ISO/TC 197
Hydrogen technologies

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WG 15 Treated CD 19884 comments 2016-12

Document type: Other committee document

Date of document: 2017-05-16

Expected action: INFO

Background: Here is the compilation of comments from the CD 19884 ballot of 2016 and their treatment by WG 15.

This information was previously sent to WG 15 experts as document N 38.

Committee URL: http://isotc.iso.org/livelink/livelink/open/tc197

Date	MB / NC1	Clause / Subclause	h / Figu	f com	Comments	Proposed change	Observations of the secretariat	To be discussed in Egmond	Conclusion / Action in Egmond	Who	When
04/10/2016	ECMA 005		general	te		This is not really an introduction. This is a list of requirements that belongs into the main body of the standard and should be removed from the introduction.	An introductory chapter is added on top of this list of requirements. Proposition by convenor to remove the bullet point list to be discussed.	Yes	List of requirements in the introduction is removed as it is seen as a nice to have, but not mandatory.		
04/10/2016	GB 199	Introduction		Te	Unnecessary information	The Introduction is very detailed and includes a great deal of information that is not required and makes it confusing for the reader. For instance : a)Service conditions cannot be precisely and comprehensively specified (they are unverifiable. What does precisely and comprehensively mean?); b)What is an appropriate method? As written ...an appropriate method... is unverifiable; d)This is outside the Scope of this standard. The testing environment is a regulatory matter, not a standards matter; f)Establishing all tolerable in-service damage levels is both impractical and open ended; h)as drafted, this is unclear and what does ...exceeded... mean? Requirements have to be met, not exceeded; and i)Establishing all in-service conditions is bot impractical and open ended Redraft the Introduction to be more in line with the ISO Drafting rules	Already discussed in ECMA001 to ECMA007. Proposition by convenor to remove the bullet point list to be discussed.	Yes	See above		
04/10/2016	IT 197	General		Ge	The current draft document is not sufficiently developed and it is recommended to deeply revise for a consolidated and agreed text in the WG, before it can be moved to DIS stage		Please propose a consolidated document. See comment above. Annex E is incorporated in the document.	Yes	Comment is closed. Point is being discussed while we review the document		
04/10/2016	ECMA 143	3 Terms and definitions	general		The terms and definitions need to be in line with ISO 10286 "Terminology" and with existing terms and definitions in similar existing standards		Please notify the differences with the latest version of the definitions developed in ISO TC58	Yes	THis work has been done. Is unconsistency is detected, please advice.		
04/10/2016	GB 022	3		Te	Clarity and continuity of definitions	All the definitions included in ISO 19884 should be reviewed with those already in use in ISO/TC 58 standards. Unless it is absolutely necessary to include a different definition in ISO 19884, those from ISO/TC 58 should be used.	Please notify the differences with the latest version of the definitions developed in ISO TC58	Yes	THis work has been done. Is unconsistency is detected, please advice.		
04/10/2016	ECMA 028	3	3.25	te	3.25 service life maximum period (expressed in years) for which the pressure vessel is designed to be in service	Stationary pressure vessels are designed for a max. No. ofpressure cyclesand not for a "service life" in No. of years. The "service life" expressed in years is dependant from the pressure cycles applied in a period of time and can therefore be very different depending on service conditions.	Add a note : service life usually depends on the pressure cycle or other service conditions and requirements from applicable standards. NOTE: For composite cylinders, life in years is a requirement to address reliability under stress rupture conditions, which is also an underlying basis for the required stress ratios.	Yes	(based on fatigue life and stress rupture characteristics of composite cylinders) is added		
04/10/2016	GB 043	3.25		Te	Incorrect definition	Service life is also dependent upon the number of cycles the cylinder is designed to withstand. Redraft definition to include pressure cycle requirements	This is precised in chapter 4.7. "NOTE Duration of service is also limited by the specified pressure cycle life. For instance, a pressure vessel specified for 150 000 cycles and subjected to a pressure cycle every hour will need to be removed from service after 17 years." Comment is rejected.	YEs	reference to "between 0 % to 100 % of MAWP" is removed.		
04/10/2016	GB 053	4.2		Te/Ed	Information should be included in the Scope	Delete Clause 4.2 and add the information included in to the Scope	300000 MPa.l is a mandatory requirement in the standard. It should not be described in the scope (a manufacturer designing a 40000 0MPa.l could propose a vessel not following the norm) .Comment is rejected.	Yes	the comment is rejected. reference to 300000MPa.l is removed from the scope and included in the madatory requirements of the document. Comment should be raised to WG24 to check the consistency of this limit with the limits set in WG24		
04/10/2016	US 059	4.4		Te	Identify two classes of fatigue service. One for applications with limited cycles, such as for emergency power, and a second for applications with high cycles, such as refuelling cascades.	4.4Pressure cycle life The class of service and pressure cycle life in hydrogen service shall be specified by the pressure vessel manufacturer. Class 1: Service is for limited cycles per year, such as an emergency power source or residential fuel cell fuel storage. Filled to Nominal Working Pressure at a settled temperature of 15C. Vessels in this class are not continuously maintained at pressure, but may be checked and refilled periodically. Pressure may fluctuate with temperature. The pressure cycle life shall be at least 25 cycles per year, but no more than 125 cycles per year. Class 2: Service is for continuous use, such as a cascade. Filled to Nominal Working Pressure at a settled temperature of 15C. The Maximum Allowable Working Pressure, also known as Design Pressure, shall be set at 10% higher than the Nominal Working Pressure. The pressure cycle life shall be at least 15000 full pressure cycles from 10% of NWP to MAWP or equivalent, with some equivalent full pressure cycles added to address expected partial pressure cycles.	This is a new concept and has never been discussed before. The class of service is not necessary to define a type of pressure vessel. A pressure vessel can be specified for a small number of cycles. Comment is rejected. NOTE: Perhaps we could have a short informative annex that addresses issues regarding type of application, and cycle requirements that may result. Might also be a means to discuss shallow cycles.	Yes	informative annex will be proposed to address the issue, only for information.	N. Newhouse	31/01/2017
04/10/2016	US 077	9.1	pp 1	Te	Can be read as no requirements for a type 1 vessel.	For all type 1 designs, a stress analysis shall be conducted and supplied to the owner/operator as mandated by the pressure technology requirements adopted by the AHJ for the location of use.	Comment is not understood.	Yes	Comment is rejected and US acepts. No actions		
04/10/2016	US 082	9.2.2001	Table 1	Te	Why require a burst test?This just requires either a demonstrated ultimate strength test (higher volumes) or analysis supporting the ultimate strength claim.	Minimumactualburst pressure	To be discussed. Because burst tests are required in all standards and easily checked	Yes	Comment is rejected and US acepts. No actions		

