

Template for comments and secretariat observations

Date:2004-03-23	Document: ISO_DIS_13985_3
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1	2	(3)	4	5	(6)	(7)
MB ¹	Clause No./ Subclause No./ Annex (e.g. 3.1)	Paragraph/ Figure/ Table/ Note (e.g. Table 1)	Type of comment ²	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
US	Document		GE	This document should be referred to technical experts in a working group because there are far too many technical issues unresolved.	Convene a working group to review this document and address these and other comments from this vote.	
**	General		ed	1) MAWP is the abbreviation for maximum allowable working pressure, thus after the first mention with explanation pls use this abbrev. instead of the entire phrase. 2) MAWP is an abbrev. NOT a symbol; the SI symbol for pressure is p which can be given subscripts as needed.	Corrections to text needed.	
UK	General		E/T	The most striking feature is that there appears to be no compatibility with ISO or ADR/EN terminology. E.g. "MAWP" is maximum allowable working pressure, where we would use working pressure. This is of concern, particularly to manufacturers and inspection bodies who would all prefer common terminology and definitions. Simpler documents = reduced risk of errors and enhancement of safety.		
UK	1	2	E/T	This standard applies to tanks intended to be permanently attached to land vehicles. How this is done is the responsibility of the vehicle designer/manufacture	Add 'intended to be' between 'fuel tanks' and 'permanently'	
**	2		ed	In order to be cited as a normative reference, the document must be publicly available (i.e. at stage DIS or further). In your list you have cited WD 21022, WDs 21013-1, -2, -3, and CD 21029-1, none of which can be cited normatively in the published ISO 13985 unless they have reached DIS stage by then. You need to decide whether to delete these refs. or to put ISO 13985 on pending until they reach DIS stage.	Decision required by TC	
UK	2		E	Must follow drafting rules Standards should only be dated if a clause, table or figure is referenced	Delete Dates from ISO 1431-1, ISO 2768-1, ISO 6957 and ISO 9227 Delete the footnotes and change to DIS/ISO 11114-4 etc. Only quote date if necessary, when it should be the date of the DIS	

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US	2		te	There is no assurance that any of the unpublished referenced standards will ever be published. Since many of the essential requirements for these tanks are in the referenced standards, this document should not be published before the normative references are at least at FDIS.	Delete references to all unpublished standards and add essential requirements to this document or simply wait until they are published or at FDIS before progressing this project.	
**	3	Figure 1	ed	Figures must be language-independent; pls remove text from figure and create a Key and footnotes giving the necessary information. See Directives Part 2, 2001, 6.6.5.	Corrections needed for Figure 1.	
US	3		te	The standard term for vehicle weight is GVWR.	Add as definition: Gross Vehicle Weight Rating – The maximum loaded weight of a vehicle, including fuel, fluids, and full payload.	
US	3.1		Te	The definition of the term boil off management system implies that the system can render gaseous hydrogen evaporating from the liquid hydrogen phase as “harmless”.	Revise to read: “ Boil off management system system that controls the boil off of gas under normal conditions.”	
US	3.2		Ed	When defining a term do not use the term in the definition	Pressure that causes rupture of a pressure vessel when subjected to a constant increase of pressure during a destructive test.	
US	3.5		Ed	The definition implies that conversion equals consumption.	Revise to read: “ hydrogen conversion system any system designed for the conversion of hydrogen from the liquid phase to the gaseous phase for consumption.”	
KR	3.6	1 st par	ed	“where” should be deleted	The range within which an unwanted event is to be expected, e.g. the corresponding pressure where from plastic deformation or bursting of the inner tank occurs as shown in Figure 1.	
KR	3.6	Figure 1	ed	“Tank 3.7” should be changed the line.	Figure 1 – Ranges of a steel inner tank 3.7 3.7	

