the pressure vessels that were qualified for a non-static application by other standard or regulation converting to a static application purpose, because Annex B contains technical matters that are not fully evaluated and is not safe for the purpose. Please refer to the comments JP2 through JP4.	Remove Annex B and require conducting all the tests required under Annex A to the pressure vessels converting from a non-static application to a static application.	
GB 131		Annex B		te	The specific requirements such as cylinder protection listed in the main body of the text shall	Add statement to text to clarify this use.	

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					be applied to cylinders being approved under Annex B.		
GB 132		Annex B		te	Type 2, 3 and 4 transportable gas cylinders converted for use as stationary cylinders should have a maximum life of 30 years in line with the main body of the text.	Add 30 year maximum life.	
GB 133		Annex B		ge	There is a concern that including Annex B will result in some confusion, for example it could be foreseen that two test pressures will be marked on a cylinder and this information could be misinterpreted by the user.		
US 74 134		Annex B		Te	There are two basic approaches for qualifying existing designs of vessels: 1) Demonstrate equivalent safety to requirements in ISO 19884. 2) Qualify the design to another standard, independent of ISO 19884. Each method should be defined and described. With regard to the first approach, an example of how to use the approach in the proposed Annex B.2 to demonstrate "equivalent safety" should be included in a separate annex. See the proposal for Annex I below.	*Delete the current Annex B, and replace it with the following text:* **Annex B** **ALTERNATIVE METHODS FOR QUALIFYING EXISTING DESIGNS AND VESSELS** **B1: Introduction** Existing designs and vessels that are designed by standards other than ISO 19884 may be evaluated for use in hydrogen service as defined within this document. This can be accomplished by basically one of the following two approaches: 1) Demonstrate that the existing design/vessel provides *equivalent safety* to each requirement in ISO 19884. 2) Qualify the design/vessel by other applicable standards for the intended hydrogen service.	

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					With regard to the second approach, the “rules” for using this approach should be defined but details should not be provided due to ambiguity of the situation. The “cleanest way” to handle this approach is to simply have the proposed paragraph under B.3 and delete the remaining items (except B.3.2.6 on “shallow cycles” handled separately below). This way, if a manufacturer chooses to use another standard that is outside of DIS 19884, he should be able to do that without interference or involvement of DIS 19884. On the other hand, if you feel strongly that some guidance is desirable, we will be flexible in retaining such guidance as long as the guidance does not create a safety concern. In this regard, we are particularly concerned about the determination of MAWP for the container. From our standpoint, limiting the MAWP to PW is more appropriate as they both represent continuous conditions – unless there is a supporting analysis that justifies a higher MAWP within the design stress limits for vessels in the nation/region of use.	These two approaches are discussed below in Sections B1 and B2, respectively. **B2: Qualify existing designs and vessels by demonstrating equivalent safety.** Each requirement in the main text of this standard shall be addressed as part of the qualification process for existing designs. See Annex I (Informative) for guidance. NOTE By so doing, use of vessels designed and built to standards where requirements are not as comprehensive as ISO 19984 is prevented. *Equivalent safety* to a particular requirement shall be demonstrated by literal compliance with the requirement or by performing additional design analyses, verification tests, or other countermeasures. As part of this process, the vessel manufacturer needs to be consulted and agree to the re-certification for the new service. Also, compliance to design margins as defined with ISO 19884 shall be maintained. The label shall indicate the prior approval basis, as noted in 8.1.5 h), and clearly indicating pressure rating per ISO 19884 terminology with required design margins. Use of “used” vessels, where vessels have been qualified and labelled under another standard and available for placement in	

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						service, or where fluid service and conditions experienced might be unknown or could jeopardize operation in hydrogen service, shall be prohibited. **B3: Qualify existing designs and vessels by using other standards (exclusive of ISO 19884)** Existing designs and vessels can be qualified for the intended hydrogen service by other internationally, nationally, or regionally accepted standards that are acceptable within the area of intended use as determined by the authority having jurisdiction. This process can occur without use of all or portions of ISO19884. As such, when this approach is taken, technical documentation and labelling shall not indicate or imply compliance to ISO 19884.	
US 75 135		Annex B		Te	The service life is limited to 30 years for Type 2, Type 3, and Type 4 stationary vessels using glass or aramid fibre reinforcement in the main body of this standard. There is no limitation on life for cylinders used under annex B.	Accept USA proposal for Annex B above, or remove Annex B.	
US 76 136		Annex B		Te	Annex B places no restriction on prior service use, and would allow taking existing cylinder, including those previously used in other applications, and simply re-purposing them for stationary used. There are no requirements for the cylinder manufacturer to approve a change in service.	Accept USA proposal for Annex B above, or remove Annex B.	
US 77 137		Annex B		Te	The requirements in the basic standard address a risk analysis for fire safety. There is no consistent requirement for fire safety in Annex B.	Accept USA proposal for Annex B above, or remove Annex B.	
US 78		Annex B		Te	MAWP is not a correct term for stationary vessels. There is potential for confusion between the use of	Accept USA proposal for Annex B above, or remove Annex B.	