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04/10/2016	NO2 084	9.2.2001	Table 1	te	The rationale for increasing the required SF for Glass and Aramid is not understood. Whereas Carbon fibre is effectively kept at the same level as described in ISO 11119-3, Glass gets an additional factor of 1.25 multiplied on to 3.65, increasing to 4.56. The fact that the required SF for Glass and Aramid is increased and not for Carbon fibre may lead to distortion of competition in favour of Carbon fibre. By thorough Glass fibre designs, sufficient SF has been documented with SF down to 3.0 according to EN-12245, and even lower (2.8) according to DNV-OS-C501. This applies for both Stress Rupture and fatigue loadings. The substantial robustness and impact performance of a glass fibre T4 pressure vessel contributes to high fault tolerance and safety levels.	Align with existing standards – e.g. EN 12245, which allows for a factor of safety of 3.0 for glass fibre.	For glass and aramid, same safety factor as described in ISO11439 TO BE FURTHER DISCUSSED AS STRESS FACTORS ARE FUNCTION OF MAWP NOT TEST PRESSURE	Yes	COmment is resolved as the ratio is back to 2.25.		
04/10/2016	US 090	10.1	pp 1	Te	Why are copper and copper alloys like Monel 440 precluded ?	Type 1 designs and Type 2 liners shall be of seamless construction using carbon, stainless steel or aluminium alloys that comply with the materials requirements in 8.2 or 8.4, as appropriate.	Don't know about copper alloy tank designs. Not commonly used for H2. Comment is to be further discussed.	Yes	No =history in using those material in this service. Lack of expertise to bring those products in the standard, therefore not addressed. Comment is rejected.		
04/10/2016	US 091	10.1	pp 2	Te	See the above two concerns.	Type 3 liners shall be constructedof alloys thatfrom steel, aluminium alloys, carbon or stainless steels, and shall be seamless. Theyshall comply with the materials requirements in 8.2, 8.3 or 8.4, as appropriate.	Comment is to be further discussed.	Yes	No =history in using those material in this service. Lack of expertise to bring those products in the standard, therefore not addressed. Comment is rejected.		
04/10/2016	US 093	10.1	1	Ed	Clarify wording	Type 1 tanks and Type 2 liners shall be of seamless construction using carbon steel, stainless steel, or aluminium alloys…	I do not see what to clarify. Please propose wording.	Yes	REsponse from convenor is fine. No need to be concerned.		
04/10/2016	US 094	10.1	2	Ed	Clarify wording	Type 3 liners shall be of seamless construction using carbon steel, stainless steel, or aluminium alloys…	I do not see what to clarify. Please propose wording.	Yes	REsponse from convenor is fine. No need to be concerned.		
04/10/2016	US 096	10.3	pp 3	Te	A hot spinning process, such as fusion welding, shall not be used to fully close and seal the ends for aluminium pressure vessels and liners. Why? The draft says for Aluminium that you can't weld and now you can't spin close. In other words, you can't use aluminium.	Delete whole paragraph	Accepted. NOTE: this means you cannot FULLY close by spinning. That means to essentially weld the end shut, which is not acceptable. You can spin the end down to an opening that can be threaded. Need to put the requirement back in.	Yes	Comment is finally rejected after discussion in Egmond		
04/10/2016	US 097	10.3	pp 4	Te	This requirement is inappropriate. It assumes only forgings and spun metal technology. This assumption can be argued to be anti-trust.	~~Metals shall not be added in the process of closure of the ends.Manufacturing defects shall not be corrected by addition of material.~~	Accepted	Yes	Comment is finally rejected after discussion in Egmond		
04/10/2016	US 104	11.2.1, 11.2.2 & 11.2.3		Te	The U.S. has some concerns regarding the requirements in the standards referenced in 11.2.1, 11.2.2 and 11.2.3.	WG is requested to elaborate on the applicability of the requirements from these standards: ISO 7866, ISO 9809-1, ISO 9809-4, and ISO 11120.	Please make a proposal	Yes	Comment is finally rejected as there is no proposal, nor precision from the US.		
04/10/2016	US 105	11.2.2 thru 11.2.4		Te	See comment Table 2 Row 2		Comment is not understood. Please precise.	Yes	Comment is finally rejected as there is no proposal, nor precision from the US.		
04/10/2016	US 112	11.2.2004	Table 3 Row 8	Te	Bonfire doesn't necessarily make sense for a type 1 vessels. The properties at temperature of vessel construction materials are well known. What temperature do you want to require? 600oC (1100oF) for a structure fire? 1300oC (2400oF) for a hydrocarbon pool fire. Gee this rules out aluminium, copper, carbon and stainless steel. At 600oC they have the strength of wet paper. At 1300oC Aluminum, Copper and alloys are molten. Carbon and Stainless are molten between 1400 and 1550oC. This would mandate nickel and titanium alloys, and they don't like hydrogen.	Remove the checkmark for type 1 vessels Matter of fact, is this a credible failure for a stationary vessel located on a plinth? Probably not. Why are we requiring it for any type of vessel?	To be discussed.	Yes	note is added for all types of cylinders : (2)If required by risk analysis described in 11.3.8		
04/10/2016	CA07 115	11.3	Table 3	te	Under the "Number of pressure vessels required for testing", for 11.3.4 LBB testing that 2 are required. However, under A.8 LBB test method it says 3 are required.	WG to determine correct number.	Comment is not understood. There is no reference to the number of cylinders to be tested in annex A.8.Comment is rejected	Yes	A8 does not require any particular number of cylinder. ISO 11439 requires 3 cylinders but with less stringent fatigue requirements. choice of 2 is therefore reasonable.		
04/10/2016	US 125	11.4	pp new	Te	New text	Tests previously exempted remain exempted.		Yes	pp is added		
04/10/2016	US 144	A.10			In the US there are two tests: 30 cal (7.62) and 50 cal. As written the notifying body could elect the 50 cal test which is not the intent. between 7 mm and 8 mm (this covers the common hunting rifles)	…diameterof 7,62 mm or greater between 7 mm and 8 mm…	Accepted NOTE:the 7.62 mm round is standard worldwide, and is always specified. Recommend specifying just 7.62mm, rather than ≥ 7.62 mm.	Yes	all other standards say 7.62mm. text is modified. another requirement is introduced : "Precautions shall be taken against drop or impact (particularly during installation). If drop or impact does occur, an inspection shall be conducted. "		
04/10/2016	CA14 146	A.10		te	Using compressed air at such high pressures may be unsafe	Eliminate compressed air	Impact test needs to be done under pneumatic pressure. EN12245 specifies air or nitrogen. Comment is rejected. NOTE: Because of the high pressure, use of compressed air will very likely result in combustion between the compressed and and a polymer or aluminum liner. This will result in a false result, and therefore should be removed as an option.	Yes	Agreed. compressed air is eliminated.		
04/10/2016	US 147	A.11.05			When burst tested in accordance with A.6, the pressure vessel shall have a burst pressure that exceeds 1,8 times the MAWP. Is 1.8 high enough?		Please suggest an alternative proposal and associate justification.	Yes	answer from US : 1.8 * MAWP is common. no modification is made.		
04/10/2016	CA15 148	A.14		te	All cylinders have pressure relief valves set at MAWP. This test should be performed at MAWP	Perform high temp cycle test to MAWP	A14 is permeation test, not high temperature test ? Comment is to be precised	Yes	COmment is accepted (test is A13, not A14). Test is done up to MAWP.		

