ISO/TC 197
Hydrogen technologies

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

DIS 19880-1 Comments Collated 2018-05-25 - NH final

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Template for comments and secretariat observations

Date:2018-05-24	Document: DIS 19880-1	Project: WG 24

Line number	MB/ NC[1]	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
1.	**	General: NOTES		ed	NOTES cannot contain requirements (“shall”), recommendations (“should”) or permission (“may”)	Review the NOTES and if they contain the provisions mentioned, either redraft the NOTE or move into normal text.	
2.	**	General: use of “must”		Ed	“shall” indicates a requirement, not “must”.	Review the instances of “must”. If it is intended to be a requirement, change to”shall”. If it isn’t intended to be a requirement, change to either “should” or another appropriate term.	
3.	GB	All	All	Ed	Chose what language is to be used for the word: refuelling / refuelling / fuelling / filling for consistency and correct accordingly	Numerous changes required depending on the decisions.	
4.	FR	Ge		ge	French title " **Carburant d'hydrogène gazeux -- Stations-service -- Partie 1: Exigences générales** " is not good	French title should be : **Carburant d'hydrogène gazeux – Stations de recharge -- Partie 1: *Exigences générales***	
5.	NL	Ge	Ge	Ed	The DIS refers, throughout the document, to several standards (and documents such as PGS 35 (reference now made to current version but soon to be updated), but also incorporates texts from a couple of these standards (and documents). This needs to be done with care, especially in case standards are (ready) for (a) revision (process), because then reference could be made to old/updated/wrong texts.	Pay attention to reference to existing standards throughout the document.	
6.	NL	Ge		Te	The definitions of Annex D and Annex E are not aligned. For example Annex D describes “*The maximum pressure at the end of “fault free” fueling is 125% of NWP (the Maximum Fueling Pressure and therefore the dispenser Maximum Operating Pressure (MOP), see Annex E*)” and Annex E “*NOTE Per the GTR, the maximum developed pressure is 1.50xNWP. See Annex* D.” are not aligned.	Align text of Annex D and Annex E.	
7.	SE	ge		ge	We think it would be valuable to maintain the examples of safety distances from different countries/regions, which are presented in the	Add an informative Annex, with the information in ISO/TS 19880-1:2016 on safety distances for different countries/regions.	

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					informative Annex A of ISO/TS 19880-1:2016. This is helpful when comparing safety distances derived according to the methods in the standard, with the country specific safety distance, which will facilitate making substantiated conclusions promoting harmonization of safety distance requirements for the different countries/regions.		
8.	SE	ge		ge	Please check that the documents referred to in the standard and listed in the last section Bibliography, is up to date, considering that the reference document [152] “Directive 94/9/EC…” is an old directive which is no longer applicable and has been replaced by Directive 2014/34/EU.	Update the references accordingly.	
9.	**	General		Ed	Use “this document” to refer to ISO XXXXX throughout the text.	Please correct as applicable.	
10.	**	General: legal statements		ed	The following are not permitted and shall be deleted: statements about the need to respect national law or regulations; statements that an ISO standard is not intended to conflict with national law or regulations. As compliance with legal obligations is always mandatory, it is understood that users of ISO standards will comply with applicable legislation and regulations and it is therefore unnecessary to include this kind of statement in an ISO standard.	Remove statements on national or local regulations from: 1) Scope, NOTE 1 2) 5.2, 3rd paragraph 3) 5.3.5.3 NOTE 4) 5.3.6.2, 2nd paragraph 5) 5.4, paragraph 4 6) 5.4.1, paragraph 3 7) 5.5.2, paragraph 2 8) 6.2.1, 3rd to last bullet point 9) 7.3.2, last bullet point 10) 8.2.1.2, 1st paragraph 11) 8.3.2.5 1st paragraph 12) 10.1.3, 2nd paragraph 13) 10.2.2, after 2nd bullet points 14) 12.1, 1st and 2nd paragraphs 15) 12.2, 1st , 3rd , 4th paragraphs 16) 12.8.3 (only sentence in clause)	

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						17) 14.1, 4th paragraph 18) 14.1, NOTE 2 19) 14.2, 4th paragraph 20) 15.1, 2nd to last paragraph 21) 15.4, 1st paragraph 22) A.1, 1st paragraph 23) A.3.2.2.1, last line 24) J.2.2 25) K.2, 1st paragraph 26) K.5.2, 1st paragraph 27) K.9.5, 1st paragraph	
11.	DIN	General		ed	For info: CEP in Germany is working on an updated list of tests for station acceptance. If work can be finished on time, the new list will be presented to the WG with possibility to include in document. The new version is intended to be used by a 3rd party to approve the station into operation.	Include CEP list in document.	
12.	**	Figures		ed	Figures shall be text independent where possible. The text shall be replaced by figure key numbers and the text moved into a figure key.	Move text from figures into a figure key and replace with figure key numbers, e.g. Figure G.1, K.3, K.7. Figures such as Figure 1, 2, A.1, A.2, A.3, J.1, K.1, K.5 etc can retain the text for readability.	
13.	**	Figures		Ed	Please provide revisable files for all figures.	Guidelines for the submission of text and graphics to ISO/CS are available in the Drafting standards section on iso.org: https://www.iso.org/drafting-standards.html	
14.	**	1 Clause Scope		Ed	The Scope cannot contain requirements (“shall”), recommendations (“should”) or permission (“may”). NOTES cannot contain recommendations.	Redraft the sentences that contain “should” to statements of fact or move to the main part of the document.	
15.	US	1 Scope	general	ed	We should be consistent with regard to calling this a “document” or “standard”. We understand that ISO prefers “document” to “standard”.	Please check with ISO and use the appropriate reference – either “document” or “standard” – throughout this section.	

