ISO/TC 197
Hydrogen technologies

Email of secretary: jim.ferrero@bnq.qc.ca
Secretariat: SCC (Canada)

ISO CD 19880-5 - Collated Comments by WG 22 2017-04

Document type: CD ballot

Date of document: 2017-05-15

Expected action: INFO

Background: Here is the compilation and treatment of the comments from the first CD ballot in 2016.

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

Template for comments and secretariat observations

Date:2017-03-09	Document: TC197/WG22	Project: ISO/CD 19880-5 Collated comments (AMS & Tokyo Meeting)

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
FR 1 001		Clause number is according to the CD draft		GE	In general, this draft has to be rewritten to better separate and regroup definitions, requirements, type tests and if necessary production tests. Also, it would be advisable to clearly distinguish the requirements of the hose per se and those specific to a hose assembly (see below). In many countries, the hose manufacturer has all equipment for the testing of the manufactured hose, whereas the manufacturer of the hose assembly can carry out all other tests. This would be coherent with the two annexes A and B In addition, many requirements are not well defined and left open to any interpretation.		**1st para.: Agreed as below** This draft is prepared according to ISO TC 45/SC1 Guide 976-Rev 7:2013 Guidance on layout of ISO and CEN standards for the format of general product standard. The requirements are specified and the test methods are referred to existing ISO test standards. This draft includes the terms which are quoted in the text of this draft only. Others are referred to ISO 8330. **2nd para.: Accepted**. Rewrite Annex A & B to distinguish the tests for hose or hose assembly. **3rd para.: Agreed as below** Requirements are clearly specified with the test method referring to existing ISO No.. If there is no test standard in ISO, described the detailed test method in this text.
FR 2 002				GE	It should be reminded that there is an existing standard for hoses (outside medical and welding applications) ISO 16964 (Gas cylinders- Flexible hoses assemblies - Specification and testing) which can be referred to in order to avoid redundancy. ISO 16964 could be the reference standard and this ISO 19880-5 could only add what is specific to hoses for filling stations		**Agreed as below** Everybody understands all the necessary requirements have been considered in the CD draft based on the existing gas hoses and other relating applications. Almost all requirements in ISO 16964 were included in the CD draft except some gas compatibilities such as Oxygen and Acetylene with reasons.

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							As for Hydrogen gas, compatibility is confirmed by Leakage, Permeation and Hydrogen Impulse test. See comparison table between ISO16964 and ISO19880-5 at the bottom of this table.
FR 3 003				GE	Whenever necessary it would be better to precisely refer to the test according to a mentioned standard and only write down the requirement to be achieved, without having to describe the whole test or only mention the specific conditions of the test for theses specific hoses.		Generally accepted. When a test is called out which is fully described to meet our purposes for hydrogen, the test will be referenced.
FR 18 004				GE	TYPE and PRODUCTION TESTS per part of the product (apart from § 8 marking and §9.11 Legibility) For the hose only § 6.2 Lining The requirement is not well defined. What does free from defects mean? Any test to check this requirement? § 6 4 Cover The requirement is not well defined. What does free from defects mean? Resistance to abrasion (see § 9.15 for a test), cracking and crazing? Any test to check this requirement? § 6.5 Static electricity dissipation. In addition Type B hoses shall be electrostatically dissipative § 7 Dimensions and tolerances Diameters	Just a recollection of what tests could be done by the hose manufacturer, and those specific to the hose assembly manufacturer	Generally accepted. Revise the Annex A & B accordingly. However, it was agreed in AMS meeting that $ 6.1 through $6.5 are just a general description for the parts of the hose and the detailed requirements are specified in clause 9 Performance. Clause 9 is not only for the test method but also for the requirement. It is a common expression for “Materials and construction” in the hose product standard. § 6 4 Cover 9.8 Ozone test, 9.3 Ultraviolet Resistance and

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					Concentricity § 9.3 Ultraviolet resistance and water exposure test § 9.4 Electrical conductivity (for both hose alone and hose assembly) § 9.5 Kink resistance § 9.6 Torsion strength § 9.8 Ozone resistance § 9.9 Corrosion test (for both hose alone and hose assembly) § 9.10 Pressure cycle test (hose impulse) § 9.12 Hose permeation § 9.13 Hydrogen impulse test (To be defined?) § 9.14 Optional Crush test § 9.15 Optional Abrasion resistance test For the hose assembly § 9.1 leakage What I the requirement? Leakage limit? § 9.2.1 Proof pressure test (Is it a production test?) § 9.2.2 Ultimate strength § 9.4 Electrical conductivity (for both hose alone and hose assembly) § 9.7 tensile test of hose assembly § 9.9 Corrosion test (for both hose alone and hose assembly)		Water Exposure test, 9.11 Marking Material Legibility, 9.15 Optional Abrasion test (Abrasion test is currently under construction in TC45/SC1/WG4) are all relating to “Cover”. Most of the tests are performed by hose assembly. $9.9 Corrosion test is done with hose assembly.
GB 006				Ge	As drafted and in parts, the requirements included in the standard are very prescriptive and in others vague. There is a big emphasis placed on the validation testing and periodic retest requirements. There is a passing reference to a nominated body (Clause 8.1)	The standard should be redrafted so as not to lend weight to any particular part of it. All the requirements included in it shall be applied equally.	**Agreed in the meeting** We understand the comment of “very prescriptive” indicates such as 9.5 Kink Resistance, 9.7 Tensile Test of Hose Assembly, 9.11 Marking Material Legibility, which have detailed test method in this text. And others are indicated as

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							vague. These are the tests already existed in ISO standard. In this text, such tests are quoted by just the ISO number. **We agree to move 8.1 c and d to below the minimum requirements as separate line – In addition, the following may be required per local regulations: - add c and d here.**
GB 007				Ge	The draft is very difficult to read (its structure and language are difficult to understand at times) and there also seem to be missing/unclear requirements. It is suggested that the structure (and requirements?) used for ISO 19880-5 could be based on that used in ISO 16964 (Gas cylinders – Flexible hose assemblies – Specification and testing). In addition and as ISO 16964 is an ISO/TC 58/SC 2 document, would an Expert from that committee be interested in being involved in the drafting of ISO 19880-5.	The standard should be redrafted following the structure of ISO 16964 so as to be clearer and easier to understand and to ensure that all the necessary requirements are included.	**Agreed as below** As same as above, all the necessary performance tests applicable for hydrogen have been taken into consideration. Some performance tests will be reconsidered according to the discussion in the meeting. However, added below to the introduction and therefore, added ISO 16964 to 2. Normative references. For assemblies connecting hydrogen supply system, (including cylinders and tube trailers) to the fueling station, see ISO 16964.
US 1 005				G	This draft does not address leakage and life testing.	WG should address leakage and life testing.	**Same as US 13**
JP02 131		Introduction	Para 5	ge	This is relating to the comment on Scope. The first portion of the paragraph 5.is the same as what we propose to add to the Scope.	Delete the sentence below. This document was developed based on two types, five classes and two ratings of wire or textile reinforced hoses and hose assemblies suitable for use with gaseous hydrogen for hydrogen dispensing at specified temperature ratings.	**Not accepted** Resolved to leave this introduction and add description to avoid confusion. (relation between ISO 16964)
JP03		Introduction	Para 6	ge	Below sentence is not necessary for introduction.	Delete paragraph 6.	**Not accepted**