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UK	3.6		E	Must follow drafting rules The example should be a NOTE. However, there is no mention of plastic deformation nor bursting in Figure 1 Cannot have a figure referenced in a definition	Suggest change to 'range within which an unwanted event is to be expected' NOTE The operating ranges are shown in Figure 1	
UK	3.7, 3.9, 3.10, 3.11, 3.12, 3.13 and 3.17		E		Delete 'the'	
US	3.12		te	Using "convex side" in the definition for outer pressure assumes a shape for the tank which may not be true.	Change to read: the pressure acting on the convex side of the inner tank or outer jacket, e.g. in case of vacuum inside the inner tank and/or the outer jacket outside of the tank	
UK	3.15 and 3.16		E	Should be in italics with subscripts normal	R_m and R_p	
UK	4.2.1.1	Equation	E	Should be in italics	ρ_{test}	
UK	4.2.1.1		E	Replace : with 'is the'	ρ_{test} is the test pressure.... MAWP is the Maximum Allowable...	
UK	4.2.1.2	1	E	Once the acronym has been defined, use it on its own	Delete 'Maximum Allowable Working Pressure' and the () leaving '...resist its MAWP, which is set...'	
US	4.2.1.2		Te	As written, the paragraph will require the jacket to withstand full MAWP of the inner tank. This means that the fuel tank is a double walled tank with each wall being "full thickness" to retain MAWP. Is this what is intended?		
US	4.2.1.2		ed	Simpler wording, more clearly stated requirement.	Change to read: The outer jacket shall be designed to resist its Maximum Allowable Working Pressure (MAWP), which is shall be at least equal to the set pressure of its pressure relief device.	

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FR	4.2.2.1	Table 1		Values given for acceleration (up to 20 G) seem to be very high . On transport rules TPED acceleration are much lower :2 G for roads 4G for train. What is reason for so high value? The level of acceleration should be linked to a given duration of time .		
KR	4.2.2.1	Table 1	ed	“.” should be deleted	Vehicles categories M3 and N3:	
UK	4.2.2.1	Table 1	T	Suggest a review of the accelerations sustainability in Table 1 of 4.2.2.1. Decelerations in collision of N3 vehicles can reach 10g. It is further suggested that to reduce vulnerability to accidental damage, relief valves should be positioned beyond an outer 270 degree arc of the tank's cross-section. Projections sometimes get hit or trodden upon	N ₃ Change to 10 g Add 'Relief valves shall be positioned beyond an outer 270 degree arc of the tank's cross-section.	
UK	4.2.2.1	Table 1	E	Must not split 5 000 kg		
US	4.2.2.1		te	What is to be without damage needs to be specified.	Change to read: The fuel tank and the fuel tank accessories shall be mounted and fixed so that the accelerations shown in Table 1 can be absorbed (without damage) to the fuel tank and the fuel tank accessories when the fuel tank is full. No uncontrolled release of hydrogen shall be allowed is permitted .	
UK	4.2.2.2			Should be in italics with subscripts normal	R_m	

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US	4.2.2.2		te	This clause is in conflict with 4.2.2.1 and repeats some requirements regarding damage and uncontrolled release.	Change to read: The fuel tank inner and the outer supports shall be designed to resist the accelerations named in Table 1 without rupture, in which case the allowable <u>When exposed to the accelerations described in Table 1, the</u> stress in the support elements shall not exceed (calculated according with the linear stress model): [equation] The allowable stress in the support elements may not have to be calculated if it can be demonstrated that the fuel tank may support the accelerations named in Table 1 without any leak of the inner tank.	
JP JNC ISO TC 220	4.3.1	Design temperature	te	We cannot understand why the design temperature of the inner tank and outer jacket can be fixed at just 20 . The outer jacket shall withstand ambient temperature ranging from -40 to 85 , and inner tank from liquid hydrogen temperature to 85 . Thermal stresses should be calculated taking into account of all the possible critical cases in the use of cylinder in design.	The design temperature shall be the lowest and the highest possible operating temperatures where low and high temperature design specifications, respectively, are required.	
US	4.3.1		te	The design temperature will range from at least -40 to 85 based on the next paragraph. In addition the temperature of the liquid hydrogen will need to be accommodated. Thus, the design temperature is not 20 C.	Insert the term "nominal" prior to "design temperature".	
US	4.3.1		te	There is no definition for design temperature. This clause inexplicably assigns a design temperature of 20 C to pressure parts that will be exposed to liquid hydrogen temperatures!!!!	Change to read: 4.3.1 Design Fuel temperature The design temperature of the inner tank and the outer jacket shall be 20°C. For all other accessories, the design temperature shall be <u>The fuel tank shall be designed to withstand</u> the lowest and the highest possible operating temperatures where low- and high- temperature design specifications, respectively, are required.	