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04/10/2016	CA16 150	A.16 (c)		te	Maximum 15 min filling time may be difficult for large cylinders	Allow subscale cylinder to be used	To be discussed	Yes	Filling time is not an issue with stationary storage. However, minimum hold time of 1 hour is specified.		
04/10/2016	IT 151	A.16 Hydrogen gas cycling test	c)	Te	The total cycle time less than 1 hour can be very demanding for testing cylinders of high volume. Remove the requirement for the maximum cycle time and maximum filling time	The pressure vessel shall then be pressure cycled using compressed hydrogen gas from 80 % of the MRP to the MAWP, for 1000 cycles.The filling time shall be less than or equal to 15 minutes, and the total cycle time shall be less than or equal to one hour. Every 100 cycles ….,	To be discussed	Yes	Requirement is removed. See comment above		
04/10/2016	US 152	A.19			Field experience has shown major H2 leaks found after passing tests on N2 or He. Suggest first test is on N2. Second test on H2.	pressurize the pressure vessel to the MAWP with hydrogen, or with dry air or nitrogen containing a detectable gas such as helium.	To be discussed	Yes	Use of air is forbidden.		
04/10/2016	US 155	A.7		te	The cycle requirements are in excess of what is conventionally required. Review requirements with consideration for reducing number of units and/or margins.	Review requirements for number of units and/or margins	PLease suggest an alternative proposal and associate justification.	Yes	NN will propose an alternative proposal.	N. Newhouse	31/01/2017
04/10/2016	JP5 156	A.7		Te		If a bonfire test is required, cylinder manufacturer may refer to Annex H and discuss with administrator of hydrogen station.	This is a design standard, not a standard to facilitate approval.Comment is not understood.	Yes	Already discussed. No modification is needed		
04/10/2016	CA09 158	A.7.1		te	Cycle life calculation is too conservative. There is no proven basis for the fatigue life variability margin factor. Cycling 2 or 3 cylinders to the specified pressure cycle life should be sufficient to demonstrate fatigue resistance. The variability is a quality control issue and not a design issue	Eliminate the variability margin factor and specify a minimum number of pressure cycles.	PLease suggest an alternative proposal and associate justification.	Yes	See comment US155		
04/10/2016	JP6 160	A.7.3		Te/Ge	An intention and the need of this clause is unidentified. Full amplitude pressure cycling and partial amplitude pressure cycling shall be carried out separately, and each test result shall be described in specifications of application report. Equivalent pressure cycle count (CLeq) is calculated as follows. ●Result of pressure cycle test CL=30,000 cycles in ⊿Pfull (=100% of MAWP) SCL=200,000 cycles in ⊿Pshallow (20% of MAWP <- 80% of MAWP to MAWP) ●n in Miner's rule for this model: (SCL/CL)=(⊿Pfull/⊿Pshallow)^n (200,000/30,000)=(100/20)^n n=1.178 ●History of pressure cycle in station 120 cycles (Number of cycles which is > 20% of MAWP) 15,000 cycles (Number of cycles which is = or < 20% of MAWP) ●Equivalent number of cycles Equivalent cycle life in ⊿Pfull CLeq=2,373 cycles ←120+15,000/[(100/20)^1.178] Remaining cycle life in ⊿Pfull=27,627 cycles Equivalent cycle life in ⊿Pshallow CLeq=15,799 cycles ←15,000+120x[(100/20)^1.178] Remaining cycle life in ⊿Pfull=27,627 cycles	This clause should be removed.	To be discussed. Please provide further justification.	Yes	Already discussed. modification of shallow cycle is proposed to consider the comment.		
04/10/2016	GB 166	All		Ge	As drafted, this standard is not fit for purpose and cannot be used by manufacturers or inspection bodies. ISO/CD 19884 is so difficult to read and understand that it was only possible to provide detailed comments up to including Clause 4.2. UK Experts were not prepared to put more time aside to complete their detailed comments (which may well have taken at least two further full days). As circulated for vote, ISO/CD 19884 must be sent back to ISO/TC 197/WG 15 for further in depth development and for subsequent circulation as another CD. As drafted, it must not be submitted to DIS vote. It is impossible for a cylinder manufacturer to specify every element of the service environment and conditions that the cylinder nay be exposed to and to be responsible for them. Close consultation with ISO/TC 58/SC 3 is recommended in order to ensure that the next version of ISO/CD 19884 can be considered as a useable design, manufacture and test standard.	Completely redraft ISO/CD 19884 in order that it can be considered a useable design, manufacture and test standard.	To be discussed. Can GB propose a new draft easier to read?	Yes	GB should pake a proposal of a new draft to WG. Comment could no t be discussed as there was no representative from GB at the meeting.	GB	31/01/2017
04/10/2016	ECMA 167	Annex A			These are material qualification tests. ECMA request clarification to understand when material tests are needed e. g. change in alloy chemistry, heat treatment and/or change in process.		To be discussed.	Yes	ECMA will take the action to precise when requalification of material and manufacturing processes are required.	ECMA	31/01/2017
04/10/2016	ECMA 168	Annex A			When are material tests that are required?		To be discussed. See ECMA167	Yes	Same as ECMA167		