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132					This standard applies to newly manufactured hose and hose assemblies for:		Leave sentence as it was.
JP04 130		Introduction	NOTE	ge	NOTE is the same as stated in 5.1 Types	Delete NOTE	**Partially accepted** Rewrite description to avoid confusion
JP01 135		Title		ge	Title should to be described more precisely	Gaseous hydrogen -- Fueling stations -- Part 5: Rubber or plastics Hoses and hose assemblies – Specification	**According to TC197 Plenary, change to:** Gaseous hydrogen -- Fueling stations -- Part 5: hoses and hose assemblies;
JP05 121		1 Scope	Whole paragraph	ge	Scope should be described more precisely	See at the bottom of this table.	Same a above JP01
GB 010		01.01		ed	Reword slightly: Is the intention that this standard is for the hose as well as hose assemblies, or just hose assemblies? It would seem to be the latter, based on the testing requirements?	This International Standard provides specification and testing requirements for high pressure flexible hose assemblies intended to be for hydrogen fueling station applications.	Resolved. This is for both “hoses” and “hose assemblies”.
GB 009		01.01		Ed	Does this need a title?	Remove title	Accepted
GB 011		02		Ge	Suggest a reference to ISO 16964 to be included.	Include reference to: ISO 16964, Gas cylinders — Flexible hoses assemblies — Specification and testing 2015 if a dated reference is needed, if specific sections are referred to?	In the meeting, comparison of ISO16964 and CD draft was presented and all the requirements are included in the draft. However, will revise 5.1 Classification to include ISO 16964. Will add ISO 16964 in Normative references.
JP06 125		3 Terms and definitions		ge	Terms should be defined as TC197 not each WG 3.1, 3.3, 3.4, 3.5, 3.6, 3.11 are not existed in the text of ISO/CD19880-5. If some terms are used as the same meaning with another term, make synonym table as annex.	Delete 3.1,3.3, 3.4, 3.5, 3.6, 3.11 Make synonym table as annex.	Accepted
GB 016		03.02		Ge	Dispenser hoses would include the fueling hose, also the vent hose when applicable (depending on the type of nozzle used) Definition only covers the fueling hose	Either include for venting, or have separate definition for dispenser hoses. Do venting hoses have the same requirements as fueling hoses? This should be made clear if that is the case.	Accepted. Vent hose is Type A of this standard. Revise to explain this in Introduction.
FR 4 012		03	03.3		The title says “fill pressure” but the definitions starts with “maximum….”. May be it would be	Define “Maximum filling pressure” as being 1.25 service pressure H35 and H70 and write	Resolved. Same as GB 017. Rearranged terms and definitions

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					simpler to define “Maximum filling pressure” as being 1.25 service pressure H35 and H70 and write a note for the rest of the definition (see § 3.8)	a note for the rest of the definition (see § 3.8)	Make synonym table as annex. (will be considered later)
GB 017		03.03		Ge	Some confusion between 3.3 and 3.8? Should the maximum fill pressure be defined in 3.3 or 3.8, or table 1? H35 & H70 are not defined in this document, and could be linked to 3.9.	Remove last sentence? Include 35 MPa (H35) and 70 MPA (H70) in 3.9	Resolved. Same as FR 4 012 Rearranged terms and definitions Make synonym table as annex. (will be considered later)
CA 019		03.03		Te	The “Maximum fill pressure is limited 1.25 times the service pressure, H35, H70.” is incorrect because the first sentence already said that the “fill pressure” is “The maximum pressure attained at the actual time of filling”. In other words the term “fill pressure” means the same as “maximum fill pressure”. So the “maximum fill pressure” is actually the “maximum operating pressure”, as defined in 3.8	Change “Maximum fill pressure” to “maximum operating pressure”, to be consistent in the use of terms. (also note that the term “Maximum fill pressure” is not used anywhere else in the draft standard)	Resolved. Same as FR 4 012 Rearranged terms and definitions Make synonym table as annex (will be considered later).
CA 018	3rd	03.03		Ed/te	Fill pressure – reference to “service” pressure is incorrect	Change service pressure to working pressure	Resolved. Same as FR 4 012 Rearranged terms and definitions Make synonym table as annex (will be considered later).
CA 021		03.04		ed	Other than the definition, the word “fuel temperature” is not found in the draft standard.	Delete the definition “Fuel temperature”. Also, this is a hose standard, not a dispenser standard.	Accepted. Delete.
GB 024		03.07		Ge	As drafted, this definition is inconsistent with those included in other ISO hose Standards and will cause confusion if it is not rewritten to be clearer	Redraft the definition to be consistent or, as a better option, refer to the new ISO vocabulary terminology Standard. As drafted, is the “design pressure” definition in ISO 10286 (a transportable cylinder term that unfortunately has a rather different meaning for stationary applications) being used here? Would this cause confusion as it is not the test pressure (as stated in ISO 10286)? For hoses the term “rated pressure” is used in ISO 16964….however, the issue with how this relates to	Partially accepted. Redraft “Terms and definitions” if terms are in the text. But not necessary to list terms are not in the text in accordance with the result of TC197/WG24 meeting at Amsterdam.

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						the working pressure then comes up, as there is potentially a higher ratio between rated pressure and working pressure for hydrogen dispensers than that defined in ISO 16964, clause 3.1 Would it be better in this context delete ...before initiating mitigation options … onwards as this is not relevant to the MAWP of the hose assembly. It is guidance for the user of the hose and out of the control of the hose manufacturer. Leave Note (which should read "Note 1 to entry")	
GB 020		03.04		Ge	Consider need for this entry as it doesn't appear to be used? If it is required, rather than specify the location here, refer to ISO 19880-1, in case this requirement changes.	Either: Remove, as not used, or Replace with "Temperature of the hydrogen fuel, measured in accordance with ISO 19880-1"	Accepted. Delete.
GB 022		03.05		Ge	Include definition of "hose assembly"	Defined in ISO 19880-1 (if a better definition doesn't exist in hose specific standards – there is no definition in ISO 16964 or ISO 10286) as: "includes the hose, appropriate end connectors (couplings or fittings), bend restrictors (if necessary), and appropriate markings"	Accepted Define "hose assembly" Put 3.5 "hose assembly" after deleting "hose breakaway device"
GB 023		03.07		Ed	Typo	MAWP rather than NAWP	Accepted.
JP07 025		03.07		ed	NAWP should be MAWP. Typo error.	Replace NAWP with MAWP	Accepted.
CA 026		03.07		ed	3.7 maximum allowable working pressure (NAWP)	Correct NAWP to MAWP	Accepted
FR 5 013		03	03.7		Maximum allowable working pressure (MAWP) and not NAWP (Set point of the pressure relief device protecting the vessel or piping system) The MAWP is also: design pressure/ Maximum allowable operating pressure/maximum permissible working pressure/ maximum allowable pressure. There are too many terms and only one should be defined as being related to national pressure vessel codes. Why not say from the start that MAWP = 1.10 x MOP –see below	define MAWP as being 1.10 x MOP (see 3.8 below)	Accepted. "NAWP" is typo and should be "MAWP". In this clause, it is explained that there are several expressions are used for the same meaning of "MAWP" in the world.

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FR 6 014		03	03.8		What is the difference with the “fill pressure” defined in § 3.3? What is the difference between maximum operating pressure and maximum allowable operating pressure defined in § 3.7 Should we say it is the developed pressure of H2 at 85°C when H2 was at NWP at 15°C which is very close to 1.25 the service pressure as defined in §3.3 (435 and 870 bar)	We should say: it is the developed pressure of H2 at 85°C when H2 was at NWP at 15°C which is very close to 1.25 the service pressure as defined in §3.3 (435 and 870 bar)	MAWP is defined in the “Pressure project” We will refer the result of WG24 meeting
GB 027		03.08		Ge	As drafted, this definition is inconsistent with those included in other ISO hose Standards and will cause confusion if it is not rewritten to be clearer	Redraft the definition to be consistent or, as a better option, refer to the new ISO vocabulary terminology Standard. NOTE It is not clear that this is defined anywhere other than in ISO 19880-1 (which is what has been used for consistency within the ISO 19880 family of standards) and SAE J2601? Is anyone aware of something else being available?	Partially accepted. Same as GB 024
CA 029		03.08		te	“3.8 maximum fill pressure maximum operating pressure (MOP)”. The term “maximum fill pressure” is not appropriate for hoses, while maximum operating pressure is appropriate	Correction: “3.8 maximum fill pressure maximum operating pressure (MOP)”	Accepted. Same as GB 024
JP08 028		03.08		ge	Not necessary to define “maximum fill pressure” If necessary, describe as NOTE.	Add NOTE to explain maximum fill pressure. Also add to the synonym table.	Accepted. Same as GB 024
FR 7 015		03	03.9		This definition should be the basis for all further references above. Hence should be placed ahead of the list of definitions. In addition, a simple table explaining the relationship between these figures would simplify the understanding of the standard.	Add a simple table with all relationships between NWP and the other types of pressure	Not accepted. These are defined in 3. Terms and definitions. They are listed in clause 5.2 Table 1- Pressure classes.
GB 030		03.09			As drafted, this definition is inconsistent with those included in other ISO hose Standards and will cause confusion if it is not rewritten to be clearer	Redraft the definition to be consistent or, as a better option, refer to the new ISO vocabulary terminology Standard. NOTE It is not clear that this is defined anywhere other than in ISO 19880-1 (which is what has been	Accepted. Same as GB 024