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138					MAWP for transportable vs. stationary cylinder/vessels that could be unsafe. See comment for 3.1.17 for further discussion.		
JP5 139		Annex B B.2.02.6	Fa for Cr-Mo quenched and tempered steels	te	The hydrogen accelerating factor, Fa, varies depending on various factors such as the material, the stress at working pressure etc., and there is no technical basis to fix the value of Fa at 5 for Cr-Mo quenched and tempered steels. Fa should be obtained by conducting fatigue tests in air and in hydrogen atmosphere. It is not safe applying a fixed value of 5 for Fa of Cr-Mo quenched and tempered steels.	Remove Annex B.	
JP4 140		Annex B B.2.02.6 Cycle life	Formula B1	te	The exponent value of 3 used in the Formula B-1 results in bigger numbers of cycles than the number of cycles obtained from the experiments conducted on Type 2, Type 3 and Type 4 vessels. Therefore, it is not safe using the exponent value of 3 to the Formula B-1 regardless of the design types, in calculating the cycle lives of the pressure vessels converting from a non-static application to a static application. The exponent value of the Formula B-1 shall be evaluated and determined on each design type. The file attached shows the comparison of the cycle life resulting from the experiments and the cycle life calculated using the Formula B1 with the exponent value of 3 for Type 2, Type 3 and Type 4 pressure vessels.  Cylinder_cycle_test_(JPEC_commit	Remove Annex B.	
JP3		Annex B	MAWP	te	Conversion of a pressure vessel designed and qualified for a non-stationary application to a	Remove Annex B.	

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141		B.2.02.1 Maximum allowable working pressure and B.5 Example of calculation for MAWP			stationary application changes the ratio of TP and the burst pressure to WP, determined by the standard or regulation by which the pressure vessel is qualified. It also reduces the safety factor on fiber stress as well as the LBB. A high-pressure hydrogen pressure vessel qualified for a non-stationary application and converted to a stationary application shall not, throughout its remaining life, be exposed to pressures higher than the working pressure authorized under the standard or regulation by which the high-pressure hydrogen pressure vessel is qualified for a non-stationary application. The definition of MAWP under B.2.2.1 and the calculation of MAWP under B.5.1 through B.5.4 are not appropriate and not safe to use.		
NO 142		Annex F		Ge	Overall, this is a nice basic description, but some details need to be changed since they may create unsafe designs It is good that lifetime calculations using Miner sum and Goodman are considered for pressure vessels by ISO! However, the way it is presented now fatigue failures can happen fairly easily.	.	
GB 143		B.1		te	This standard should not apply to used cylinders. It will be extremely difficult to determine the past life that any cylinder or tube has experienced.	Make it explicit that this standard is only applicable to virgin cylinders.	
GB 144		B.2.01		te	Missing reference	Add ISO 11515	