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04/10/2016	CZ 169	Annex A Clause A2.2 - 2.4		te	**It is necessary to clarify whether this test in a gaseous hydrogen environment is used to qualify a material.** **Example: steel 34CrMo4** **Material qualification would be as follows:** **1) Two sets of specimens to be extracted from two different heats of the same quality steel2) Testing of specimens from 1) and achieve positive results** **If the above two points are met, the steel 34CrMo4 is approved (suitable for the production of pressure vessels according to ISO 19884 (ISO 15399).However, how is it in the case of variations of steels 34CrMo4 in terms of micro alloying (V, Nb, B, Ti, Zr)? It is thought that always it will be a steel 34CrMo4, but with different contents of mentioned micro alloying elements. If there is a change in the content of these micro-alloying elements, but the steel grade will remain 34CrMo4, will it be necessary to repeat this test as per A2.4?** **What happens when the steel 34CrMo4 will be classified as a compliant material from material source tube, but there will be a necessity to change material sources to billet or to steel coil? Will it be necessary to do again brand new material qualification even provided that the chemical composition and the material quality remain the same as material source tube?**	**Revise Annex A, Clause A2.2 - 2.4 based on the comment including clarification when material tests are needed e.g. change in alloy, chemistry, heat treatment and/or change in process.**	To be discussed. See ECMA167	Yes	Same as ECMA167		
04/10/2016	ECMA 170	Annex A	A 2.2 to A 2.4	te	It is necessary to clarify whether this test in a gaseous hydrogen environment is used to qualify a material. Example: steel 34CrMo4 Material qualification would be as follows: 1) Two sets of specimens to be extracted from two different heats of the same quality steel 2) Testing of specimens from 1) and achieve positive results If the above two points are met, the steel 34CrMo4 is approved (suitable for the production of pressure vessels according to ISO 19884 (ISO 15399). However, how is it in the case of variations of steels 34CrMo4 in terms of microalloying (V, Nb, B, Ti, Zr)? It is thought that always it will be a steel 34CrMo4, but with different contents of mentioned microalloying elements. If there is a change in the content of these micro-alloying elements, but the steel grade will remain 34CrMo4, will it be necessary to repeat this test as per A2.4? What happens when the steel 34CrMo4 will be classified as a compliant material from material source tube, but there will be a necessity to change material sources to billet or to steel coil? Will it be necessary to do again brand new material qualification even provided that the chemical composition and the material quality remain the same as material source tube?		To be discussed. See ECMA167	Yes			
04/10/2016	ECMA 172	Annex A	A.7.1.	te	The ambient pressure cycling tests as per N764 is extremely demanding, lead to very high costs and very long time to market (months of testing on big pressure vessels). The proposed change aims to maintain an adequate level of safety.	Modify the test procedure and Kn factor as per following proposal. Number of pressure vessel to be tested:3. In case of cycling up to MAWP revise Kn to2, in case of cycling up to 1.25*MAWP, revise Kn to 1. Table A.1 Number of tested pressure vessels 3 Kn 2 Table A.2 Number of tested pressure vessels 3 Kn 1	To be discussed.	Yes	See comment US155		
04/10/2016	IT 173	Annex A.7		Te	The ambient pressure cycling tests required is extremely demanding and lead to very high costs and very long time to market (months of testing on big pressure vessels). The proposed change maintains an adequate level of safety.	Modify the test procedure and Kn factor as per following proposal. Number of pressure vessel to be tested:3. In case of cycling up to MAWP revise Kn to2, in Table A.1 In case of cycling up to 1.25*MAWP, revise Kn to 1 in Table A.2.	To be discussed.	Yes	See comment US155		
04/10/2016	IT 174	Annex A.8		Te	It is not clear whether the number of cycles to be reached is the one as per Annex A.7 or the one declared in section 4.3.	Please clarify.	Section 4.3 refers to maximum and minimum allowable temperature?Comment is not understood.	Yes	Wrong reference to 4.3. need to be corrected.	LA	31/01/2017
04/10/2016	US 176	Annex E		Te	This annex needs to be reviewed in detail in order to confirm that vessels qualified to its requirements would also be capable of meeting the requirements of the baseline standard, with additional testing or requirements as needed to show equivalence. Recommended approach would include: Only allowing ISO standards to be referenced Allow ISO standards must be listed Each standard must be reviewed for equivalency, and additional qualification testing conducted to meet any deficiencies Review all other requirements for compliance, such as labelling, quality requirements, and suitability for service conditions Ensure that the labels correctly identify the pedigree of these cylinders, as to their baseline, qualification per Annex E, and other requirements as appropriate		To be discussed.	Yes	Annex E will be reintroduced		