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						used for consistency within the ISO 19880 family of standards) and SAE J2601? Is anyone aware of something else being available? It is felt that in this context, that the definition would be better reworded : ...the pressure to which a hydrogen vehicle is fuelled, once the temperature of the hydrogen stored in the vehicle has settled to 15 deg C...	
CA 032		03.09		ed	"3.9 nominal working pressure (NWP) service pressure"	Delete the term "service pressure" from the title	Accepted. Delete service pressure
JP09 031		03.09		ge	Not necessary to define "service pressure" If necessary, describe as NOTE.	Add NOTE to explain service pressure. Also. add to the synonym table.	Accepted.
GB 033		03.11		Ge	Why is this relevant to this document? The word isn't used….	Remove 3.11	Accepted.
GB 034		03.12		Ge	Would a definition of a fueling nozzle (used in description of Type A hoses) be useful?	Use definition from ISO 19880-1? (for nozzle)	Accepted Define "fueling nozzle" according to ISO 19880-1
FR 8 035		04			This paragraph should be placed at the end of the document. Item k) should be deleted and be a specific paragraph for requirements	To be placed at the end of the document.	Will be considered whether place at the end or not. As for item k), they are general instructions when using hydrogen hose for the user.
GB 036		04		Ed	The manual instructions should be located after the section on marking (see 6.3.7.3 of the ISO/IEC Directives part 2)	Move Chap 4 to end of the body of the standard	Same as FR 8 035
GB 037		04	c	Ge	The need for overpressure is irrespective of Type of hose (Pressure classes only being relevant to dispenser hoses) Also, please see comment on 4f – this is equally valid for pressure.	Remove second part of bullet, or at least the "when the hose is marked with a pressure Class (H35, H70)" part of the bullet Also, allowable MAWP is redundant – refer to just the MAWP (or rated pressure if to be consistent with ISO 16964)	Partially accepted. Remove (H35, H70) as this paragraph is applicable all classes. MAWP is specified in clause 5.2 Table 1.

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JP10 038		04	c	ge	As MAWP is not included in the marking, "which is marked on the hose" needs to be deleted.	Delete "which is marked on the hose"	Accepted
GB 039		04	e	Ed	This isn't a statement. Is it an instruction to the manufacturer to include the minimum bend radius? Or is it a statement to the user to the effect that the manufacturer's specified minimum bend radius for the hose shall not be exceeded? (which would need the bend radius to be stated separately)	Remove from ordered list and include under: The manufacturer's instructions shall include, as a minimum: i) The minimum bend radius ii) Installation instructions	Partially accepted Rewrite for minimum bend radius. The hose shall not be used less than specified minimum bend radius.
GB 040		04	f	Ge	This assumes that the temperature rating of the hose assembly is limited by the hose, and not the fittings – is this a requirement in the document?	Please clarify, and ensure the hose is not marked with different operating conditions to those of the hose assembly if these limit the assembly operating conditions.	Accepted. Delete temperature range from marking of hose. See JP 010
GB 041		04	g	Ge	Why is the hose not permitted to be used in a vehicle? If it fulfils the requirements for vehicles (to be assessed separately), is there a reason that prevents the hose from being suitable for use?	Please clarify reasoning behind this statement.	Not accepted It is out of scope of ISO/TC 197. Vehicle hose is different from dispenser hose. Therefore, it was deleted from this standard.
GB 042		04	h	Ed	This isn't a statement.	See comment on 4 e above	Partially accepted. Same as GB 039
GB 043		04	k	Ed	Separate the section "The manufacturer's instructions shall address such items as:..." and the following numbered bullet points from this section, as this is not a statement for the user to follow, rather it is a requirement on the manufacturer.	Remove from ordered list and include under: The manufacturer's instructions shall address, as a minimum: 1) Leakage, 2) Soft spots…. 3) ….	Accepted. Rewrite Instruction manual more understandable.
GB 044		04	l	Ge	(The hose assembly shall provide protection for the user from contact damage) This statement needs further explanation. Is this a statement to be made for the user to follow?	Redraft, for instance: The user shall ensure adequate protection from contact damage / injury (for instance due to low	Accepted. Rewrite Instruction manual Same as GB 043

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						temperatures) is installed around the hose assembly	
JP11 046		05.01	Type A	ge	Need to insert “dispenser hoses” at the beginning	Change as below; Type A: dispenser hoses connecting the dispenser to the fueling nozzle.	Accepted
GB 047		05.02		Ge	Relevant to Type A hoses only. Otherwise this would potentially infer that the pressure in the station is limited to the same as that in the dispenser.	Clarify that not relevant to other types of hoses	Accepted Change Table 1 only applied to Type A as 5.2.1. Add 5.2.2 Type B
GB 050		05.02	Table 1	Ge	Split into 2 tables – are the sizes a requirement, or just guidance of typical sizes? This needs to be made clear by introductory text to the table.	Please clarify in text leading into new Table 2 if this is requirement or informative.	Accepted. Separate the table and explain the size more clearly with NOTE. See at the bottom of this table
CA 051		05.02	Table 1	Te	Can’t move the draft standard on without the TBD’s in the Table resolved.		Accepted
US 3 048		05.02	Table 1	ed	It is very difficult to understand this table as formatted.	Re-format so that pressure classes and hose nominal size are clear, easier to understand or Separate into two tables.	Accepted. Separate the Table See at the bottom of this table
NZ 008			Table 1	ed	Table 1 should include “mm” units after the nominal sizes		Resolved – Table 1 has been modified. Table 2 has nominal size – units are not required.
GB 049		05.02	Table 1	Ge	There is further discussion needed over whether or not this table is useful – if vehicles are not rated to 138% NWP, and therefore dispenser PRVs cannot be set this high in Europe, there is limited point from a European perspective having dispenser components rated to this pressure as a minimum. It should state somewhere that these pressure values for the MAWP should be a minimum. Is it felt that these MAWPs are a requirements? If so, this needs to be clear in the text, as it isn’t currently the case that for instance, H70	To be discussed in WG24 in December, and decision to be taken forward where relevant to dispenser components.	To be discussed according to the result of WG24 meeting.

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					components are rated to 87.5 MPa as seems to be stated by this table.		
GB 052		05.03			Conflicting requirements. In this Clause, the hose temperature rating is stated to be -40 °C to 65 °C. However, in Clause 9.7 the temperature rating is much higher at 85 °C ± 1 °C. Please clarify this position and whether the rated temperature is the same for all pressure classes.	Re-draft the requirements in Clauses 5.3 and 9.7 so that they are either clearer or not in conflict with each other.	Not accepted. Clause 5.3 is for the operating temperature. Clause 9.7 is the accelerated temperature for aging.
FR 9 045		05	05.3	te	This paragraph is difficult to apply and to understand for the user. In the case T0 is used, the user cannot know the operating temperature range. In addition, even the assembly does not require marking the temperature range of the hose.	?	Accepted. Change as below Temperature ratings for hose assemblies shall be suitable for use at a temperature range shown below.
US 4 057		06.X	New	te	It is important to ensure the reader know that all materials need to be suitable for use with hydrogen.	Add: 6.X Hydrogen Compatibility All materials exposed to hydrogen shall be suitable for use with hydrogen.	Accepted Add the proposed sentence at 6.1 General.
GB 053		06.01		ed	Improved clarity	In the first line of the second paragraph delete ...by... and add ...with...	Accepted
GB 054		06.04			Missing requirements This clause states that covers shall ...be resistant to abrasion... but the only test specified to establish whether this requirement is met (Clause 9.15) is optional and only applies to hoses over 3 metres in length.	Requirements for hoses of less than 3 metres in length should be added to the standard and this additional text is suggested for addition as a new paragraph : An outer cover of corrosion abrasion-resistant material (non-PVC). All outer covering shall either be of a permeable material or sufficiently perforated to avoid diffused gas build up".	Agreed and rewritten.
US 5 055		06.05	P1	TE	Important to specify the resistance and the measurement points Requirement for less than 0.1 ohm per meter length of hose – from NFPA 79 for EN 60204 For ESD, SAE J517 for 6 milliamps at 1000 volts at 330 centimetres	6.5 Static electricity dissipation Hose assemblies shall be constructed so as to provide for electrical bonding between the nozzle and dispenser. They shall have a measured	As clause 6.5 is a general description and clause 9.4 is for its requirement We agree to "electrical resistance between