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NO 145		B.2.02.1		te	The original comment to DIS was: As the phara is written, the MAWP can be as high as Ph for transportable cylinders. After reading the entire document, and annex B in particular, it has become very unclear what pressure the MAWP represents. The document as written can be misinterpreted and misused in many directions and will obviously create many discussions between manufacturers and Inspectors, Notified bodies and customers/users	Original proposed was rejected. The term MAWP must be clarified and adjusted throughout the document, so that the term becomes consistent in use throughout the document. An alternative might be to replace the term MAWP with Design Pressure, equal to PS in the European PED, which without any doubt represent the maximum pressure the cylinder shall be exposed for.	
US 79 146		B.2.02.1		Te	The approach for this section, to allow the cylinder to operate continuously at the MAWP, or even the test pressure, Ph, violates the requirements for stress and stress ratio of the main document and of the original standard being referenced (except for ISO 11439). This reinforces the need to adopt the USA proposal for Annex B as a whole, or remove Annex B as a whole. Annex B is allowing that cylinders could be pressurized as high as test pressure, and held at that pressure continuously, in violation of the intent of the main body of this standard, and in violation of the requirements of the standard allowed under Annex B. An intended safety factor for a steel cylinder made to ISO 9809-1 could be reduced from 2.4 to 1.86 if filled to MAWP, and to 1.8 if filled to Ph. An intended safety factor for a glass fibre reinforced cylinder made to ISO 11119 would be reduced from 3.6 to 2.88 if filled to MAWP, and to 2.4 if filled to Ph. The glass cylinder would therefore have a high risk of exploding due to stress rupture, and any cylinder would be at risk of failing catastrophically due to the reduced safety factors. If these factors were safe, they would have been allowed in their	Accept USA proposal for Annex B above, or remove Annex B.	

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					standards. Although B.2.2.4 offers some mitigation to the above issues, it is poorly formulated and worded, and can be worked around, and therefore would allow cylinders to be used in an unsafe manner.		
GB 147		B.2.02.2	2	te	Transportable cylinders typically have a MAWP of 65 °C. As used in the examples in B.5.	Change 85 °C to 65 °C.	
US 80 148		B.2.02.4		Te	The approach for this section, to revise the stationary test pressure, violates the requirements for stress and stress ratio of the main document. This reinforces the need to adopt the USA proposal for Annex B as a whole, or remove Annex B as a whole	Accept USA proposal for Annex B in US comment #74, or remove Annex B.	
US 81 149		B.2.02.6		Te	The reference cited as the basis for the equation in this section does not appear to be technically supportive of the equation. Therefore, the equation is not valid and should be removed, and replaced with an equation or methodology that is valid and safe. Further, this equation is not consistent with the overall topic of this annex.	Replace the equation with an equation or methodology that is valid. Consider moving a valid equation or methodology into the main body of the standard.	
GB 150		B.2.02.6	3	te	This standard should not apply to used cylinders.	'The user shall specify the predicted maximum number of pressure cycles and the corresponding amplitudes and the pressure cycles that the pressure vessel has already experienced.' Change to: 'The user shall specify the predicted maximum number of pressure cycles and the corresponding amplitudes and the pressure cycles that the pressure vessel will experience.'	
AU 151	Ref [26]	Bibliography		ed	This reference does not contain sufficient information to locate the exact document.	Provide more citation details.	

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AU 152	Ref [24]	Bibliography		ed	Relying on non-reviewed presentations does not seem particularly robust.	Find a more reliable reference source for technical information.	
AU 153	Ref [21]	Bibliography		ed	Website URLs are liable to change with no notice.	Add a “last accessed” date to the reference.	
US 82 154		Bibliography	[15]	Ed	Correct the entry.	Change to “ASME BPVC Section VIII, *ASME Boiler and Pressure Vessel Code, Section VIII: Pressure Vessels”*	
US 83 155		Bibliography	[26]	Ed	Delete the entry.	Duplicate of entry [15]	
NO 156		D		te	OK, but Annex A7 does not require testing to failure, only survival testing. So the comparison cannot be made.	Require tests to failure in A7.	
NO 157		E6		te	A procedure needs to be described how the operator needs to log the pressure cycles. This procedure must match the design approach. It also must survive crashing of the computer doing the monitoring.		
NO 158		F2		te	The strain rate of all fatigue tests should be the same, otherwise the slope of the SN curve can be changed positively.	The strain rate should be specified and kept constant.	
NO 159		F2		te	What happens if one of the eight fatigue tests fails under testing? This should be described. Certainly the point on the SN curve would have to be moved to a lower number of cycles. Otherwise there	The manufacturer should not be allowed to pick the samples that did not fail during testing for the qualification approach and to “hide” the failed results.	