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16.	US	1 Scope	NOTE 1	ed	Clarification – and preparation for future scrubbing of references to local regulations.	Delete NOTE 1 and replace with a new NOTE below pp4: NOTE Any requirements and recommendations in this standard may be superseded by national, state, or local codes and standards of the region where the filling station is installed (without specific reference to such possibilities within clauses of this standard).	
17.	US	1 Scope	NOTE 2	ed	Clearly out of scope and unnecessary.	Delete NOTE 2 (or incorporate in the list lower in the scope).	
18.	US	1 Scope	4th pp	te	Problems have been encountered when manufacturers exceed the “minimum requirements”. This should be clarified in order to hopefully prevent this situation and also introduce the risk assessment methodology in the SCOPE that would likely drive such situations.	*Add the following after pp4:* Since this standard is intended to provide minimum requirements for fueling stations, manufacturers can take additional safety precautions as determined by a risk management methodology to address potential safety risks of specific designs and applications.	
19.	**	2 Clause normative references		Ed	Introductory generic text is not correct.	Up-to-date generic text is provided in the Simple template in the Drafting standards section on iso.org: https://www.iso.org/drafting-standards.html	
20.	CA	2		te	ISO 60079 has 37 parts, therefore the normative reference to ISO 60079 (all parts) should be changed to refer only to the specific parts that are required.	Check how the ISO 60079 (all parts) is used in the DIS. If it is referred to in a non-normative fashion, it can be left unchanged and mentioned in the Bibliography. In all places where it is used in a normative fashion, it should be replaced with specific parts and the parts should be listed in the normative references.	
21.	CA	2		ed	The new version of 14687 is now at the DIS stage. Therefore references to ISO 14687-2 should be changed to ISO 14687 indicating that it is under development.	Change all of the references to ISO 14687-2 to ISO 14687. These references can be found in clauses 9.1, 12.8 and Table 4.	
22.	CA	2		te	ISO/IEC 80079 has several parts, therefore the	Check how the ISO/IEC 80079 (all parts) is used in	

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					normative reference to ISO/IEC 80079 (all parts) should be changed to refer only to the specific parts that are required.	the DIS. If it is referred to in a non-normative fashion, it can be left unchanged and mentioned in the Bibliography. In all places where it is used in a normative fashion, it should be replaced with specific parts and the parts should be listed in the normative references.	
23.	SE	2		ed	”ISO/IEC 80079” shall read: ”ISO 80079”	Change ”ISO/IEC 80079” to: ”ISO 80079”	
24.	US	3	New term	ed	There is a desire to provide a term to describe a term for the dispenser equipment in the fueling area. DIS 19880-1 (by definition) does not distinguish between “dispenser systems” and dispensers. Based on the recent report from WG19 (N38) and follow-up confirmation note from Yuko-san and Watanabe-san, the Japanese are comfortable with this position. WG19 plans to handle details in the “wording of clauses” to handle equipment in the fueling area. Wikipedia defines the general device in the fueling area as a “fuel dispenser”. It is therefore recommended to add a new “hydrogen fuel dispenser” to describe this equipment in the -1 document and possibly the -2 document.	*Add the new definition:* **Hydrogen fuel dispenser** Equipment in the dispenser system, cabinet(s), and support structure that are physically located in the fueling area for hydrogen and fuel cell vehicles. NOTES 1) The hydrogen fuel dispenser includes, at a minimum, the fueling assembly, required temperature and pressure instrumentation, filters (when necessary), and the user interface to conduct vehicle fueling. 2) The manufacturer of the hydrogen fuel dispenser can elect to include additional equipment, including the possibility of all equipment in the dispenser system.	
25.	**	3 Clause Terms and definitions		Ed	Definitions cannot have articles (“a”, “the” at the start	Please delete articles at the start of definitions.	
26.	**	3 Clause Terms and definitions		Ed	Any supplementary information to the main definition shall be placed in a Note to entry.	Move supplementary information to the main definition into a Note to entry, e.g. 3.11 control system, 3.70	
27.	NL	3.1 and Annex E		Te	The definition of maximum allowable pressure or PS according to the Pressure Equipment Directive (PED) needs to be added to chapter 3.	Add definition for PS (according to PED): "*Maximum allowable pressure PS means the maximum pressure for which the equipment is designed, as specified by the manufacturer*:	

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28.	NL	3.1 and Annex E		Te	The definitions of component pressure rating given in Annex E are not in line with definitions of component pressure rating given in 3.10.	Include in Annex E a proper explanation of PED/for European application of the standard, which regard to Maximum Operating Pressure (MOP), to make the standard usable for European application. Note: examples haven already been delivered, for several times, by European WG 24 experts, during the ISO 19880-1 development process.	
29.	US	3.5		ed	Clarification	~~device~~ A valve, similar to a quick disconnect valve, on the fueling hose that disconnects the hose when a tension limit is exceeded and blocks the flow from the dispenser (for example if the vehicle moves away with the fueling hose connected)	
30.	US	3.12		ed	Try to avoid the use, currently the joint between the nozzle and vehicle receptacle, the transition between the hose and the hose end, and any ancillary fittings used for gas sampling.	Switch notes 1 and 2. Change “connector” to “fitting” in example a.	
31.	US	3.12	Note 2	ed	References “fire” not “fitting”	Note 2 to entry: Fittings as defined in ~~3.19~~ 3.20 are a type of connector used in piping systems	
32.	JP	3.18		ed	Factory Acceptance Testing	factory acceptance testing	
33.	US	3.19	NOTE	ed	Given that metal hydrides may be present their combustion is explicitly not a fire based on the proposed definition. Metals don’t tend to undergo pyrolysis or evaporate prior to combustion.	*Replace 2nd sentence in the NOTE:* A non-premixed combustion of a flammable plume (jet fire) is covered by this definition and so is combustion of metals and of hydrogen released by a metal hydride.	
34.	US	3.20		ed	See above	Fitting ~~connector~~ part or design feature on a component used to join (i.e., connect) any pressure retaining components in the system	
35.	US	3.22		ed	Either change connectors or remove refer to the components.	Change “connectors” to “connections”.	
36.	**	3.31		ed	Remove “hazard distance is” from beginning of		