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						resistance of less than 0.1 ohm per meter length of hose.	couplings at each end of a dispenser hose shall not exceed 1MΩ per meter, in order to dissipate static electricity. But we don't think 0.1 Ω/m is necessary for hydrogen hose. Presentation available upon request: ISO_TC197_Static_Electricity_Nishimura_170307.pdf
GB 056		06.05 and 9.4			Confusing requirements. Due to the possible ambiguity of the conductivity/ dissipative requirements will be beneficial to include this as a definition in section 3 In a delivery hose one of the big concerns is generating static or the hose being struck by a static charge. In these cases, the level of hose conductivity needs to be defined. For instance, a static charge can range from tens of volts to 18 000 volts. It is noted that all hoses should have the capability to be cross bonded and given the multitude of options that includes, the standard needs to include requirements that ensure that interchangeability is always possible. 9.4 states that only hoses in category B (within equipment) need to be dissipative, is that correct? The dissipative requirements included in Clause 9.4 clearly state that measurements should be made between end connections. If the hose has a metal braid and this makes contact with or is attached at each end to the end connector, by implication the hose will be conductive and, most likely in the range of tens of ohms. However, the	Re draft the requirements included in these clauses to be consistent with each other and to provide a basis so as to able to ensure that all hoses meeting the requirements of this standard can be cross bonded successfully	Same as US 05

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					required resistance is 1 MΩ per meter (is this intended for hoses that use a carbon charge in their construction with no metal braid?). By definition dissipative resistance lies in the range 3 x 105 Ω to 3 x 109.Ω		
CA 058		07.01	Table 2	Te	Can't move the draft standard on without the TBD's in the Table resolved.		Accepted Will decide by the time of FDIS vote
CA 059		07.02	Table 3	Te	Can't move the draft standard on without the TBD's in the Table resolved.		Accepted Same as CA 058
GB 060		08		Ed	Chapter on marking should come after testing, but before the section on the manual (see 6.3.7.2 of the ISO/IEC Directives part 2)	Move Chapter to later in document.	Accepted Move to later in document
GB 065		08.01	a	Ge	If T0, where are the temperature ratings to be indicated. Also, this is possibly a bad example, as a dispenser hose shouldn't be T0 unless it exceeds the -40 to +65 (or +85?) deg C minimum requirements	Clarify where the temperature rating is to be included if T0 and therefore not on the hose?	Accepted Same as FR 9 045
JP12 067		08.01	a)	ge	Marking order should be the same as 5. Classification Pressure should be pressure class	Change as below; Type, Pressure class, Temperature rating, (e.g. Type A/H70/T1);	Accepted
FR 10 061		08	08.1		d) What is the purpose of the notified body? Is this due to a European Directive? Which one? g) The marking includes a "Q" which is not easy to understand for the customer worldwide. It is better, as in many other standard, to simply state the month and year MMYY. (same for 8.2 f) and 8.3 e))	Change the marking into "MMYY"	Accepted "Q" is commonly used for the manufacturing date code indicating "quarter" However, it "MM/YY" is accepted as a hydrogen hose. "/" is optional.
GB 066		08.01	a	Ge	Make clear that pressure class is only relevant to Type A hoses	Add clarification as to what marking is needed for Type A, and what is needed for Type B hoses	Partially accepted In clause 8.1, marking shall be applied both type A and B

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							as there is no exception specified. But maybe better to add “both Type A and Type B” after Hose (8.1 1st paragraph).
GB 068		08.01	c	Ge	Shall….if necessary – how is this determined if it is a shall or not?	Please clarify	Resolved “if necessary” is understandable. If it is not necessary, not necessary to mark these.
GB 069		8.2		Ge	Is this consistent with ISO 19880-6 – if so, could this not be referenced instead?	Please clarify	Accepted. If/when -6 is published, it will be referenced. However, better to add “thread and seal portion of fittings are out of the scope” in the Scope. And add in clause 3 terms and definitions for hose fittings.
GB 070		08.02		Ge	Is the temperature rating of the fitting not required?	Please clarify	Accepted Add temperature range for hose end fittings
GB 071		08.02	a	Ge	Make clear that pressure class is only relevant to Type A hoses	Add clarification as to what marking is needed for Type A, and what is needed for Type B hose fittings	Partially accepted. Same as GB 066
FR 11 062		08	08.2	te	c) What is the material heat code (HTC#)? Where can this figure be found? Which standard?	The origin of the classification should be clearly described.	Accepted Delete HTC# as it can be traced by the lot mark of hose assembly
JP13 072		08.02	c)	te	Heat code is not necessary to include in the marking as it can be traced by manufacturing date of fitting. In the WG23 standard, the marking of Fittings is stated as “Heat code of the material or marking directly traceable to the material test report”	Change as below; Heat code of the material or marking directly traceable to the material test report.	Accepted
GB 073		8.2	d	Ge	Is the fitting not designed to ISO 19880-6? – if so, shouldn’t this be referenced instead?	Please clarify	Same as GB 069

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GB 074		08.03	a & b	Ge	Annex A seems to imply that there are only samples taken from a batch that are pressure tested. If this is the case, and is considered acceptable, what happens to the marking for hoses that aren't pressure tested? Also, is it not confusing that the maximum allowable working pressure, and minimum and maximum temperatures for the assembly are not included somewhere (unless it is required that the hose is always the limiting factor?)	Please clarify	Agreed. All hose assemblies are proof tested as routine test. However, change Proof test of Annex A to "all assemblies" instead of "min. 3" Also removing Proof Test Pressure from marking requirements, as this may cause confusion regarding pressure where hose can be used.
FR 12 063		08	08.3	te	a) The proof test pressure should be included in the definition part of the standard In this paragraph, under 1) there is a statement about the maximum working pressure (of the hose assembly….), however there is no requirement to declare it. Only the proof test pressure (definition needed, see above) is required.	Define "proof pressure" in the definition paragraph (§3)	Accepted Add in $3
FR 13 064		08	08.3	ge	At the bottom of page 6; it says "However, g) Two digits… . "The idea can be understood but the location of this line is inappropriate and should be an f) just below the e) of § 8.3	Replace as appropriate	Accepted
FR 14 075		09	09.1		The test referred to is (ISO 4080) a permeability test, not a leakage test. What is the purpose of the hose cover mentioned in the second line? Is it only to better see where the leakage comes from? The limit of authorized leakage during these 5 minutes should be specified in the requirement. It cannot be: no leakage.	Use the proper terms and refer to an ISO method that is widely spread in the hose industry	Partially agreed. We are using a short-duration, modified Method 1 test to determine leakage. We will consider the maximum leakage amount as detectable limit such as 10-200 ml/hr
US 6 079		09.01			Requiring that the hose/end-connector have no leakage when leakage due to hose permeation is allowed. It doesn't matter if a hydrogen discharge	Limit allowable leakage from any point source to value established by the manufacturer (as being	Agreed. Separated leakage and permeation. Agree to determine leakage

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					comes from leak or from permeation! While a manufacturer may elect to use a leak test as a production quality control measure, the test is really only meaningful after completion of the hydrogen gas cycling in 9.10. Following the rationale in US comments on 9.12, the allowable leakage from a point source of 200ml/hr is acceptable as it is small compared to other allowables and is not capable of sustaining a flame.	accepting for his product) but not exceeding 200 ml/hr under any circumstance.	detectable limit- 10 – 200 ml. Homework Japan.
JP14 080		09.01		te	Although ISO 4080:2009 Method 2 is quoted, amount of leak is not necessary to measure and pressure hold time is different from ISO 4080 Propose to perform Hose leakage at the beginning of Hose Permeation	Change 9.12 to include Hose leakage to 9.12 Hose Permeation Delete 9.1 and change section numbers accordingly.	Agreed to pull out method from ISO 4080 and include directly in this standard.
JP15 081		09.01		te	During the Leakage test, it is natural to have bubbles from perforated holes. Need to add the description it is not a defect.	Add the following sentence. In this test, bubbles from perforated holes shall not be deemed as defect unless otherwise the bubbles are abnormal e.g. large amount of bubbles come out continuously.	Accepted
US 7 086		09.02.1	P2	TE	The proof pressure test should be used to check for both leakage and strength after completing 9.5 and 9.6, especially since leaks have been found in hose assemblies after use. To properly test for leaks, hydrogen should be use. Also, use of water or oil could contaminate hose.	Hydrogen shall be used as a test fluid.	Agreed as below This test is to confirm the reinforcement strength. Therefore, not necessary to test with Hydrogen. Leakage test will be revised and separated considering small leak but not permeation. We agree to add Proof test after the test for Torsion resistance, Vertical strength (replaced Kink resistance), and Tensile test of hose assembly.