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04/10/2016	IT 182	Annex I I8 Additional information from HyComp development.			The paragraph does not explains clearly the outcome and the recommendations from HyComp. Remove the paragraph and add a link to the HyComp Public Deliverables	Delete the paragraph and add a reference to HyComp Public Deliverables http://www.hycomp.eu/menus-sp/menu-bas/pressroom/publicdelivrables.html	NOt sure it is possible in an ISO standard which is supposed to be self standing to refer to an internet address which might become invalid with time. Consider removing the slides from Hycomp in the annex and replace by a paragraph which explains clearly the outcome and the recommendations from HyComp. To be discussed.	Yes	Agreed. Convenor will introduce a link to the public deliverable section of the Hycomp website.		
04/10/2016	US 189	D.7.3			Natural gas vehicle vessels which were "scrapped" keep showing up on other vehicles. Sending the vessel to a landfill is insufficient. Cutting the vessel in half, while extreme, may be the only way to meet this requirement.	Pressure vessels having experienced impact damage should be re-inspected by an authorized inspection agency or condemned,and removed from servicedecommissioned, removed from service and scrapped in a manner to prevent alternative use	Accepted NOTE: While we may want to have the tanks destroyed, we cannot mandate that in the standard. We should say the vessels are no longer authorized for service, or similar wording.	Yes	Agreed. text is modified.		
04/10/2016	US 190	D.7.4			See comment above	Pressure vessels that have been subject to the action of fire should be re-inspected by an authorized inspection agency, or condemned ,and removed from servicedecommissioned, removed from service and scrapped in a manner to prevent alternative use	Accepted NOTE: While we may want to have the tanks destroyed, we cannot mandate that in the standard. We should say the vessels are no longer authorized for service, or similar wording.	Yes	Agreed. text is modified.		
18/11/2016	JP	SCope / 9.2			It is described in the scope with "For Existing design already qualified for other applications (e.g. transportable applications) follow the requirements of Annex A.". However, there is not such the description in "9.2 Requirements for existing design". If this DIS requires the design requirements of Annex A in the existing design cylinder, we can accept to converting existing design cylinder already qualified for other applications into stationary cylinder. Pleas tell me this point.	there is a mismatch or discrepancy between the text in the Scope regarding the existing design and Chapter 9.2 and Annex A: The Scope states "For Existing design already qualified for other applications (e.g. transportable applications) follow the requirements of Annex A.". There is no reference to new Chapter 9.2 here although it directly refers to existing design. Annex A appears to be applicable to all designs not just existing design since it is called "Test methods and acceptance criteria" and there is no indication that it may be applicable only to existing design. Also, new Chapter 9.2 (former Annex E) refers to Existing designs, but does not say that those have already been approved for other applications and does not refer explicitly to Annex A either. So, in summary, my understanding of Japan position expressed by Akiyama-san is that Japan will support requalification of an existing design already approved for another application to a stationary storage cylinder if Chapter 9.2 will have an explicit reference to Annex A. In this case, a reference to an existing design could be removed from the Scope.		Yes	Already discussed. Text will be modified accodingly.		
18/11/2016	JP	9.1			in "9.1 Requirements for new design", there is not the description to require Annex A either.			Yes	Already discussed. Text will be modified accodingly.		
19/11/2016					document N27 is not a DIS, but a CD2 document. There is conflicting information on different pages of the document showing both CD and DIS, and 15399 and 19884 numbers. The correct reference should be ISO/CD2 19884.		Convenor has no rigth on the DOC document to change its properties and modify the reference to 15399	Yes	REference to CD2 is made. reference to CD2 19884 is modified in the header.		
21/11/2016			Table 1 - Minimum stress ratios and burst pressure in 9.1.2.1 Pressure vessel]		The safety factor for carbon composite is 2 in Table 1. Although we think this to be suggestion of USA, the USA and Japan members who examining gtr 13 (Global technical regulation No.13) for FCV fuel tank, they request safety factor 2. However safety factor for carbon composite remains 2.25 at present because there is not evidence to prove the safety.			Yes	coefficient 2.25 is introduced according to comment.		
21/11/2016			[Equation 1 in 9.2.4.7]		This equation shows that exponent 3 is safety side for EVERY METAL and for EVERY PRESSURE AMPLITUDE ⊿Pi. In here, in case of the pressure amplitude ⊿Pi [Lower P=0 MPa (constant) and Upper P=variable], Japan think exponent 3 may be safety side. However in case of the pressure amplitude ⊿Pi [Lower P=variable and Upper P=variable (or = Pmax), Japan does not have the date to prove that exponent 3 is safe enough. And Japan think that probably USA does not have such data, too.			Yes	Already discussed. definition of shallow cycle is modified to accomodate for the comment.		
01/12/2016	ECMA	Introduction	f)	te	requiring manufacturers to specify for maximum acceptable in-service damage levels for their design;	It is impossible to give examples, there are too many options. This is impracticable Reference should be given to ISO 11363, where acceptable and not acceptable damages are explained		Yes	Already discussed. The list of requirements is removed from the introduction.		
01/12/2016	ECMA	2 Normative references		te	ISO 10460	To be removed, applies to welded cylinders. Destructive Examination inspection should be done according to the procedure listed in ISO 10460 is wrong it should be ISO 11119-1 and ISO 11119-2 for type II and Type III cylinders respectively		Yes	reference is changed to ISO11119-1 and -2		
01/12/2016				te	EN 13322-2,	To be removed, applies to welded cylinders. This standard does not allow non seamless liners. See scope		Yes	scope is rephrased to be unambiguous. scopes includes type 4 with welded non load sharing metallic liners		
01/12/2016	ECMA			te	ISO 9809-3	To be added There is no logic reason to not give reference to ISO 9809-3.		Yes	Agreed and already modified		
01/12/2016	ECMA			te	EN 1964-3	To be removed, ISO standards refer only to ISO standards and not to EN-standards See above		Yes	Agreed and already modified		