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US	4.3.1		Te	The design temperature of the inner tank and outer jacket shall be consistent with the ambient temperature to which the system is subjected.	The design temperature for the system shall be consistent with Ambient temperature in 4.3.2. Components are allowed to have a design temperature range greater than 4.3.2.	
US	4.3.1		Te	The first sentence creates confusion by implying that the outer jacket should be designed to 20C. Since venting can lower the temperature of metal near the outer tank, shouldn't the design temperature be lower than 20C?	Delete the first sentence and leave the second sentence.	
US	4.3.2		te	The requirement that a higher ambient temperature be "considered" is unacceptable.	Change to read: The fuel tank shall be designed to withstand ambient temperatures ranging from -40 °C to 85 °C. If the fuel tank is to be installed in the internal combustion engine compartment of a vehicle, a maximum <u>the fuel tank shall be designed for an ambient temperature of 120°C shall be considered. or a lower value substantiated by calculations.</u>	
US	4.4		te	There is nothing in this clause about "chemical stresses", whatever they are.	Delete this clause and move requirements to clause 4.5. Remove references to unpublished standards.	
US	4.4	(b)	Ed	Battery acid is a significant potential exposure for LH2 tanks and should be mentioned in the test.	Revise (b) to read: (b) other media and fluids found in a land vehicle environment such as coolant, battery acid.	
US	4.5	4 th para.	te	There should be no requirement that the filler materials be compatible...the wording implies that the choice of the filler material is the only important variable.	Change to read: The filler materials shall be compatible with the parent material so as to form welds with <u>Welds shall have</u> properties equivalent to those specified for the parent material for all temperatures that the material may encounter.	
US	4.5	5 th para.	te	Keeping records may make sense, but this specifies no retention period, requiring the manufacturer to keep the records for ever! There is also no requirement for traceability, i.e., no requirement to link the records to particular tanks, so the records would be of little value anyway.	Delete this para.	

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US	4.5	6 th para.	te	Keeping records may make sense, but this specifies no retention period, requiring the manufacturer to keep the records for ever! There is also no requirement for traceability, i.e., no requirement to link the records to particular tanks, so the records would be of little value anyway.	Delete this para.	
US	4.6		te	The referenced standard is perhaps the most significant part of the requirements for the tank, yet the reference is to an unpublished standard, subject to change.	Withhold balloting on this standard until ISO 21029-1 is published.	
US	4.7	1 st para.	ed	Clearer wording.	Change to read: <u>Except in the vicinity of the pressure relief device, no ice shall form on the outer wall of the fuel tank under normal operating conditions.</u> Under no circumstances shall ice be allowed to form on the outer wall of the fuel tank under normal operating conditions. At the area of pressure relief pipe, local ice formation may form on the outside of the pipe.	
US	4.8.1	1 st para.	te	If "coefficient of safety" is to be retained, it must be defined. If the rules of clause 4.6 apply to the outer tank, then it probably doesn't need to be defined. The proposed wording assumes that it does not.	Change to read: The fuel tanks accessories shall have a Maximum Allowable Working Pressure (MAWP) equal to the maximum pressure the accessory is to be subjected to, which shall be at least 1,5 times the Maximum Allowable Working Pressure (MAWP) of the inner tank with a coefficient of safety of not less than that of the inner tank.	
US	4.8.2	1 st para.	ed	"above the liquid level" will be understood better than "gaseous part".	Change to read: ...and shall be connected directly to the gaseous part <u>of the tank that is above the liquid level</u> under normal operating conditions.	
US	4.8.2	2 nd para.	te	The pressure relief requirements should apply to tanks of all materials, not just those made of steel.	Change to read: In the case of steel inner tanks, The secondary pressure relief device shall limit the pressure in the <u>inner</u> tank to:	
US	4.8.2	3 rd para.	te	It is impossible to demonstrate an equivalent level of safety without a set very specific evaluation criteria. The pressure relief requirements should apply to tanks of all materials, not just those made of steel.	Delete: For other materials, an equivalent level of safety shall be applied.	