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							However, leakage can be detected by Helium or air. Also, Proof test shall be performed for each hose assembly after production as a routine test. Therefore, as Hydrogen can't be used by economical reason.
CA 085		09.02.1		Ed	9.2.1 Proof pressure test "…a hose assembly shall withstand without bursting or visible loss of fluid with the pressure of two times of MAWP for 5 min…." and "This is a non- destructive test,". The latter statement is not true – after a test to 2x MAWP, the hose is for all intents and purposes, unusable, i.e. it must be destroyed.	Delete the statement "This is a non- destructive test,"	Disagree. Proof test is not a destructive test, and is done for every hose assembly.
GB 082		09.02.1		Ed	Reword	When tested in accordance with ISO 1402, a hose assembly shall withstand a pressure of at least two times MAWP for 5 min without bursting or visible loss of fluid.	Accepted
JP17 084		09.02.1		ed	Proof Pressure Test should be Proof test. 9.2.2 Ultimate Strength does does not include "pressure"	Change to Proof test	Accepted
JP16 083		09.02.1		te	As Proof pressure test needs to be performed as Routine test, 5 min is too long.	Change pressure hold time to 30 to 60 sec. according ISO 1402 instead of 5 min.	Accepted
FR 15 077		09	09.2.2	te	Since 3.5 x MAWP and 4 x MOP are different figures, this document should select only one possibility for the industry.	Select only one figure	Accepted Decided to use X 4 MOP. But add note stating this test can be performed in accordance with national standard.
CA 087		09.04		te	"For Type B Hose: TBD". Can't move the draft standard on without the TBD resolved.		Accepted
US 8		09.04	P1	TE	1 M-ohm is a very high resistance for something	When determined in accordance with clause 4.8 of	Same as US 05

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088					that should be conductive and dissipate static electricity. Is this being mistaken for grounding? Also, is the meter referring to length of hose	ISO 8031:2009, electrical resistance between couplings at each end of a dispenser hose shall not exceed 1MΩ 0. 1 ohm per meter length of hose, in order to dissipate static electricity.	
US 9 089		09.05	P3	TE	100 cycles is not representative of what is seen in the field. Consider 15000 or a number based on cycle life + TBD safety factor. (10 years * 2 fills per day *2 safety factor)	Repeat this procedure for 100 15000 cycles or a number based on cycle life + TBD safety factor	**See JP 18 091 and see below:** Regarding “Abnormal load”, three tests “Vertical load strength”, “Torsion strength” and “Tensile test of hose assembly” were assigned. Kink resistance has been deleted as “Torsion strength” and “Vertical load strength” are determined as alternative.
JP18 091		09.05	Whole clause	te	Kink resistance at -40℃ is the same test as 9.6 Torsion Strength. Not necessary to specify Kink resistance as a separate test.	Delete 9.5 Kink Resistance. Instead, add new clause 7.3 Minimum bend radius after 7.2 Concentricity and change the number for the Table accordingly. See below the description of Clause 7.3. When determined in accordance with the tests bent to the minimum bend radius, the values given in Table X shall apply.	**Accepted** Kink resistance is replaced with Torsion test with 1000 cycles based on the usage pattern of hydrogen hose. Will reconsider the offset distance. **ISO 6802 Rubber and plastics hoses and hose assemblies with wire reinforcement – Hydraulic impulse test with flexin**g
CA 090		09.05	Table 4.1	Te	Can’t move the draft standard on without the TBD’s in the Table resolved.		**Accepted**
FR 16 078		09	09.5.1	te	Under c) there is no requirement for pass-fail criteria. A requirement must be added. Are there any similar requirement for type B hoses? If not, rearrange the numbering of this paragraph.	Add a pass-fail criteria	**Accepted** Rewrite c) as below, inspect it for no delamination, no cracking or no breaking.
JP19		09.05.1		ge	No title of 9.5.1 is necessary	Delete the title of 9.5.1	**Accepted**

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092							
US 10 093		09.05.1	P1-3	TE	It is important to perform this test with the hose assembly because leaks have been found due to poor hose end fitting connection Change appendix as appropriate	When tested in accordance with method B of ISO 10619-2: 2011 at a minimum temperature of the hose assembly being rated the hose assembly shall not become damaged or leak and shall meet the electrical resistance limits specified in Section 9.4, Electrical Conductivity when tested as follows. This is a destructive test, do not use these test samples for any further testing or for resale. Bend a hose assembly at -40°C degrees to a half of the Minimum Bend Radius given in Table 4 (along the mandrel size of a half of Minimum Bend Radius) Hold the hose assembly in position for 1 minute, then straighten the hose assembly and allow it to recover for 2 min. Repeat this procedure for 100 cycles. Upon completion of the cycling, check the following:	**Agreed as below:** For the abnormal load, we add additional tests – vertical load strength – clause 9.5; and torsion strength – clause 9.6, and tensile test of hose assembly – clause 9.7. Will reconsider the offset distance necessary to simulate twisting moment. Excess torque applying to the nozzle is not applicable as nozzle is out of scope of this standard
JP20 094		09.05.1	Para1	ge	at a minimum temperature, should be “at the lowest temperature” If clause 9.5 is deleted, not necessary to consider.	Replace “a minimum“ with “the lowest”	**Accepted**
JP21 095		09.05.1	Para3	te	No temperature is given for Rating T0. If clause 9.5 is deleted, not necessary to consider.	Replace “at -40°C degrees” with the description below. at the lowest temperature of the hose being rated	**Accepted**
JP22 096		09.05.1	Para3	te	This procedure to “repeat this procedure for 100 cycles” is exactly the same as 9.6 with even longer cycles. If clause 9.5 is deleted, not necessary to consider.	Delete clause 9.5.	**Accepted**
JP24	2	09.06		ge	Year of publication of ISO 6802 should be	Change to Method 2 of ISO6802:2005	**Accepted**

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098					necessary as the Method 2 is quoted. If the detailed procedure is described in the text, this comment should be ignored.		
JP25 100		09.06	Test conditions	te	Necessary to describe more detailed sample setting to determine the resistance to the “Torsion”.	1）Direction of the offset. 2）Install sample hose to the tester in order not to give torsion at the distance center of “l” specified in ISO6802 Figure 2	**Accepted**
JP26 101		09.06	Test conditions	te	No description for the temperature for Rating T0	Change “-40°C” as below. at the lowest temperature of the hose being rated	**Accepted**
JP23 097		09.06		te	To do the test it is not sufficient to quote ISO6802.	Describe the detailed procedure in the text. Then delete the ISO 6802 from Reference standard	**Partially accepted.** OK to refer. Agreed to reconsider offset distance to have adequate torsion strength.
US 11 099		09.06	P2	TE	1000 cycles is not representative of what is seen in the field. Consider 15000 or a number based on cycle life + TBD safety factor. (10 years * 2 fills per day *2 safety factor) Clarify test is done with assembly (recommend checking wording of all test performed with hose assembly	When tested in accordance with ISO 6802 with the conditions listed below, a dispenser hose assembly shall withstand 1000 15000 cycles or a number based on cycle life + TBD safety factor	**Agreed as below:** Add assemblies However, 10 years’ service life is too long. Agreed required cycle for Torsion test is 1000. See JP23
US 12 102		09.06 & 9.7		Te	These are abnormal load tests; moment and axial load are addressed – excess torque is not addressed. Abnormal Loads 9.6 Torsion (Bending Moment) Strength The description of this test is unclear as to the	Clarify and add requirements as described.	**Agreed as below:** For the abnormal load, we add additional tests – vertical load strength – clause 9.5; and torsion strength – clause 9.6, and tensile test of hose assembly – clause 9.7. Will reconsider the offset distance necessary to