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					definition.		
37.	**	3.33		ed	Add “assembly which…” to the beginning of the definition		
38.	US	3.33		ed	A coupling is a length of oversized pipe with female tapered threads. With regards to a hose assembly, a connector is the fitting that transitions between the interference hose joint and the threaded joint of the interfacing hardware.	Hose assembly includes the hose~~, appropriate~~ and end ~~connectors~~ connections (~~couplings or~~ including necessary fittings~~)~~, bends, restrictors ~~(if necessary),~~ and appropriate markings.	
39.	GB	3.36	New Note	Ed	Point to Annex E for clarity Also, in the HSL definition, is NWP a “rating”?	Add: Note 2 to entry: See Annex E for application of pressure terminology to hydrogen dispenser systems and vehicles.	
40.	JP	3.36		ed	Hydrogen Service Level	hydrogen service level	
41.	NL	3.36		Ed	Reference should be made to applicable Table since the text is now unclear.	Make reference to Table 1 in section 8.3.2.	
42.	US	3.40		ed	Normal operation includes planned and unplanned shutdowns and restarts.	maximum operating pressure MOP highest pressure that is expected for a component or system during normal operation including anticipated transients	
43.	GB	3.45	1	Ed	Clarification of the intention of the word “full”	pressure of a ~~full~~ vehicle CHSS at 100% SOC at a gas temperature of 15 °C	
44.	NL	3.45 and Annex E		Te	The definition of Nominal working pressure (NWP)" is incomplete and thus incorrect.	3.45 Nominal Working Pressure (NWP). Add to “pressure of a full vehicle CHSS at a gas temperature of 15 ºC”….: “at 100% SOC.”	
45.	US	3.47		ed	Clarification on storage system	Nozzle device connected to a fuel dispensing system, which permits the quick connect and disconnect of	

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						fuel supply to the vehicle ~~or~~ storage system	
46.	DE	3.50	page 10	ed	The abbreviation of HSG253 is not given	abbreviation of HSG (Health and safety guidance) can be implemented in Chapter 4 “Abbreviated terms”	
47.	US	3.50		ed	Definition of positive and proved are not clear. Inadequate definition to help correct	Add to end of definition – …using a means that is clearly visible to confirm disconnection or separation of up-stream and down-stream systems	
48.	US	3.55		ed	Unclear as to difference from positive (3.50) and proved (3.55)	Add to end of definition – …using a means can be indirectly confirmed by process measurement or other inspection	
49.	US	3.58		ed		Receptacle Device ~~connected to~~ on a vehicle ~~or storage system~~ which receives the nozzle	
50.	NL	3.62		Te	The definition of ‘Safeguarding’ is not correct, and could result in measures which cannot be considered as real safeguards.	Term/definition needs correction (as followed), or needs to be removed/replaced and text of standard need to be rewritten on this aspect: - Remove current text - Add: ‘instruments or final elements related to SIS or pressure relief device PRD’ - Add ‘Note 1 to entry: safeguarding can be instrumental safeguarding or mechanical safeguarding’	
51.	NL	3.65		Te	Control system is intended for system regulation and not for guaranteeing a safety level. (although the ‘reverse’ could be true, it is not the definition of safety function itself).	Delete “control system or”.	
52.	NL	3.65 and 3.66		Te	Both definitions are not completely clear. Since the note of BPCS is now added (note 2), BPCS itself must be defined as well.	Add definition of BPCS as follows: “A system that responds to input signals from the process and its associated equipment, other programmable systems, and/or from an operator, and generates output signals causing the process	

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						and its associated equipment to operate in the desired manner and within normal production limits." (source: https://www.aiche.org/ccps/resources/glossary/process-safety-glossary/basic-process-control-system-bpcs)	
53.	JP	3.69		ed	Site Acceptance Testing	site acceptance testing	
54.	JP	3.70		ed	Standards Development Organisation	standards development organisation	
55.	JP	3.71		ed	State Of Charge	state of charge	
56.	US	3.72		ed	Shouldn't dispenser delivery pressure and temperature measurement be co-located immediately upstream of access by the general public and therefore treated equally by either inclusion in this definition, addition of a separate definition, or deletion of the pressure definition.	station dispenser pressure and temperature pressure and temperature of the hydrogen gas supplied to the vehicle by the station, measured near the hose breakaway	
57.	JP	5.1	Title	ed	Insert space between "5.1" and "Hydrogen" 5.1Hydrogen fueling station safety recommendations	5.1 Hydrogen fueling station safety recommendations	
58.	JP	5.2	Paragraph 2	ed	Delete a comma between "station" and "except" A risk assessment shall be performed for the hydrogen fueling station,, except for stations which comply with prescriptive regulations.	A risk assessment shall be performed for the hydrogen fueling station, except for stations which comply with prescriptive regulations.	
59.	US	5.3.2	Note 2	ed	Modify	Sudden and catastrophic failure of vessels or piping systems need not be considered a leak scenario in this analysis when protection against such failures has already been contemplated in the vessel, ~~and~~ piping design and site layout.	
60.	US	5.3.2	4th pp	ed	There should be no trap points regardless of elevation.	Enclosures should be designed so as to minimise high points (or locally high points) where hydrogen can accumulate undetected.	
61.	DE	5.3.3	page 18	ed	"Canopies should be designed so as to avoid high	Canopies should be designed to minimise high	

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					points where hydrogen can accumulate undetected". This can be written as enclosures design in 5.3.2	points where hydrogen can accumulate	
62.	DE	5.3.5.2	Para 2, page 19	ge	The risk assessment shall consider potential leak rate(s) and their frequency, ,……. The risk assessment, which is described here, is a quantitative. Therefore, it's better to say "should" because the frequencies of failure rates are not easy to found as well as questionable.	Shall to should	
63.	US	5.3.5.3	1st pp	ed	1. Loss of containment is a leak, but not necessarily catastrophic. A rupture is catastrophic. 2. Multiple fuels 3. Safe is too subjected.	…safely vent all the content of the hydrogen storage~~. Where such a valve needs manual activation, this should be possible from~~ to an appropriate location.	
64.	US	5.3.6.1	1st pp	ed	"minimize" has a connotative meaning of lowest possible. "reduced" has a connotative meaning of lowest required. A 0.5-meter plinth with 20-cm bollards every 0.5 meters would minimize the risk. A 20-cm plinth with a 10-cm bollard at the four corners of the plinth would reduce the risk.	The layout of a hydrogen fueling station shall be reduced ~~minimise~~ to an acceptable level the likelihood of damage or injury from activities carried out on the fueling station, or external to the fueling station property.	
65.	NL	5.3.6.2		Te	Mentioned at NOTE is ISO 834-1 as this is for elements of building construction, heat curve is as for slow rise to max, as well as limited heatflux. Jet fires are no regular building fire phenomenon.	There is no specific ISO Hydrogen fire / heat curve. Change ISO834-1 to more appropriate ISO 22899-1 (Jet fires – see also further NL comments).	
66.	US	5.3.6.2			Fire barriers are limited to non-combustible materials. While that might be the workgroup's intent, this explicitly eliminates the most common fire barrier material, gypsum wallboard. Wallboard is a limited combustible material because it is a sandwich of noncombustible surrounded by cardboard.	*Add* "or limited combustible" *after* "non-combustible".	
67.	DE	5.3.6.3	Para 1, page 21	ed	Repeating of the sentences in Para 1 and 2: Vehicular impact protection should be Para 1: Vehicular impact protection should be appropriate for the anticipated type and speed of	One of those to delete	