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					would be no conservatism in the SN curve.		
NO 160		F2		te	Assuming the 2x4 tests are not tested to failure any slope of the SN curve can be created. The only real point is the static burst point, which should not be used, see comment above. The eight fatigue tests ensure that at least these eight points are below the "real" mean SN curve with some statistical relevance. But we do not know by how far the SN curve created by the method is below the "real" curve. Note that the curve may be above the real curve if it gets extrapolated to higher number of cycles. See attached Figure 01 to demonstrate how a completely wrong SN curve can be obtained with the approach described in the new document.	The SN curve should be based on samples tested to failure, not survival tests! If the survival testing approach is used: Results should NEVER be extrapolated to higher number of cycles than what was tested. If testing large pressure vessels to failure is seen as not feasible an alternative can be: Test small pressure vessels or laminates to failure to obtain the SN curve. Make survival tests on full-scale pressure vessels to show that the pressure vessels are as good as predicted from the laminate /small scale testing. This would essentially be the approach in DNVGL-ST-C501 and DNVGL-ST-F119.	
NO 161		F2		te	Constructing the SN curve based on using static burst data is wrong. Often the static strength is lower than what an SN curve based on 1000 cycles and more extrapolated to 1 cycle would predict. Including the static data can make the slope of the SN curve too flat, which is non-conservative. It may be counter intuitive that using a minimum static burst strength gives a too good fatigue curve, but that is the case, see attached Figure 01.	The slope of SN curves should never be based on static data. The slope needs to be obtained from samples tested to failure in fatigue.	
NO 162		general		te	The ISO standard is a design standard that does not address production quality assurance. Without a thorough production QA the pressure vessels should not be certified.	Add a section on production Quality Assurance	
JP1 163		General		ge	Many of our comments made at the DIS balloting arising from serious concerns for the safety of pressure vessels have not been addressed.	Create a new working group to develop an appropriate standard for the pressure vessels for stationary storage with members and new leadership who are committed to following the	

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					Against the requests of WG members, no WG meeting to discuss and address the safety matters brought up by WG members was held. The process was not in line with the consensus-based document development process of ISO and not appropriate.	consensus-based document development process of ISO.	
DE 164		General A.11		te	The standard focusses on the load cycle fatigue. The aspect of static fatigue is just touched within a time frame of 2 000 hours by the accelerated stress rupture test. Since the average stress level is very high, the aspect of load cycle strength becomes less important in comparison with the static fatigue aspect. This is not covered in this standard.		
US 01 165		General		Te	The US was very disappointed to see that our comments related to safety-critical aspects of cylinder design that were submitted during the DIS ballot were not discussed and addressed. Many previously-submitted comments (that were not yet addressed) have been updated and included below as part of our comments to ensure that the full scope of our concerns is documented. We have also added new comments as some of the changes made for FDIS introduced new problems and safety concerns.	The FDIS document as balloted should not be published as there are design requirements and practices within this document that are not safe for high pressure hydrogen pressure vessel applications.	
US 02 166		General		Te	Being able to claim that an alternative container standard is compliant with this standard by simply meeting the requirements defined in Annex B is deceptive and border on an effort to legitimise fraud! The MAWP (design pressure or component pressure rating) in Annex B does not necessarily meet the stress limits defined in the main clauses of ISO 19884 and the correction described in Annex B for “shallow cycling” is not supported by data and appears optimistic.	Annex B needs to re-written as described in US comments below such that a container (designed and fabricated to an alternative standard) cannot be labelled as being compliant to ISO 19884 unless “equivalent safety” to each clause in the main text of ISO 19884 is demonstrated / proven.	

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Template for comments and secretariat observations

Date:2019-07-13	Document:	Project:

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US 03 167		General		Te	The lack of discussion of US comments, particularly comments related to safety-critical items, is very disturbing and reflective of conduct by the WG leadership that is inconsistent with a consensus-based process. Many of our comments submitted during the DIS ballot were indicated as being previously discussed when, in fact, no such discussion occurred. The inability of WG experts to review changes to the document prior to the FDIS ballot is further evidence of the break-down of the consensus process.	Disband the current working group and reconstitute it with members and leadership who are committed to following a consensus-based document development process.	

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ISO_FDIS 19884_ANSI.doc: Collation successful

ISO_FDIS 19884_BSI.doc: Collation successful

ISO_FDIS 19884_DIN.doc: Collation successful

ISO_FDIS 19884_JISC.doc: Collation successful

ISO_FDIS 19884_SA.doc: Collation successful

ISO_FDIS 19884_SN.doc: Collation successful

ISO_FDIS 19884_UNI.doc: Collation successful

Collation of files was successful. Number of collated files: 7

SELECTED (number of files): 7

PASSED TEST (number of files conformed to CCT table model): 7

FAILED TEST (number of files conformed to CCT table model): 0

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