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					purpose and the method. I believe that this test should be applying a moment on the hose/hose connection joint. The load applied should be greater than that required on the nozzle/receptacle (ISO 17268 7.10 Abnormal Loads). A moment in excess of 240 N-m should be applied to the hose normal to the centerline of the hose end when mounted horizontally. This test would simulate some failing against the hose while the nozzle is attached for the vehicle. A value like 360 N-m is suggested to the committee as being suitable. The requirement is for the nozzle/receptacle joint to be the weak link and not the hose/end connector. A failure at the nozzle/receptacle should maintain containment of the fuel. A failure at the hose/end connector will not maintain containment. 9.7 Tensile Test of Hose Assembly This test is easier understand. The test is modelling a drive away. The problem here is that the test load is insufficient. The first point of release should be the breakaway (DIS 19880-3:2016 Part 9.2.7). This document requires the breakaway to release before reaching a load of 1000 N. The nozzle/receptacle is to release above 2000 N (ISO 17268 7.10 Abnormal Loads), the second level of safety while maintaining containment. The hose/end connector should fail at a higher level. A value like 3000 N is suggested to the committee as being suitable. X.X Excess Torque This is a missing test. This test would model twisting of the hose at the hose/end connector. A failure at the hose/end connector joint or the		simulate twisting moment. Excess torque applying to the nozzle is not applicable as nozzle is out of scope of this standard

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					device/ end connector joint are equally problematic. There is no requirement for the nozzle (ISO 17268). The breakaway requirement (DIS 19880-3:2016 Part 9.2.7) is 150 % of the rated installation value which is not actionable out of context. A table supplying the standard torques for machine and tapered pipe threads for ferric and austenitic stainless steel with the 150% multiplier would be helpful.		
Resistance. GB 103		09.07		te	Missing requirements. As a performance type test this is satisfactory, but being part of the production acceptance test is not practical.	Requirements should be included that state if one manufacturer makes/assembles both the hose and its end fittings, then the tests set out in 9.7 need only be carried out on assemblies from each manufacturing batch of hoses and end fittings.	**Accepted** Move Hose to Hose assembly
GB 105		09.10			Missing requirements. As a performance type test this is satisfactory, but being part of the production acceptance test is not practical.	Requirements should be included that state if one manufacturer makes/assembles both the hose and its end fittings, then the tests set out in 9.7 need only be carried out on assemblies from each manufacturing batch of hoses and end fittings.	**Seek clarification on comment.** 9.10 need only be carried out on each batch. (9.7 or 9.10 in comment?) Production acceptance test is not carried out per manufacturing batch (lot). It is a test carried out to control the quality of manufacture. Add below to the end of the paragraph of Annex B It is recommended to carry out per 3 000 m of hose production.
US 13 104		09.10			While hydraulic testing may be used in conjunction with actual hydrogen gas cycling, it is not how hydraulic testing by itself can demonstrate the ability withstand hydrogen pressure cycles over the range of possible fill temperatures (-40C to 85C) where hose materials could experience blistering or blow-out, for example, due to high temperature	Define a realistic performance-based cycle test using hydrogen gas for at least a portion of the testing: 1) At least 10 samples shall be submitted for testing. Each sample shall be a complete hose assembly with end connections representative of production and at least 0.3m	Draft of Hydrogen Impulse test has been presented and a discussion was made to consider a realistic required cycle. Propose 10,000 for the tentative minimum required cycles. **See US 14**

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					and/or the permeation of hydrogen into the hose structure. Per WD19880-1, at least 100 cycles to 1.5xNWP needs to be conducted.	of hosing. 2) Type B dispenser hoses shall perform at least 500 hydrogen fill cycles to the hose MAWP (1.38xNWP) at -40C to simulate “normal” fast fills. Each cycle shall ramp to pressure in 3 minutes, hold at pressure for 30 seconds, and then depressurize in 30 seconds to 0.5MPa for a 2-minute hold before starting the next cycle. 3) At least 100 cycles total shall then be conducted with hydrogen gas to 1.1xMAWP (1.5xNWP) to simulate the fault condition. The test shall be conducted at +65C. Each cycle shall ramp to pressure in 3 minutes, hold at pressure for 1 hold, and then depressurize in 30 seconds to 0.5MPa for a 10-minute hold before starting the next cycle. 4) A minimum of 500 additional cycles shall then be conducted at the conditions defined in Item 1. After the above service (aging) tests, permeation (and leak) tests shall be conducted as defined in 9.12. Failure to meet the criteria in 9.12 shall be deemed a failure. Following successful completion of the above hydrogen gas tests, the remainder of the impulse cycling may be conducted as already defined in Clause 9.10 of CD19880-2 except that the proof test in 9.2 shall be conducted (and passed) after completion of the cycling.	We separate 9.10 Pressure cycle test and 9.13 Hydrogen Impulse test. Pressure cycle test is to determine the hose strength for the pressure and leakage resistance under pressure and temperature with hydraulic or water/water glycol. In order to see leakage resistance under repeated pressure with highest temperature rating This can be determined not using Hydrogen but using oil or water/water glycol pressure with elevated temperature. Leakage likely to occur when temperature drops from high to room temperature. Therefore added cool down phase for this Hydraulic impulse test. Plastic lining becomes hard and leakage is unlikely to occur at lower temperature.
US 14 108		09.10 & 9.13		T	The tests do not properly address cycle life. The final test would be a cycle life test. It would take elements from the current draft test: 9.10 Pressure Cycle Test (Impulse Test) 9.13 Hydrogen Impulse Test And the derived service life. Service life should dominate. Cycle life should be verified to avoid a	Add a cycle life test.	Same as above. Hydrogen impulse test has been proposed as an overall durability test for Hydrogen hose. However, correlation between actual number of the filling and impulse cycle number has not been confirmed at this moment. Therefore, move 9.13

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					catastrophic surprise. Cycle Life: The test in question is not an accelerated life test. The test would use a minimum of 6 hose assemblies. Again, the assembly can be as short as 10". This would mean that each sample would have two end connections and about 6 inches of base material per sample. The cycles shall be determined by the service life determined above. Assume ten, six minute cycle at peak hours and that peak hours cover 15% of the daily usage; ~65 cycle/day or ~2.8 cycles/hr. Total cycles is service life in hours times cycles/hr. In this example this would be ~3000 cycles. Of the cycles, the first 100 cycles and the last 100 cycles would be on hydrogen a maximum rated temperature for a duration of 1 cycle per minute (testing for blistering). The balance can be done hydraulically at a faster cycle rate. Compare the results of the service life tests to cycle life tests to determine which is limiting. If service life is limiting, that is the product life. If cycle life is limiting, calculate the service life for the average number of cycles to failure and this becomes the product life.		Hydrogen impulse to Informative annex with the cycle of 10 000 as tentative minimum requirements.
JP28 107		09.10	Figure4	te	The description of "P+/-5%" is wrong. Upper range of pressure wave form shows p +/-5% but the dimension lines reflect +/-5% of p.	Remove "p" in "p ± 5%" or Rewrite as "±5% p".	Accepted

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JP27 106	1	09.10		te	No description for the temperature for Rating T0	Change “65 °C” as below. at the highest temperature of the hose being rated	Accepted
FR 17 076		09	09.12		Where does the 500 cm3/m/h come from? Is it industry standard for NWP of H35 and/or H70? In the third sub-paragraph, we have to choose between 1.1 x MAWP and 1.5 NWP, which does not correspond to the same final figure;	The 500 cm3/m/h seems to be a high end figure. What is the average permeation observed in the hose industry for H2 at these pressures?	As permeation test is separated from Leakage test,,500 ml/m.hr is a good number. This 500 cm3/m/hr is the level hydrogen concentration does not exceed 1000 ppm at the distance of 4 cm from the hose. See PPT material. Same as US 06
US 15 109		09.12			The “permeation test” measures both leakage and permeation – not just permeation. The leakage/permeation must be met over the life of the hose and not just on a new part. Exposure to pressure/temperature cycles associated with fills (in 9.10) may cause internal damage, leading to increased leakage and/or permeation. While a manufacturer may elect to use a leak and/or permeation test as a production quality control measure, the test is really only meaningful after completion of the hydrogen gas cycling in 9.10. Based on the FCV GTR, the allowable vehicle leakage for a standard size vehicle is 150Ncc/min = 9000ml/hr. The proposed leakage of 500 ml/min means the hose is the “driver” relative to hydrogen emissions. This does not seem acceptable. Assuming that we do not want the hose to contribute more than 10% to hydrogen emissions	Make it clear, this is total permeation/leak test. Require conduct of the permeation/leak test only after hydrogen gas cycling as defined in comments on 9.10 above. Establish an allowable hose leakage/permeation of	Agreed is as below. Leakage and permeation need to be separated. Permeation is an unavoidable phenomenon in the principle as polymeric material is used as lining. And the amount of permeation is constant as long as the materials and construction are the same. However, leakage shall be avoided as hose assemblies when they are manufactured. And also, need to be inspected for each assembly after manufacture as a routine test after proof test. Permeation takes some certain period of time to come out as Hydrogen passes through polymeric material. Normally it takes at least around 150 minutes. Leakage occurs from the early stage of pressurization