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US	4.8.2	Last para.	te	It is impossible for a manufacturer to judge what an equivalent system is. Guidance is needed on what is meant must be provided.	Change to read: Tampering with the devices shall be prevented <u>discouraged</u> by means of a lead seal or equivalent system. a similar system that knowledgeable workers would recognize as something that should not be done.	
US	4.8.5	3 rd para.	ed	Clearer wording. Wording implies that two valves are always required.	Change the last sentence to read: One of these <u>When</u> two isolating devices <u>are required, one</u> shall be mounted directly on or within the fuel tank.	
US	4.8.5	4 th para.	ed.	More clearly describe the requirement.	Change to read: The automatic shut-off valves shall be closed idle (fail-safe). <u>close with loss of electricity or other motive power.</u>	
US	4.8.6		Te	For a very light material like hydrogen we are requiring an accuracy in the level measurement of only 10%?	Recommend that 10% be investigated. This could lead to overfill conditions.	
US	4.8.6	para 2	Te	This paragraph requires a safety factor of 2 while other components require a safety factor of 3.25. Shouldn't the safety factor be 3.25 for each?		
US	4.8.6	2 nd para.	ed	If "coefficient of safety" is to be retained, it must be defined. The proposed words assume the phrase does not need to be used.	Change to read: If the system comprises a float, the latter shall withstand an outside pressure greater than <u>twice</u> the Maximum Allowable Working Pressure (MAWP) of the inner tank with a minimum coefficient of safety of 2 with respect to the buckling failure criteria.	

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DE	4.8.7		te	Delete the last paragraph. It has been previously agreed to be changed that way, but apparently bee forgotten.	<p>4.8.7 Maximum filling level</p> <p>A system shall be provided for preventing the fuel tank from being overfilled. This system may work in conjunction with the refueling station. This system shall bear a permanent marking, indicating the fuel tank-type for which it has been designed and if applicable the mounting position and orientation.</p> <p>The filling process shall not cause any pressure relief device to operate during or after the filling process. The filling process shall not lead to operating conditions the boil-off management system is not designed for and therefore cannot handle.</p> <p>Under all circumstances and regardless of the fuel condition and the maximum operating pressure of the inner tank, the filling volume of the liquid shall not exceed 95% of the water volume of the inner tank.</p>	
US	4.8.7	3 rd para.	ed	The word “water” used before “volume” is unnecessary and confusing. The words “hydrogen”, “salad oil”, and “gasoline” could be used in its place and the meaning would be the same.	Delete “water” and add "at operating temperature.".	
KR	4.9	2 nd par	ed	“minimised” misspelled	The number of joints should be minimised minimized .	
US	4.9		Ed	The word void is confusing.	Replace the word void with the term “annular space” or “space between the inner and outer tanks.”	

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US	4.9	2 nd para.	te	Having a joint in a void is not possible...otherwise it would not be a void.	Change to read: The number of joints should be minimised. Joints shall not be permitted within the void between the inner tank and the outer jacket unless they are welded or glued. Should read: For metallic materials, joints within the annular space between the inner tank and outer jacket shall be welded; for other materials, they shall be joined with a suitable adhesive.	
KR	5.		ed	Test name may be changed	Type-test Design qualification test	
KR	5.		te	Hydrogen liquid is cryogenic. Cryogenic vessel usually be required insulation performance test including boil off test. Insulation performance test should be added		
US	5.1	1 st para.	te	The tank cannot be proved to be adequate for the intended service by passing the type tests...much more is required.	Change to read: The tank material, design, manufacture and examination shall be proved to be adequate for the intended service of the tank by meeting the requirements of the type tests specified in 5.2 to 5.4.	
US	5.1	2 nd para.	te	There is no reason to destroy a tank that has been subjected to the maximum filling test.	Change to read: All tanks subjected to type burst and thermal autonomy tests shall be made unserviceable after the tests. <i>(Or simply delete the sentence since these tests will themselves make the tanks unserviceable.)</i>	
KR	6.		ed	Test name may be changed	Routine Batch test	
KR	6.2	5 th par	ed	"Maximum allowable working pressure" may be changed	Maximum allowable working pressure Allowable Working Pressure	
US	6.2	3 rd para.	te	In order to establish the tank is not leaking, it is required that no additional test media be added.	Change to read: The inner tank shall remain under the test pressure without the addition of test media for at least 10 minutes to establish that the pressure is not decreasing.	