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					vehicles in the vicinity of the hydrogen equipment. Para 2: The fueling station operator shall assess impact hazards in the fueling station risk assessment based on the type and speed of vehicles expected in the vicinity of the hydrogen equipment.		
68.	US	5.3.6.3	Note 2	ed	New note	*Add new note:* NOTE 3 Plinths of adequate height and bollards of sufficient strength strategically placed are techniques currently in used.	
69.	US	5.4.1	Note 2	ed	Add references to note.	Reference EIGA 211/17 or CGA G-5.5 for additional guidance.	
70.	US	5.5		ed	Revise list per IEC 62282-3-100 Table A1. Current list is incomplete.	*Delete the NOTE at the end of 5.5 and replace with the following:* Additional examples of non-hydrogen hazards typically encountered at filling stations are listed in Annex B.5. These hazards as well as any other hazards unique to a particular filling station system or site shall be considered and addressed when appropriate. *Add the following to a new section B.5:* **B.5 Examples of Non-hydrogen Hydrogen Hazards for 5.5** Examples of non-hydrogen hazards to be considered as part of Section 5.5 are as follows: **Mechanical hazards due to:** • Shape (sharp surfaces) • Relative location (trip/crash hazard) • Mass and stability (potential energy of	

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						elements which may move under the effect of gravity) • Mass and velocity (kinetic energy of elements in controlled or uncontrolled motion) • Inadequacy of mechanical strength (inadequate specification of material or geometry) • Fluids under pressure (over-pressurization, ejection of fluids under pressure, vacuum) **Electrical hazards due to:** • Contact of persons with live parts (direct contact) • Contact of persons with parts that have become live under faulty conditions (indirect contact) • Approach to live parts under high voltage • Electrostatic phenomena • Electromagnetic phenomena • Heat/chemical effects from short circuits, overloads • Projection of molten particles **Thermal hazards due to:** • Contact of persons with surfaces at extreme high and low temperatures • Release of high temperature fluids • Thermal fatigue • Equipment over temperature causing unsafe operation **Hazards generated by materials and**	

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						substances: • Hazards from release, venting, contact with, or inhalation of, harmful fluids, gases, mists, fumes and dusts • Fire or explosion hazard due to leak of flammable fluids • Fire or explosion hazard due to internal build-up of flammable mixture • Hazardous situations caused by material deterioration (for example, corrosion) or accumulation (for example, fouling) • Asphyxiation • Reactive materials (pyrophoric) **Hazards generated by malfunctions:** • Unsafe operation due to failures or inadequacy of software or control logic • Unsafe operation due to failures of control circuit or protective/safety components • Unsafe operation due to power outage **Hazards generated by neglecting ergonomic principles:** • Hazards due to inadequate design, location or identification of manual controls • Hazards due to inadequate design or location of visual display units and warning signs • Noise **Hazards generated by erroneous human intervention:** • Hazards due to deviation from correct	

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						operating • Hazards due to errors of manufacturing/fitting/installation • Hazards due to errors of maintenance • Vandalism **Environmental hazards:** • Unsafe operation in extreme hot/cold environments • Rain, flooding • Wind • Earthquake • External fire • Smoke • Snow, ice load • Attack by vermin • Pollution • Air pollution • Water pollution • Soil pollution	
71.	US	5.5		Te	While hazards related to cold temperatures are discussed in Chapter 6 as it relates to cryo systems, the general issue related to human contact with of extreme temperatures is not identified or discussed.	*Add a subsection to discuss the hazard of human touch with surfaces at extreme temperatures.* **5.5.7 Protection against Exposure to Extremely Cold or Hot Temperatures** Processes within the hydrogen filling station may operate at extremely cold temperatures or very hot temperatures. Liquid hydrogen storage and processing systems operate below 250 °C and hydrogen dispenser precooling systems (including refrigerant systems, if used) operate at temperatures as low as -40°C. Conversely, hot surfaces may be encountered on processing equipment (i.e., compressors and	

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						pumps) or due to solar exposure. In addition to possible exposure of workers during maintenance, the risk to the general public in the dispensing area shall be assessed, particularly with fueling assembly which is handled as part of vehicle fueling. If people come in contact with surfaces at these extremely cold temperatures, injury may occur so this potential hazard needs to considered as part of the risk analysis. See ISO 13732 (Ergonomics of the thermal environment -- Methods for the assessment of human responses to contact with surfaces). Examples of countermeasures to prevent exposure to cold temperatures are (but not limited to) the following: 1) Protective coverings or insulation on piping or components with cold surfaces. 2) Fences, guards, cabinets, or enclosures on hydrogen systems operating at cold temperatures. 3) Appropriate PPE (gloves, etc.) for workers.	
72.	US	6.1.1		ed	Electrolyzers require utility support: water and electricity as a minimum.	Hydrogen generators using water electrolysis process should comply with ISO 22734-1, manufacturer's requirements and ~~or~~ be designed in accordance with a commonly used national/regional standard.	
73.	US	6.1.2		ed	Electrolyzers require utility support: fuel, water and electricity as a minimum	Hydrogen generators using fuel processing technologies, including ancillary hydrocarbon storage and pipework, should meet the requirements of ISO 16110-1~~ and references therein~~, manufacturer's requirements and ~~or~~ be designed in accordance with a commonly used national/regional standard.	
74.	FR	6.2.1		ed	The standard does not require the use of a single hose between tube trailer and HRS. Put the sentence "When the unloading hose is	"When the offloading hoses are disconnected, any gaseous hydrogen released shall be discharged through a vent stack to an	