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01/12/2016	ECMA	3 Terms and definitions	42646	te	3.10 exterior coating layers of material applied to the cylinder as protection or for cosmetic purposes	New wording to read: 3.10 exterior coating layers of material applied to the cylinder for protection. o.k. In general all definitions should be checked with ISO 10286 “Terminology”		Yes	some manufacturer use exterior coating mainly for cosmetic purposes. definition is not modified.		
01/12/2016	ECMA		42707	te	3.12 full cycle cycle of pressure amplitude between MAWP and 10 % of the MAWP (or if Annex E is used, cycle of pressure amplitude as per the reference standard (e.g. between the test pressure and 10 % of the test pressure)).	Current wording is confusing. Make full stop after 1st sentence and delete the rest to read: 3.12 full cycle cycle of pressure amplitude between MAWP and 10 % of the MAWP. Definition not in compliance with ISO-rules- only one definition and no choice should be given.		Yes	Comment is taken into account "no less and no more than 10% of MAWP is added. reference to 9.2 is deleted.		
01/12/2016	ECMA		3.25	te	3.25 service life maximum period (expressed in years) for which the pressure vessel is designed to be in service	Stationary pressure vessels are designed for a max. No. of pressure cycles and not for a “service life” in No. of years. The “service life” expressed in years is dependant from the pressure cycles applied over a period of time and can therefore be very different depending on service conditions. Service life is either expressed in No. of year and/or No. of pressure cycles. See clause 4.7		Yes	Comment is taken into account.		
01/12/2016	ECMA	42464		te	Identify two classes of fatigue service. One for applications with limited cycles, such as for emergency power, and a second for applications with high cycles, such as refuelling cascades.	4.4 Pressure cycle life The class of service and pressure cycle life in hydrogen service shall be specified by the pressure vessel manufacturer. Class 1: Service is for limited cycles per year, such as an emergency power source or residential fuel cell fuel storage. Filled to Nominal Working Pressure at a settled temperature of 15C. Vessels in this class are not continuously maintained at pressure, but may be checked and refilled periodically. Pressure may fluctuate with temperature. The pressure cycle life shall be at least 25 cycles per year, but no more than 125 cycles per year. Class 2: Service is for continuous use, such as a cascade. Filled to Nominal Working Pressure at a settled temperature of 15C. The Maximum Allowable Working Pressure, also known as Design Pressure, shall be set at 10% higher than the Nominal Working Pressure. The pressure cycle life shall be at least 15000 full pressure cycles from 10% of NWP to MAWP or equivalent, with some equivalent full pressure cycles added to address expected partia pressure cycles.		Yes	informative annex will be proposed to discuss the issue regarding class 1 and class 2 pressure vessels.		
01/12/2016	ECMA	4.7		te	First sentence to be deleted	The manufacturer cannot know how (in terms of pressure cycles and amplitude) the pressure receptacle is going to be used.		Yes	Already discussed. First sentence is modified.		
01/12/2016	ECMA	Annex D	general	te	The whole Annex D shall be removed from the standard! This information has nothing to do with a manufacturing standard for stationary storage vessels! Consideration should be given to periodic inspection of stationary storage vessels in a separate standard. Further consideration should be given to the installation and maintenance of stationary storage vessels in a separate standard.	D.7 shall be deleted, because it deals with periodic inspection. For periodic inspection of stationary pressure receptacle there should be a separate standard.		Yes	modification of 1st paragraph is proposed to be less demanding for the manufacturer.		
01/12/2016	ECMA	Annex E	general	te	This Annex is a standard within a standard! This part has been disapproved as a standalone standard. Why should it be acceptable now as an Annex of this standard? It should be checked ifi is is in line with ISO rules! Comments given to the rejected standard should be revisited. There must have been good reasons to reject it.	Annex E has been inserted as clause 9.2 and should be deleted from this standard, based on previous negative ISO voting.		Yes	Chapter 9.2 will be reinserted as an annex		
4/12/2016	IT	12		te	Allow proof test instead of EE, PE measurement	…diameterof 7,62 mm or greater between	NOTE: Measuring elastic expansion on T3, T4, and PE on T1, T2, offers an easy and inexpensive means to measure compliance with requirements, and an excellent quality assessment. What measures are proposed in EE and PE measurement are deleted? Let’s discuss this!	Yes	This is already in the document.		
4/12/2016	Several	Annex E		Te	Several comments to delete Annex E were rejected. Simply moving the annex to a section of the standard does not address the concerns raised.			Yes	Already discussed		
4/12/2016		1.0		Te	The scope has been modified. TC197 must vote on a change in scope. Some of the elements could be put into the requirements section instead.			Yes	Scope has not been modified. It has only been rephrased when considered unclear.		
4/12/2016		1.0		Te	Requirement was added for 300,000 MPa-L maximum energy. It should be clarified this is for a single vessel.			Yes	OK. PRecised in 4.2		
4/12/2016		9.2			Return 9.2 to an Annex (Normative). The scope of the (old) annex should be removed. This may require a revision of the scope of the standard which needs to be approved by the TC197. The modification made in the scope should be done in the requirements. The Elements of the scope will be incorporated into the requirements chapter.			Yes	OK. It will be done by convenor. Scope of 9.2 will be removed. Some of the elements of the scope might return in the requirements.	LA	31/01/2017
4/12/2016					move the "The maximum allowable energy content shall not exceed 300000 Mpa.l." in the scope to the general requirement section.			Yes	This is precised in 4.2		
4/12/2016					Reference to Annex A in the scope is not correct. Should be a reference to chapter 9.2 which is goiing to be moved to a n Annex (NOrmative)			Yes	Reference to Annex A in the scope has been removed.		
01/12/2016	IT		General	Ge	Several technical comments need to be deeply examined and agreed within the WG before proceeding to a DIS stage.	To be discussed by the WG.		Yes	cannot answer anything about this comment....		
01/12/2016	IT		Introduct	Te	Acceptable in-service damage is very a general description and not completely clear, a clearer and unambiguous definition should be provided.	Please clarify.		Yes	part is removed.		
01/12/2016	IT	11	Scope	Ed	Reference to Annex A is wrong	Reference to clause 9.2		Yes	Agreed. Reference will be modified.		