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JP JNC ISO TC 220	6.3		te	The pressure of helium should be given to define the allowable leakage rate as 10 cm ³ /hour .		
US	6.3		te	There are no conditions specified for this test.	Specify test pressure and temperature.	
US	6.3		te	The pressure at which the leaked volume is to be measured is not specified.	Change "10 cm ³ /hr" to "10 atmospheric cm ³ /hr".	
US	6.4		te	All of the requirements of this clause rely on an unpublished standard.	Delete the clause, incorporate the requirements of the reference here, or wait until the reference is published until submitting this document for a DIS vote.	
US	6.5		Te	The section does not require non-destructive inspection of inner tank welds and there is no interpretation of test results to validate that the welds are acceptable for the intended service.	Revise the first sentence: All welded joints of the inner tanks and the internal piping between the inner tank and outer jacket shall be . . . "Reference to ISO 21029-1 may be acceptable, but non-destructive and destructive testing must have acceptance criteria clearly defined. Add a second sentence: Non-destructive test results shall be interpreted to validate that the welds are suitable for the intended service.	
US	6.5	1 st para.	te	The requirements of this para. rely on an unpublished standard.	Delete the para., incorporate the requirements of the reference here, or wait until the reference is published until submitting this document for a DIS vote.	

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US	6.5	2 nd para.	te	This para. allows the manufacturer to do virtually anything she pleases. The requirement should be more specific.	Change to read: All welded joints of the internal pipe work between the inner tank and the outer jacket shall be subjected to 100% nondestructive inspection. whenever possible by radiographic inspection, alternatively ultrasonic test, penetration test, helium leakage test etc. <u>When radiographs can be interpreted, radiographic inspection shall be used. When radiographs cannot be interpreted, ultrasonic inspection shall be used. When both radiographs and ultrasonic inspection results cannot be interpreted, visual inspection of welds, both inside and out shall be used.</u>	
US	6.6		te	Since no inspection openings are required, the visual inspection described here will be difficult. The acceptance criteria must be described much better than "critical damages or defaults". Perhaps ISO 21029 will have something suitable to reference.	Describe acceptance criteria.	
KR	B.3	a)	ed	" ; " should be added	As per clause 4.3.2 ;	
KR	B.3	b)	ed	":" Should be added	-253 to 85 .	
US	B.4		ed		Correct references to clauses for type test descriptions.	
US	B.4.1	1 st para.	te	Relief devices should be subjected to all of the type tests as for valves except for the endurance test. The seat leakage test is particularly important. Passing these tests will not prove them to be adequate...more is required.	Change to read: The pressure relief device material, design, manufacture and examination shall be proved to be adequate for their intended service by meeting the requirements of the type tests specified in C.4.2 to C.4.6 <u>D.2, D.3, D.4, D.6, D.7, D8 and D.9.</u>	
KR	C.3	b)	ed	"," should be change to "	-253 to 85 .	
US	C.4		ed		Correct references to clauses for type test descriptions.	