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					disconnected …" in plural form	appropriate location."	
75.	DE	6.2.2.1		ed	Some words left, probably from editing. Delete last paragraph.	delete	
76.	US	6.2.2.4	3rd pp	ed	The vaporizer is required to be anchored, the liquid tank doesn't? In the parts of the world likely to see gross flooding (hurricanes, typhons, cyclones) vessel are anchored so that first responders know where the hazards are.	*Add:* The foundation and supports shall withstand the buoyant forces of the vessel. The vessel shall be secured to the foundation.	
77.	DE	7.1	Para 5, page 31	te	Valves, instruments and other equipment requiring servicing shall not be buried, and when installed underground, shall be accessible without the need of excavation. Why the need of excavation is excluded, when equipment's are installed underground?	The last part of sentence to delete; Keep only: Valves, instruments and other equipment requiring servicing shall not be buried, and when installed underground, shall be accessible.	
78.	DE	7.1.2	page 31	ed	The abbreviation of RoHS is not given	abbreviation of RoHS (Restriction of Hazardous Substances Directive) can be implemented in Chapter 4 "Abbreviated terms"	
79.	NL	7.3.2		Te	Thermal shielding is mentioned in text , but text is for protection in case of fire.	Change text of thermal shielding into fire barrier, text fire barrier also mentioned in 5.3.6.2 (see other related NL comments) & B.4.6.2. (Pg111)	
80.	DIN	7.3.2		te	Include wording on increased risk of DDT when using MEGCs.	Add to last paragraph: When MEGCs are used, the station risk assessment shall include mitigation considerations about deflagration detonation transition in the area of the MEGC storage.	
81.	US	7.3.3.1	2nd pp	ed	Add. Floods and floating vessels are a real hazard outside of Western Europe, the hurricane in Houston this year had over 30,000 sq miles of flooding. In the 1990's Flooding in Missouri was 10 times greater. Vessel are anchored so that first responders know where these hazards are located.	Vessels shall be secured to the foundation with consideration of possible environmental situations identified in the risk analysis and of national, regional, and/or local codes.	
82.	DIN	7.3.3.2		te	Add requirements to buried underground storage	Add: When buried underground storage is used, the station manufacturer/integrator shall work out a safety concept for the recurring testing of the buried vessels. This concept should work without the need	

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						of people entering the buried vessel.	
83.	NL	7.4.1		Te	The text “Area classification….” is confusing. Area classification should be defined on the basis of normal operating status.	Replace: “maximum flow rate,” by “normal operating conditions”. Replace “potential upset or accidental flow” by “normal and foreseeable operating conditions.”	
84.	SE	7.4.2		ed	Align the text to suit electrical equipment with mechanical parts covered by the IEC 60079 series of standards (for example electrical fans and motors according to IEC 60079-0). Electrical fans (electrical equipment) are more common than e.g. pneumatic fans (non-electrical equipment). Therefore, we suggest an electrical fan to be exemplified in the NOTE. Constructional requirements for electrical fans and other electrical machines, can be found in clause 17 in IEC 60079-0:2017 standard for electrical equipment.	Amend the text; “In addition to the electrical ignition sources, mechanical ~~equipment~~ ignition sources can also ignite hydrogen and other flammable fluids…” “NOTE As an example, ~~a~~ an explosion protected electrical fan ~~protected by construction could~~ should comply with the requirements for electrical machines according to IEC 60079-0 ~~80079 ISO/IEC 80079-36 and ISO/IEC 80079-37~~.”	
85.	NL	7.5		Te	The complete paragraph is dedicated to ‘mechanical compressors’, however, the standard should mention the application of compressors without moving parts.	Add: “For compressors without moving parts there is no minimum on the input pressure applicable.”	
86.	DIN	7.8.1 And/or 10.1.4		te	Add recommendation for lighntning current capability to vent stack. Aim is to remove additional lightning protection, if allowed for by local regulations	Add: Vent stacks should be designed to be able to carry lightning currents without adverse effects. If done so, this shall be documented in the manufacturers documentation pack and shall allow for no need of additional lightning protection rods, if allowed by the local regulations.	
87.	DIN	7.8.1		ed	Doubling of requirements in two places: paragraph 6 of 7.8.1 and paragraph 3 of 7.8.3. consider deleting sentence in 7.8.1, as 7.8.3 is more accurate in its wording	Consider deleting	
88.	US	7.9		te	Modify title	Pneumatics and hydraulics	
89.	US	7.9	1st pp	te	Modify for both Pneumatics / Hydraulics	Instrument air from an air compressor or cylinder supply system ~~should~~ shall be supplied through	

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						control valves. Hydraulic control supply from pumps and pressurized supply shall be supplied through control valves. A buffer volume should maintain the air pressure to allow a safe shutdown of the fueling station should the supply lapse. ~~Pneumatic equipment and systems should satisfy the requirements of ISO 4414.~~	
90.	US	7.9	New pp	te	Move and add	Pneumatic equipment and systems ~~should~~ shall satisfy the requirements of ISO 4414. Hydraulic equipment and systems shall satisfy the requirements of ISO 4413.	
91.	US	7.9	Old 2nd pp	te	Add hydraulics	Pneumatic and hydraulic systems shall be designed so that no hazard may result from pressure losses, pressure drops.	
92.	US	7.9	Old 3rd pp	te	Add hydraulics. Protect from high pressure sources regardless of the risk analysis.	All elements of the pneumatic and hydraulic systems, especially pipes and hoses, shall be protected against harmful external effects ~~where this is required by the fueling station risk assessment~~.	
93.	DIN	7.11.1		te	Consider adding note on not recommending concrete housings for hydrogen equipment due to projectile risk in case of ignition.		
94.	US	7.11.3	1st pp	ed	Retain the reference to other flammable gases. A fueling station is likely to have multiple flammable gases – Petrol, diesel, alcohol, LPG, CNG, CHG	Where passive or active ventilation is relied upon for preventing ignitable mixtures of hydrogen/air or other flammable gases, the ventilation rate shall ~~should~~ maintain a volume fraction below 25 % of the lower flammability limit (LFL), in accordance with IEC 60079-10-1. Where continuous or primary grades of release, as defined in IEC 60079-10-1, are anticipated, a lower volume fraction may be appropriate.	
95.	US	7.11.3	2nd pp	ed	Equipment is “approved” or “suitable”, areas are "determined", "classified" or "designated".	The equipment within dilution volumes around potential leak points, as defined in IEC 60079-10-1, shall be suitable for the area classification	