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01/12/2016	IT		3.28	Te	Shallow cycle should not be defined only based on the allowable pressure cycle life.	Shallow cycle life should be defined as a percentage of the MAWP. This should be discussed in the WG.		Yes	Definition of shallow cycle has been modified.		
01/12/2016	IT		4.5	Te	Shallow pressure life can be calculated according to one of the proposed methods.	Modify to shall: "Pressure cycle life shall be calculated according to one of the proposed methods".		Yes	modification from "can" to "shall" has been done in the text.		
01/12/2016	IT		4.7	Te	Service life shall be at least 15 years.	Allow the manufacturer to specify service life, as there might be cases with very high cycle fatigue requirements, where 15 years might not be guaranteed.		Yes	reference to 15 years was deleted.		
01/12/2016	IT		6	Te	The manufacturer cannot perform a risk analysis since site design might not be known.	Delete the entire section. Operator/owner of the filling station is responsible to perform a risk analysis.		Yes	change manufacturer to owner / operator		
01/12/2016	IT		8.2	Te	Allowed steel material should not be limited to ISO 9809 and ISO 11120. Once hydrogen material compatibility is demonstrated, proprietary grades should be allowed. For example, an ASME steel grade might not be included in the typical ISO 11120 alloy composition, however there is in service experience for pressure vessels design and therefore it should be allowed.	Add the possibility to use steel grades that are internationally recognized (e.g. ASME grades or equivalent).		Yes	modification is made to text in chapter 8.2		
01/12/2016	IT		9.1.2001	Te	Type I cylinders have been designed according to Lamè Von Mises theory for several years and a large experience exists.	Rephrase text as in the previous version.		Yes	new paragraphe was added : "Alternatively, for Type 1, methods described in ISO9809 or ISO 11120 can be used . "		
01/12/2016	IT		9.2	Te	We suggest to have a discussion on JP 177 and US 178 comments (document N028), regarding testing protocol for existing designs.	To be discussed.		Yes	Already discussed.		
01/12/2016	IT		9.2.4.7		It seems that the proposed hydrogen-accelerating factor does not depend on the MAWP and it can be generally applied.	Please clarify.		Yes	reference to MAWP is removed		
01/12/2016	IT	8	10.3	Te	In the current document welding is not allowed, so why was the paragraph removed?	Addition of metals in the closing process shall not be allowed. Please clarify.		Yes	already discussed		
01/12/2016	IT	1	11.2	Ed	11.2.2 to 11.2.4	Please modify text including 11.2.1 to 11.2.4.		Yes	OK modification has been made.		
01/12/2016	IT	1	11.2	Te	One pressure vessel, liner or representative test ring.	Please modify text accordingly.		Yes	OK modification has been made.		