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					and that a typical length for a standard fueling hose is 3m, the allowable dispenser hose leakage/permeation should be no greater than 900 ml/hr for a 3m hose. In order to prevent a sustainable ignition, there should also be a maximum local leakage. Per SAE J2579, the max local leakage should be 3.6 ml/min (equal to about 200 ml/hr). Reference: “Flame Quenching Limits of Hydrogen Leaks”, paper number 08B-315 at the SAE 2007 World Congress.	200ml/hr/m at 1.1xMAWP (1.5xNWP). For a typical 3m dispenser hose, this corresponds to 600 ml/hr. Impose a max allowable local leakage limit of 200 ml/hr based on a standard bubble test.	if the hose assembly has some defect at the hose crimp or hose body. Leakage test can be performed within 5 minutes. The amount of permeation increases proportionally to the hose length. On the other hand, local or point leakage is not supposed to change even hose length changed.
JP34 110		09.12		te	Regarding “Permeation test”, add safer and more highly precise test method as Method 2 Then the previous test should be Method 1	See at the bottom of this table	Accepted. Redraft Permeation test according to the collated comments.
NZ 111		09.12		ed	In section 9.12 the units of temperature for Tt should be specified and deg C		Accepted Add ℃
CA 112		09.12		ed	“….less than 1.1 times the specified maximum allowable working pressure, or 1.5 times service pressure, is….”.	Change service pressure to working pressure	Accepted Change to nominal working pressure
JP33 113		09.12	formula	ed	cm3N	cm3N	Accepted
JP29 114		09.12	para1	te	The unit of “Permeation” should be cm3N/m.	Replace “cm3/m” with “cm3N/m”	Accepted
JP30 115		09.12	Para3		Service pressure should be “nominal working pressure” Term should be standardized.	Replace “service pressure” with “nominal working pressure”	Accepted

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JP31 116		09.12	The last para	te	As test is conducted in accordance with ISO 4080, the test temperature is 23℃+/-2℃, “If the condition of standard pressure and 15℃” is not necessary.	Delete “If the condition of standard pressure and 15 ℃ cannot be controlled”	Accepted
JP32 117		09.12	The last para	Ed	cm3N	cm3N	Accepted
GB 118		9.13			Is this test really necessary, if it is then consideration should be given to changing the test medium to Helium.	Either delete this clause or consider redrafting it so as to include Helium as the test medium	This is a type test. As presented Hydrogen Impulse test, this test is the main durability test and cannot be evaluated with Helium as the properties are different. Note, this Test is moving to an informative annex for present.
CA 119		09.13		Te	“9.13 Hydrogen Impulse Test TBD by CD or DIS stage.” - Can’t move the draft standard on without the TBDs resolved.		Accepted Hydrogen impulse test has been presented in Amsterdam meeting Detailed test procedure will be drafted in the next 2nd CD.
US 16 120		09.14	P1	TE	Crush test should be mandatory since hose damage due to being run over by a vehicle is likely. Crimps can be problematic. Change appendix as appropriate	9.14 Optional Crush Test	Accepted Although it is not necessary for suspension (hanging) type, hose (assembly) manufacture does not know it is used which type.
US 2 133		No test		T	The tests do not properly address service life. Life consists of service life and cycle life. It is uncertain as to which is dominant. Therefore, the following accelerated test is suggested for service life. Service Life The test would use a minimum of 18 hose	WG should address leakage and life testing.	Same as US 13 Durability and service life are tested and evaluated by clause 9.13 Hydrogen Impulse test. Regarding expected profile, our opinion is as below; According to the hydraulic impulse test and Hydrogen impulse test during the

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					assemblies. The assembly can be as short as 10". This would mean that each sample would have two end connections and about 6 inches of base material per sample. (A variant might be for the assembly to be long enough to be bent and restrained in a 'U-shape' to include the bend in the life determination.) Each sample shall be held at maximum rated temperature and pressure for a specific time period. The time periods would be set by decade (e.g. 5, 50, 500 hours). The test media would be hydrogen. Six samples would be removed from the aging cycle after the first-time period (~5 hrs). Six samples would be removed from the aging cycle after the second-time period (~50 hrs). And the last six samples would be removed from the aging cycle after the final time period (~500 hrs). The samples would be depressurized, purged, and then hydrostatically tested at temperature to burst. The data would be plotted on semi-log paper with an expected profile similar to Figure 1. This test assumes that maximum rated temperature is limiting. The test should allow include life testing at minimum rated temperature to determine the actual limiting profile. Using the limiting profile data, extrapolate the nominal life curve and the minimum life curve. The nominal life curve is shown in figure 1. The minimum life curve would be the regression line for		development, it is confirmed that no burst pressure reduction occurred by the test under rated temperature and pressure with Hydrogen. (reinforcement wire or yarn does not deteriorate) Therefore, proposed semi-log plotted data becomes horizontal line and the service life is determined as infinite. According to the test data, it is confirmed failure mode of Hydrogen hose under user environment is a fatigue fracture of the lining material by repeated Hydrogen pressure at low temperature and it is a leakage from hose body or hose end not a hose burst. Therefore, Hydrogen impulse test is being proposed as an overall durability test for Hydrogen hose. However, correlation between actual number of the filling and impulse cycle number has not been confirmed at this moment. Therefore, move 9.13 Hydrogen impulse to Informative annex with the cycle of 10000 as tentative minimum requirements. (same as US 13) Considering "Shelf life" issue, we agreed to test Ultimate strength (hose burst

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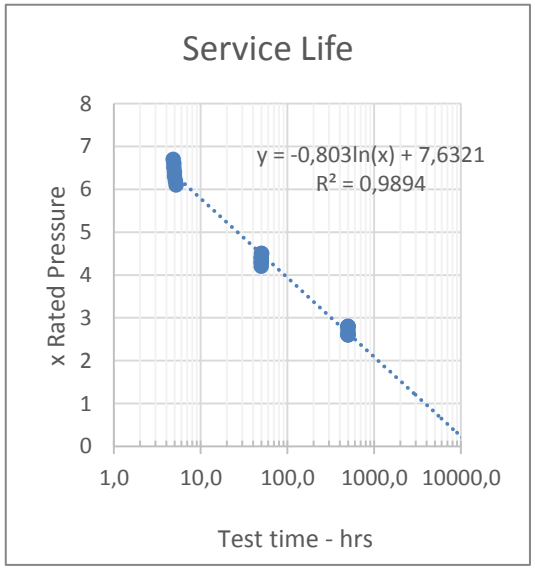
					the minima points at each time point in figure 1. The nominal data should be extrapolated to a criterion agreed upon at ISO. For this discussion, twice rated pressure is suggested. The minima data should be also extrapolated to a criterion agreed upon at ISO. For this discussion, 150% of rated pressure is suggested. Figure 1 Expected profile  This test could be coupled with the leakage tests to understand if permeation changes with service.		test) and Tensile test of hose assembly after the preconditioning of 85 ℃ X 70 hr.
JP35 123		10.		ge	Maximum of five-year is not necessary. “whenever a change in the method of manufacture or materials used occurs” is sufficient	Delete “maximum of five-year”	Accepted

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US 19 126		Annex A		TE	Because of poor end fitting connection has been a major issue with hoses, Kink resistance, torsion test and tensile test should be added to Routine testing	Add 9.5, 9.6, and 9.7 to routine test in addition to being proof test	Not accepted These tests cannot be performed as routine test. Routine test is those performed every production. These are labor, time and cost-intensive. 9.7 is a destructive test! These tests are for quality control.
GB 127		Annex A		Ge	Due to the reference in Clause 10, these tests are normative. Is it correct that routine testing includes only samples from a batch? This seems to conflict with the description in Clause 10, para 3?	Change to “Normative” Please clarify if “number of samples” under “routine” test is appropriate? If so, modify the description of routine test in Chapter 10 to say this is routine per batch of hoses, not per hose. If not, remove this column	Accepted Change number of sample for appearance and dimensions to whole length and for proof test to all assemblies.
JP36 128		Annex B		te	Even Annex B is informative, better to determine the recommended frequency for Production test as it is hydrogen hose. Recommend to conduct per 3000 m of hose production.	Add below to the end of the paragraph It is recommended to carry out per 3 000 m of hose production.	Accepted
US 20 129		Annex B	09.2	TE	It is important to perform this test with the hose assembly to check for leakage of the end fittings which has been a past problem Change appendix also	Change 9.2 to include hose assembly.	Accepted Move to hose assembly
US 17 122		10 Annex B	P4	TE	There are no testing frequencies in Annex B, but it is important to add them.	Add frequencies to Annex B or change following phrase in Clause 10 The frequencies specified in Annex B are given as a guide only.	Accepted Add “It is recommended to carry out per 3000 m of hose production.