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						~~appropriately classified~~, see 7.4.2.	
96.	US	7.11.3	Note after 3rd pp	ed	Welded joints built to piping codes are usually not considered a credible leak source.	Leakage at coded weld joints is not considered a credible release.	
97.	US	7.11.3	4th pp	ed	Make “higher ventilation rates…" a new 5th pp	Higher ventilation rates, if required to address fault management, may be provided continuously (when the system is operating) or initiated by a flammable gas detection system upon measurement of the lower activation limit complying to the recommendations of 11.2.2.	
98.	US	7.11.3	7th pp	ed	Any flammable gas release results in a shutdown. Non-classified applies to areas not hardware	... and the de-energization of ~~non-classified~~ electrical equipment not suitable for classified areas.	
99.	US	7.11.3	8th pp	ed	High/low - no matter – No accumulation of any flammables allowed. Example under a shelf	Enclosures shall ~~should~~ be designed so as to minimise ~~high~~ points where flammable gases ~~hydrogen~~ can accumulate.	
100.	JP	8.1	1st para	te	It should be better to clarify the case which could be controlled SOC at dispensing point. “The dispensing point should also control the State of Charge (SOC) of the vehicle.”	Replace the last sentence of the 1st paragraph with; “In the case of the fueling with communications, the dispensing point may also control the State of Charge (SOC) of the vehicle.”	
101.	US	8.1	Old 1st pp	ed	In Petrol service, the dispenser is the box on the island that the general public comes in contact with. As a minimum it is a fueling assembly, shut off and point of sale equipment. Historically, it is called a pump, but there is no pump in the box. It is a submersible in the storage vessel. Using the petrol model nomenclature will minimize confusion.	The hydrogen fueling station ~~shall~~ may have one or more ~~dedicated dispensing points~~ hydrogen fuel dispensers for the transfer of hydrogen to hydrogen fueled vehicles. The dispenser system shall prevent the allowable limits of temperature and pressure for the vehicle high pressure hydrogen system from being exceeded during fueling and ~~. The dispensing point should also~~ control the State of Charge (SOC) of the vehicle.	
102.	DE	8.2.1.1	Para 7, page 44	te	Following “shall” approach to delete: The fueling protocol shall ensure that the maximum CHSS material temperature does not exceed 85 °C throughout the fueling.	Change to should or similar, because it’s not valid for non-communicated fueling: Please write: maximum communicated CHSS temperature (where applicable) shall be less than	

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						85 °C	
103.	DE	8.2.1.1	Para 9, page 44	ge	Following “shall” approach change to should: The fueling protocol shall adjust the fueling rate and target pressure based on measured ambient and process conditions as necessary, such as dispensed hydrogen gas temperature and pressure, to ensure that the process limits listed below are maintained for the vehicle.	Because: The communication with the vehicle does sometimes not exist, sometimes even if it’s existing cannot be realized as safety intended. The adjustment of fuelling rates with storage system of vehicle is also not defined in fuelling protocol.	
104.	GB	8.2.1.1	2	Ed	Error in where text is placed gives a different meaning - The second paragraph and the note only refers to bullet point 2, and should be indented. Note should say “fuelling protocol” to differentiate from the same text in 8.2.1.4.	In order to ensure that the fuelling is conducted within the fuelling protocol process limits for vehicle compressed hydrogen storage systems, as defined in 8.2.1.2 or 8.2.1.3 as applicable, hydrogen dispensers shall either: — use an approved published fuelling protocol developed by a recognized standards development organization (SDO), such as SAE J2601 (see Annex C.2 for further information), JPEC-S0003; or — use protocols that have been approved by the manufacturers of each vehicle to fuel at that station using that protocol and by regulatory authorities when appropriate. The fueling station operator should take measures to prevent the fueling of vehicles where fueling protocols are not approved by the manufacturer(s) of the vehicles using the station. NOTE Examples of countermeasures that can be employed to prevent vehicles fuelling at stations where the fuelling protocol has not been approved are provided in Annex J. The station manufacturer shall ensure ……	
105.	GB	8.2.1.1	6	Ed	Relocation of text to make it clear that this might not be necessary.	If necessary, the fuelling protocol shall adjust the fuelling rate and target pressure based on	

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						measured ambient and process conditions ~~as necessary~~, such as dispensed hydrogen gas temperature and pressure, to ensure that the process limits listed in 5.3.2 and 5.3.3 below are maintained for the vehicle…..	
106.	US	8.2.1.1	P2	TE	Unauthorized fueling protocols can cause damage to the vehicle and preventing their use on vehicles is critical. This clause should be made mandatory	The fueling station operator ~~should~~ shall take measures to prevent the fueling of vehicles where fueling protocols are not approved by the manufacturer(s) of the vehicles using the station.	
107.	GB	8.2.1.2	Title	Ed	Change title for clarity	**Fuelling protocol process limits for light duty vehicle stations**	
108.	GB	8.2.1.2	NOTE 2	Ed	Change wording for clarity	NOTE 2 Vehicles compliant ~~Compliance~~ with local regulations only may not necessarily be consistent with the GTR#13, and the fuelling protocol limits defined in this subclause should be considered accordingly.	
109.	GB	8.2.1.2	6	Te	Is the pressure pulse optional? i.e. is it a “may” or a “shall”?	Numerous options: As is currently: As part of the fuelling protocol, a quantity of hydrogen may be transferred to the vehicle to determine the start pressure prior to the start of refuelling: Or (still optional, depending on protocol): As part of the fuelling protocol, a quantity of hydrogen is typically transferred to the vehicle to determine the start pressure prior to the start of refuelling: Or mandatory: As part of the fuelling protocol, a quantity of hydrogen shall be transferred to the vehicle to determine the start pressure prior to the start of refuelling:	
110.	NL	8.2.1.2		Te	The following text is unclear: Stations using fuelling protocols that could potentially be unsafe for GTR#13 vehicles shall	Add the following sentence to 8.2.1.2: Maximum dispensed refuelling pressure shall be limited to 87,5 MPa.	