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01/12/2016	IT		11.5	Te	Proposal for fracture mechanics was not included.	Proposal is submitted again with further modifications. 11.5 Design qualification by fracture mechanics As an alternative method for new design qualification, fracture mechanics design based approaches can be used. If pressure vessel cycle life is determined in accordance with the rules in section 11.5, clause 11.2.4 and annex A.7 shall be ignored. Fracture mechanics assumes that an initial crack exists in the pressure vessel. Crack propagates due to cyclic internal pressure variation and failure is assumed to occur when a valid fracture mechanics parameter (e.g. elastic stress intensity factor, K) reaches a critical threshold value. 11.5.1 Fatigue crack growth rate tests Fatigue crack growth rates shall be measured in accordance with ASTM E647 or ISO 12108 standards with the following exceptions: § Test frequency shall not be greater than 1 Hz. Higher frequencies may be used provided it is clearly demonstrated that fatigue crack growth rate data are not affected by frequency in the explored ΔK region. NOTE: This frequency is known to be valid for ferritic steels. Other metallic materials, e.g. austenitic stainless steels or aluminum alloys, may require different test frequencies. § Waveform shall be either triangular or sinusoidal. § Stress ratio shall be consistent with stress ratio seen by the pressure vessel during its lifetime. Stress ratio R=0.8 shall be considered as an upper bound for fatigue crack growth rate. NOTE: a single linear relationship in the form da/dN=C*ΔKm may not be obtained since different regions with different parameters exist depending on the appliedΔK level. Use of multiple da/dN=C*ΔKm relationships for calculation of pressure vessels cycle life is allowed. NOTE: the pressure vessel can be subjected to different cyclic ranges. Fatigue crack growth rates may follow the different stress ranges. A minimum of three tests shall be carried out. Test pressure shall not be less than the intended service pressure. Specimens shall be machined with TL orientation, meaning the test specimen has a fracture plane whose normal is in the transverse direction of the pressure vessel and the expected crack propagation direction is in the longitudinal direction of the pressure vessel. The hydrogen used for testing shall comply with the requirement listed in ISO 11114-4. 11.5.2 Fracture toughness testing The test method allows to determine the onset of critical threshold for hydrogen assisted cracking. Guidance on this test method is given in standard ANSI/CSA CHMC 1-2014. A minimum of two tests shall be carried out. Test pressure shall not be less than the intended service pressure. The lower bound fracture toughness data shall be considered for design purposes. 11.5.3 Allowable number of cycle Allowable number of cycles is half the number of cycles to reach the final crack depth defined as the crack size at which stress intensity factor reaches material fracture toughness. NOTE: Art. KD-4 and KD-10 provides guidance for fracture mechanics evaluation 11.5.4 Material qualification Tests results from clauses 11.5.1 and 11.5.2 only apply to a batch of material from which specimens were extracted. a. The purpose of this clause is to qualify a material by testing two heats of material per heat treatment condition. Specimens for hydrogen tests shall be in the final heat treated condition to be used in the pressure vessels construction and obtained on a minimum of two heats representative of the material specification. Specifically the maximum tensile strength allowed by the specification shall not exceed 5% of the highest strength heat. A set of minimum three specimens per heat shall be tested according to clause 11.5.1, allowing a sufficient ΔK range to be explored. The upper bound fatigue crack growth rate curve, for each of the explored ΔK region, data shall be used for calculation in clause 11.5.3. A set of minimum two specimens per heat shall be tested according to clause 11.5.2. The lower bound fracture toughness data shall be used for calculation in clause 11.5.3. The data obtained in a) may be used for other pressure vessels manufactured from the same material and grade, having the same nominal composition and heat treatment condition, provided its tensile strength do not exceed the values of the material used in the qualification tests by more than 5%.		Yes	COmment is included as new paragraph 11.5. Action to all WG to review the proposed paragraph	ALL	31/01/2017
01/12/2016	IT		11.2.200	Te	This paragraph does not apply if clause 11.5 is used.	Modify text accordingly.		Yes	Text is changed in 11.2.4		
01/12/2016	IT		11.3.200	Te	For fracture mechanics based design as per clause 11.5 ambient temperature pressure cycling test should not be needed.	Modify text accordingly.		Yes	Text is changed in 11.2.4		
01/12/2016	IT		11.4	Te	Type 1 and 2 should not be re-qualified if only length is changed.	Modify text accordingly, following also indications from US comment 124, document N28.		Yes	Note h already addresses the point. No need for modification.		
01/12/2016	IT	g)	12.1	Te	Hydraulic test in accordance with A.18. Proof pressure test was agreed as alternative to volumetric expansion test.	Modify paragraph A.18 since measurement of elastic expansion is not required being the volumetric expansion test optional for all types.		Yes	point c) of A 18 is removed to keep consistency.		
01/12/2016	IT		12.2.4	Te	For fracture mechanics based design as per clause 11.5 ambient temperature pressure cycling test should not be needed.	Remove ambient pressure cycling test as a batch test for fracture mechanics based design.		Yes	12.2.4 is applicable to all designs except those according to section 11.5		
01/12/2016	IT			Te	What is the meaning of “cleaned for hydrogen service”? US 136 comment should be discussed.	Please clarify.		Yes	According to owner / operator specificaiton has been added.		

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01/12/2016	IT	3	Method 1	Te	Maximum pressure is indicated as 80% of the pressure leading to burst when performing method A of ISO 11114-4. Does this mean that tests given in Method A of ISO 11114-4 should be carried out even if the material is exempted?	Please clarify.		Yes	paragraph is removed.		
01/12/2016	IT			Te	See comment IT 153, document N28.			Yes	Action already taken by NN		
01/12/2016	IT		General	Te	Proposal from US (see US comment 059, document N 28) for different classes of pressure vessels should be discussed in the WG.	Allow proposal to be discussed and eventually rejected by the WG.		Yes	Already discussed.		