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CA 124		22.03		ed	"Pressurize the assembly to the maximum rated hose pressure, or 1.25 times the service pressure, …"	Change service pressure to working pressure	Accepted Change to Nominal working pressure
US 18 134		Table A.1		ED	Wrong reference	79.5 Kink Resistance (Minimum Bend Radius	Accepted If clause 9.5 is remained

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FR2

Table — Comparison of ISO 16964 and ISO/CD19880-5

Basically, these clauses are existed in ISO/CD19880-5
Substituted by different methods
Not existed in ISO/CD19880-5 with reasons
Not existed in ISO 16964 but existed in ISO/CD19880-5

ISO 16964	ISO/CD19880-5	Comments
1 Scope	1 Scope	
2 Normative references	2 Normative references	
3 Terms and definitions	3 Terms and Definitions	
Not existed	4 Instruction manual	Consider to move to the later section
Not existed	5 Classification	
Not existed	5.1 Types	Type A: Dispenser hose, Type B: Not accessible to the public (no specific to type B requirements specified yet)
Not existed	5.2 Classes	H11 to H70 are listed with NWP, MOP, MAWP
Not existed	5.3 Rating	T0 & T1 T1 is dispenser application
Not existed	6 Materials and construction	These are brief description for the construction of the hose. Detailed tests to determine each performance are in clause 9 Performance (9.1 to 9.15)
Not existed	6.1 General	
Not existed	6.2 Lining	
Not existed	6.3 Reinforcement	
Not existed	6.4 Cover	
Not existed	6.5 Static electricity dissipation	
Not existed	7 Dimensions and tolerances	These are necessary for manufacturing hose.
Not existed	7.1 Diameters	
Not existed	7.2 Concentricity	
4 Requirements	9. Performance	Requirement and detailed test procedure are different as ISO 19880-5 is specialized in Hydrogen dispensing hose.
4.1 Production pressure tests	9.2 Hydrostatic Strength	
4.1.1 Strength test	9.2.1 Proof pressure test	
4.1.2 Leak test	9.1 Leakage and 2 Normative references	
4.2 Type tests	Annex A (normative) Type tests and routine tests	
4.2.1 General	2 Normative references and 11 Test report	
4.2.2 Burst pressure test	9.2.2 Ultimate Strength	
4.2.3 Pressure cycle test	9.10 Pressure Cycle Test (Impulse Test)	

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					4.2.4 Oxygen compatibility test	Not existed	Hydrogen hose is not exposed under pure Oxygen and Acetylene.
					4.2.5 Acetylene compatibility test	Not existed	
					4.2.6 Gas material compatibility	9.1 Leakage 9.12 Hose Permeation 9.13 Hydrogen Impulse Test	As for Hydrogen gas, compatibility is confirmed by Leakage, Permeation and Hydrogen Impulse test.
					4.2.7 Test of the safety cable	Not existed	Not applicable as safety cablei is not used for Hydrogen hose
					4.2.8 Additional tests	No title existed	
					4.2.8.1 Kink test	9.5 Kink Resistance- (Minimum Bend Radius)	Will be replaced with “Vertical load strength”
					4.2.8.2 Side impact test	9.14 Optional Crush Test	In ISO/CD19880-5, evaluate the durability when the hose is run over by a car.
					4.2.8.3 Tensile pull test	9.7 Tensile Test of Hose Assembly	
					4.2.8.4 Fatigue cycling test under pressure (Only for the metallic lined hoses)	9.6 Torsion Strength	The flexing resistance is tested by modified ISO 6302 generating tortion.
					4.2.8.5 Torsion test	9.6 Torsion Strength	The torsion resistance is tested by modified ISO 6302 by generating tortion.
					4.2.8.6 Permeability test	9.12 Hose Permeation	
					5 Marking	8. Marking	
					Annex A (normative) Examples of kink test, side impact test and torsion test	Not existed or 2 Normative references	
					Not existed	9.3 Ultraviolet Resistance and Water Exposure Test	Not existed in ISO 16964. However, these are necessary for Hydrogen dispensing hose.
					Not existed	9.4 Electrical Conductivity	
					Not existed	9.8 Ozone Resistance	
					Not existed	9.9 Corrosion Test	
					Not existed	9.11 Marking Material Legibility	
					Not existed	9.13 Hydrogen Impulse Test	
					Not existed	9.15 Optional Abrasion Resistance Test	
					Not existed	10 Frequency of testing	It is a normal practice for hose standard
					Not existed	Annex B (informative) Production acceptance tests	Same as above

JP05 Below will be modified according to the result of Tokyo Meeting.

This standard relates to two types, five classes and two ratings of wire or textile reinforced hoses and hose assemblies suitable for use with gaseous hydrogen for hydrogen dispensing at specified temperature ratings.

This standard contains safety requirements for material, design, manufacture and testing of gaseous hydrogen hose and hose assemblies.

Hose and hose assemblies excluded from the scope of this document are those:

used as part of a vehicle on-board fuel storage system, high pressure

used as part of a vehicle low pressure fuel delivery system

Metal flexible hoses

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NOTE Classification of hoses are in accordance with clause 5. Classification

JP34

Method 2

a. Each sample shall have a minimum hose free length of 600 mm excluding end fittings and shall be assembled with applicable fittings.

b. Plug one end of each sample using an approved plug appropriate for the fitting(s) used on the hose being tested and connect the other end to a regulated hydrogen pressure source using appropriate connectors and adapters.

c. Pressurize the assembled hose to the maximum working pressure (MOP) using hydrogen in a sealed chamber filled with an inert gas and hold the sample at 15 ℃, otherwise the temperature shall be converted, for three hours after the pressure was stabilized.

d. Measure the amount of hydrogen gas that has passed into the inert gas. The period to determine the permeation rate shall be the last two hours.

e. The average permeation rate shall be less than 500 cm3N/h per meter of hose free length.

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US3, GB050, CA

Table 1 — Classes

Pressure class	H11	H25	H35	H50	H70
NWPa(MPa)	11	25	35	50	70
MOPb(MPa)	13.75	31.25	43.75	62.5	87.5
MAWPc(MPa)	15.13	34.38	48.13	68.75	96.25
a Nominal Working Pressure b Maximum Operating Pressure (1.25 x NWP) c Maximum Allowable Working Pressure (1.1xMOP)					

Table 2 —Nominal sizes

Nominal size	H11	H25	H35	H50	H70
6.3	X	X	X	X	X
8	X	X	X	X	X
10	X	X	X	N/A	N/A
~~Other sizes~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~
NOTE X = Applicable; N/A = Not applicable.					

Table 3 — Dimensions of hoses

Nominal size	Inside diameter mm		Maximum outside diameter of hose mm	Concentricity mm
	min.	max.		
6,3	5.9	7.0	25	0.8
8	7.7	8.5	30	1.0
10	9.3	10.1	35	1.0
~~As specified by manufacturer~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~

CA090

Nominal size	Minimum bend radius mm				
	H11	H25	H35	H50	H70
6,3	150	150	150	200	200
8	200	200	200	250	250
10	200	200	200	300	300
~~As specified by manufacturer~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~	~~TBD~~

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