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					incorporate appropriate countermeasures. and Reference to table 1 is not applicable for Europe (with respect to the Maximum Allowable Working Pressure of the vehicle (vehicle homologation). MAWP of 87,5 MPa while table 1 accepts 96,25MPa. For example the WEH refuelling nozzles/receptacles is 87,5MPa.		
111.	US	8.2.1.2	P1-4	TE	Public stations should be limited to fueling GTR #13 vehicles only. Having public stations with non-standard protocols could cause significant damage to the vehicle. Are we also having a statement saying we could have a station that is “unsafe” for GTR #13 vehicles?	~~Public~~ Hydrogen stations shall be designed to fuel vehicles compliant with the GTR#13 (see Annex D for relevant limits based on GTR #13) or local regulations by fulfilling the requirements of this section.	
112.	GB	8.2.1.3	All	TE	This section applies to heavy/medium duty stations (regardless of public or private) and should ideally state this fact	**5.3.3 Fuelling protocol process limits for ~~other~~ medium and heavy duty vehicle stations** Where ~~public~~ hydrogen stations are designed to fuel medium or heavy duty vehicles ~~other than GTR#13 vehicles~~, the requirements for 8.2.1.2 shall be met, with the following exception: — the maximum fuel flow rate (excluding momentary excursions during the initial connection sequence - i.e. connecting the nozzle to the receptacle prior to the start of fuelling) shall be less than 120 g/s when the dispenser has a high flow nozzle (see ISO 17268) which prevents connection to a standard vehicle receptacle, see Annex J; Lockout measures shall be included to prevent vehicles that are not suitable for the fuelling protocol from being filled, see Annex J.	
113.	US	8.2.1.3	All	TE	Public stations should be limited to fueling GTR #13 light-duty vehicles. The titles and wording of this clause should clearly differentiate the type of vehicles that are subject to this requirement.	8.2.1.3 Fueling protocol process limits for medium- and heavy-duty ~~other~~ vehicles Where ~~public~~ hydrogen stations are designed to fuel medium- or heavy-duty vehicles ~~other than~~	

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						~~GTR#13 vehicles~~, the requirements for 8.2.1.2 shall be met, with the following exception:	
114.	DIN	8.2.1.3		te	In many upcoming applications, 120g/s will not suffice. This passage should not limit the possible fill rates to only 120g/s, which will hamper a number of applications and projects	Add note to explain that higher flowrates are possible, if both station and vehicle are designed for the higher flow rate. In that case, the flow rate can be as appropriate.	
115.	GB	8.2.1.4	Note 1	Ed	Relocation of text, to make it clear that this recommendation refers to the incorporation of the hardware for communications fuelling on 350 bar dispensers.	For public H70 vehicle fueling, hydrogen dispensers shall have the communications hardware and software to ensure that the fueling is conducted within the fueling protocol process limits for vehicles compressed hydrogen storage systems as defined in 8.2.1.2 and 8.2.1.3. NOTE 1 This is recommended for H35 dispensers as well, as there are some applications which use communications. The light duty vehicle public fueling station H70 dispenser shall be able to respond to an abort signal from the vehicle, and halt the fueling process. ~~NOTE 1 This is recommended for H35 dispensers as well, as there are some applications which use communications.~~	
116.	GB	8.2.1.4	3-5	Ge	Error in where text is placed gives a different meaning - The fifth paragraph and the note only refers to bullet point 2, and should be indented. Note should say “communications protocol” to differentiate from the same text in 8.2.1.1 General tidy up of language for consistency in grammar with the bullet above (a fuelling can only use one protocol). Clarification that it may simply be an issue of incompatibility rather than the manufacturer has not approved it.	Fueling with communications shall either: — use an approved published communications protocol developed by a recognized standards development organization (SDO), such as SAE J2799 (see Annex C.4); or — use a communications protocol~~s~~ that ~~have~~has been approved by the manufacturers of each vehicle to fuel at that station using that protocol. The fueling station operator should take measures to prevent vehicles to refuel ~~with~~ using such a communications protocol~~s~~ if the vehicle manufacturer has	

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						not approved it / the protocol is incompatible with the vehicle. NOTE Examples of countermeasures that can be employed to prevent vehicles fuelling at stations where the communications protocol has not been approved are provided in Annex B. If the communications fail during fueling, the station shall either terminate the fuelling within 5 s or the fueling may continue without communications if allowed by the fuelling protocol. ~~The fueling station operator should take measures to prevent the fueling of vehicles with a communication protocol that is not approved by the manufacturer(s) of the vehicles using the station.~~ ~~NOTE Examples of countermeasures that can be employed to prevent vehicles refuelling at stations where the protocol has not been approved are provided in Annex J.~~	
117.	US	8.2.2.2	3rd pp	ed	My solenoid could be immediately upstream of the breakaway	Activation of the emergency shutdown shall cut off the flow of hydrogen gas to the hydrogen fuel dispenser and vehicle which initiated the shutdown by closing the automatic isolation valves defined in 8.3.2.2.1.	
118.	US	8.2.2.2	4th pp, 1st bullet	ed	Safe is a subjective term	vent any remaining gas in the dispenser lines to ~~a safe~~ an appropriate location	
119.	US	8.2.2.2	3rd pp, 3rd bullet	ed	Areas are classified, not hardware which is approved for use, or listed	removal of power to ~~non-classified~~ electrical components in the vicinity of the dispenser that are not suitable for classified areas.	
120.	GB	8.2.2.3	3	Te	Instrumental or instrumented?	(such as an instrument~~ed~~ safeguarding system with an appropriate SIL level)	
121.	GB	8.2.2.3	5	Ed	Missing words Rearrangement of word “lowered” for better English	If components in the dispensing system are rated lower than values defined, then the MAWP of the dispenser system shall be lowered accordingly	