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US	C.4.1		te	Passing these tests will not prove them to be adequate...more is required.	Change to read: The cryogenic hydrogen valve material, design, manufacture and examination shall be proved to be adequate for their intended service by meeting the requirements of the type tests specified in D.4.2 to D.4.6 D.2 through D.9 .	
US	C.4.1 through C.4.9		Ed	Wrong references	Annex C contains references to Annex E when references to Annex D should be made.	
US	C.4.2		te	It is unnecessary to perform this test on a new valve when both D.5 and D.9 require the test on a stressed valve.	Delete C.4.2.	
US	C.4.3		te	It is unnecessary to perform this test on a new valve when both D.5 and D.9 require the test on a stressed valve.	Delete C.4.3.	
UK	Annex D	All	E	Once the acronym has been defined, use it on its own	Delete 'Maximum Allowable Working Pressure' and the () leaving '...resist its MAWP, which is set...'	
US	D.1	4 th para.	ed	More specific description.	Change to read: The test period for leakage and pressure tests shall be not less than 3 minutes more than the response time of the sensor pressure measuring device .	
US	D.2		Te	In the 3 rd paragraph, there is no requirement to install a pressure limiting control to prevent over pressurizing of the tank.	In the 2d sentence add the term "pressure limiting control" after the words "shutoff valve."	
US	D.2	4 th para.	te	The pressure at which the leaked volume is to be measured is not specified. Simpler wording.	Change to read: Throughout the test, the sample shall be checked for leakage. If a surface-active agent is used, there shall be no formation of bubbles. If the leakage rate is measured with a flow meter, the leakage rate shall be less than 10 atmospheric cm ³ /hour. If a flow meter is used, it shall be capable of measuring, for the test fluid employed, the maximum leakage rate permitted with an accuracy of +/-1%. measured with an accuracy of 0.1 atmospheric cm³/hr.	

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US	D.3	2 nd para.	te	Specify seat leakage test pressure for relief devices.	Change to read: In order to perform the test, The pressure shall be gradually increased to the Maximum Allowable Working Pressure (MAWP) of the component under test <u>for valves. For relief devices, the test pressure shall be 90% of the set pressure.</u> Observations for leakage shall be made with the open outlet submerged in water or with a flow meter installed on the inlet side of the valve under test.	
US	D.3(a)		te	The pressure at which the leaked volume is to be measured is not specified.	Change "10 cm ³ /hr" to "10 atmospheric cm ³ /hr".	
US	D.3(b)		te	The pressure at which the leaked volume is to be measured is not specified.	Change "10 cm ³ /hr" to "10 atmospheric cm ³ /hr".	
US	D.4		Te	There is an inconsistency between the pressure requirements in the first & second paragraphs. The first paragraph means pressures of 1.5 – 3 times MAWP while the supply system gauges have a pressure range of 1.5 – 2 times MAWP. Shouldn't these be consistent?		
US	D.4	1 st sentence	te	Permit caps as well as plugs.	Change to read: The component under test shall withstand without any visible evidence of leak or deformation a test pressure of 1,5 times its Maximum Allowable Working Pressure (MAWP) with the outlets of the high pressure part plugged <u>openings plugged or capped.</u>	
US	D.4	2 nd para.	te	Correct the specification for the pressure gage range.	Change to read: The pressure supply system shall be equipped with a positive shut-off valve and a pressure gauge, having a pressure range of not less than 1,5 times nor more than 2 times the <u>higher</u> test pressure. The accuracy of the gauge shall not be less than 1% of the <u>higher</u> test pressure <u>range.</u>	
US	D.5	1 st para.	te	The pressure decay should be a requirement, not permissive.	Change to read: ...During the off cycle, the downstream pressure of the test fixture should <u>shall</u> be allowed to decay to 50 % <u>or less</u> of the MAWP of the component.	
US	D.5		ed	Correct references to type test descriptions..	Change "E.2" to "D.2" and "E.3" to "D.3".	
US	D.6		ed	Correct references to type test descriptions.	Change "E.2" to "D.2" and "E.3" to "D.3".	

Template for comments and secretariat observations

Date:2004-03-23 Document: ISO_DIS_13985_3

1	2	(3)	4	5	(6)	(7)
MB ¹	Clause No./ Subclause No./ Annex (e.g. 3.1)	Paragraph/ Figure/ Table/ Note (e.g. Table 1)	Type of comment ²	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
US	D.6	2 nd para.	te	Make it applicable to all copper alloys.	Change to read: Copper and brass copper alloy parts...	
US	D.9		ed	Correct references to type test descriptions.	Change "E.2" to "D.2" and "E.3" to "D.3".	
US	D.9	1 st para.	te	The current wording requires only one temperature cycle.	Change to read: The component under test shall be submitted to 96 hours of 24 temperature cycling cycles at its Maximum Allowable Working Pressure (MAWP). Each temperature cycle shall range from the minimum design temperature up to the maximum design temperature specified for the component under test in a period of 120 minutes. and back to the minimum temperature in a period of about 4 hours.	
UK	Annex E		E/T	This Annex is not referenced in the text	Provide a normative reference to Annex E after 4.8.1 (c)	
UK	E.1.2		E	Once the acronym has been defined, use it on its own	Delete 'Maximum Allowable Working Pressure' and the () leaving '...resist its MAWP, which is set...'	
US	E.1.2		te	The test pressure should apply to tanks made from materials other than steel. Testing to only 1.5 times R_m/R_p is unsafe for high strength materials where R_m/R_p might be 1.1 or less. It is impossible to demonstrate tanks made from materials other than steel are "equivalent" to those of made from steel without a detailed set of requirements.	Change to read: The burst pressure shall be at least equal to the burst pressure used for the mechanical calculations. For steel tanks, The burst pressure shall be at least equal to: <ul style="list-style-type: none"> o the Maximum Allowable Working Pressure (MAWP) in MPa plus 0,1 MPa multiplied by 3,25; o the Maximum Allowable Working Pressure (MAWP) in MPa plus 0,1 MPa multiplied by 1,5 and multiplied by R_m/R_p At the Maximum Allowable Working Pressure (MAWP), the principal dimensions perimeter, and length... shall not be modified more than 1%. Once the test is completed, At burst, the volume of the tank shall have increased by more no than 8% above the volume at atmospheric pressure. The performance of hydrogen containers made from materials other than steel, shall be demonstrated to be equivalent to these requirements.	

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1	2	(3)	4	5	(6)	(7)
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US	E.2.1		te	A scenario with the tank filled to 50 percent of capacity may not result in the most severe relief flow demand. The vaporization rate is typically assumed proportional to the wetted perimeter.	Change "half of the maximum allowed" to "the maximum allowed." Add to the end of the sentence "unless an alternate fill capacity is known to result in a more demanding scenario."	
US	E.2.1	1 st para.	ed	Simpler wording.	Change to read: The fuel tank shall be cooled down and the inner tank shall be at the same temperature as the temperature of liquid hydrogen. This requirements shall be deemed met if, during the previous 24 hours, the fuel tank has contained a volume of liquid hydrogen at least equal to half of the water volume of the inner tank at operating temperature.	
US	E.2.1	2 nd para.	te	A tolerance on "half" is needed.	Change to read: The tank shall be filled with liquid hydrogen so that the quantity of liquid hydrogen measured by the mass measurement system shall be <u>within 10% of</u> half of the maximum allowed quantity that may be contained in the inner tank.	
US	E.2.1	3 rd para.	te	A more specific requirement for fire temperature is required.	Change to read: A fire shall burn 0,1 meter underneath the fuel tank. The length and the width of the fire shall exceed the plan dimensions of the container by 0,1m. The <u>average</u> temperature of <u>space 10 mm below the tank as measured by 2 or more thermocouples</u> the fire shall be at least 590°C. The fire shall continue to burn <u>average temperature shall remain above 590°C</u> for the duration of the test.	
US	E.2.1	5 th para.	te	The start of the test must be defined.	Change to read: The lapse of time before <u>from the time the average temperature first reaches 590°C until</u> the opening of the primary pressure relief device shall be measured.	
US	E.2.2	2 nd para.	te	The acceptance criteria should be the same for tanks not made of steel. An equivalent level of safety is impossible to determine.	Change to read: The tank shall not burst and the pressure inside the inner tank shall not exceed the permissible fault range of the inner tank. In the case of steel inner tanks, The secondary pressure device shall limit the pressure inside the tank to the values specified in 4.8.2. For other materials, an equivalent level of safety shall be applied.	

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US	E.3.1	1 st para.	ed	Simpler wording.	Change to read: The fuel tank shall be cooled down and the inner tank shall be brought at the same temperature as the temperature of liquid hydrogen. This requirement shall be deemed as met if, during the previous 24 hours, the fuel tank has contained a volume of liquid hydrogen at least equal to half of the water volume of the inner tank at operating temperature.	
UK	E.3.3		T	Must state how long the records must be kept	Add 'for 10 years'	