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						~~lowered~~ and the dispenser pressure protection set point shall be lowered to protect the lowest rated component in the dispensing system.	
122.	US	8.2.2.4	1st pp	ed	What does correct mean?	When ambient temperature is measured for the purpose of establishing the vehicle pressurization rate or fueling target pressure, the ~~dispensing system shall be equipped with a means to confirm that the ambient temperature is correct~~ sensor shall be placed so that it is an accurate measurement of ambient temperature and not unduly influenced by solar or other effects.	
123.	US	8.2.2.5		Te	Break away is a shut off. If the break-away function properly, the flow will stop without the dispenser control immediately terminating the fueling process. If break away does leak, then H2 leak detection will stop fill.	The disconnection of the breakaway shall ~~terminate the fueling process and isolate the fueling hose assembly~~ shut off hydrogen flow at or up-stream of the breakaway. In addition, measures shall be taken to mitigate against the failure of the breakaway coupling to seal, see 8.2.2.6.	
124.	DIN	8.2.2.5 Or 8.3.4.1 Or 8.4.4		Te	Following an incident, it is suggested to add a requirement that the hose cannot get caught on parts of the dispenser and thereby make the breakaway ineffective.	It shall be ensured that the breakaway function is not affected by the shape and features of the dispenser, e.g by protruding elements at which the hose can get caught and thereby preventing the breakaway to function properly.	
125.	US	8.2.2.6	1st pp	ed	Clarity	*Replace pp1 with the following:* A potentially hazardous leak (e.g. failure of a breakaway to close, hose leak, etc.) shall be detected by the system and the volume of leaked flammable gas shall be limited. The allowable leakage volume and response time shall be determined by the risk analysis.	
126.	US	8.2.2.7	3rd pp	Te	If the process controller locks up, then the system will lock up in the condition it was in. Since it was in a safe condition when it locked up, then no need to have an additional shut down. Note the suggested text is intended to differentiate between a system that locks up in a safe mode, or a need to shut down any time there is a lock up.	Either remove requirement, or revise to read: A means shall be provided to detect that the controller has failed, for example~~, such as a watch-dog timer,~~ and, if necessary based on the risk assessment, initiate an emergency shutdown per 8.2.2.2.	

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127.	DIN	8.2.2.8		Te	Make section more relevant to vehicle impact to dispenser.	e.g. add sentence at end: Phisical disturbance can also occur due to vehicle impact to the dispenser, which shall also trigger an emergency shutdown.	
128.	DIN	8.3.1		ed	Faulty reference to chapter in second paragraph (refers to chapter 0)	Fix	
129.	US	8.3.1	pp1	Te	Per comment in 5.5, there is a potential for cold surface contact and harm to the general public in the dispensing area.	*Add sentence to end of the paragraph:* Exposure of people to extremely cold temperatures shall be considered in the risk assessment and countermeasures shall be provided when necessary to prevent injury. See 5.5.7.	
130.	US	8.3.1	2nd pp	ed	Incomplete reference. What is "0"?	The dispensing system shall meet general requirements for mechanical and electrical equipment in Chapters 7 and 10.	
131.	DE	8.3.2	Table 1, page 51	ge	Add in following headlines the word "recommended": Dispenser Maximum Allowable Working Pressure (MAWP) Minimum dispenser component rating (PS)	Recommended Dispenser Maximum Allowable Working Pressure Recommended (MAWP) Minimum dispenser component rating (PS)	
132.	US	8.3.2	6th pp	ed	There are additional labelling requirements to be addressed in the component standards; example MFG, lot number, size)	High pressure hydrogen dispenser components shall ~~only~~ be marked with the pressure class rating if components are designed and verified to meet or exceed the pressure, temperature, material compatibility, and service life requirements as defined above.	
133.	US	8.3.2.2		ed	Actuators should comply with 7.4.2.	Dispenser valves shall comply with 7.2.1 and 7.4.2 (when appropriate) using the…	
134.	NL	8.3.2.2.1		Te	Text ;" Isolation valve body should be constructed with material that will continue to function in case of engulfment in fire " – as option mention use of Passive Fire Protection (PFP) means as f.e. box of jacket.	Make reference to specific ISO fire standard at engulfement of fire, ISO 22899-1 Add as option the use of PFP boxes and or jackets.	
135.	US	8.3.2.2.1	5th pp	ed	Since "dispenser" and "dispensing system" are used interchangeably, should clarify that vehicle	*Replace* "dispenser" *with* "hydrogen fuel dispenser" in the 1st sentence and replace "dispenser" *with* "in	

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					protection is specifically directed to “point of fueling”.	the fueling area” in the second sentence as follows: The manufacturer’s risk assessment should consider the need for an automatic isolation valve to be provided at each end of the pipe between the ~~dispenser and the hydrogen~~ buffer storage and the hydrogen fuel dispenser, dependent on the amount of hydrogen that would be released in case of a loss of containment. Where required, the automatic valve ~~at the dispenser~~ in the fueling area should be located such that it is protected from vehicular impact.	
136.	US	8.3.4.1	Note	ed	The 1 kΩ requirement appears to be only 1/700 of the open petroleum system requirement (UL330). How can this be defended?	It is recommended that the ~~bonding~~ resistance of the fueling hose assembly (from fitting to fitting) should be no greater than 1 kΩ.	
137.	US	8.3.4.1		Te	Per earlier U.S. comment to 5.5, there is a potential for cold surface contact and harm to the general public if the fueling assembly is not properly protected (when appropriate).	*Add the following paragraph after pp2:* Exposure of people to extremely cold temperatures shall be considered in the risk assessment and countermeasures shall be provided when necessary to prevent injury due to touching extremely cold fueling assembly components or connections. See 5.5 for guidance.	
138.	US	8.4.1	4th pp	ed	Allowing distributed dispensing,	Dispensers and dispensing equipment shall ~~should~~ not be located beneath a canopy nor within 1 m of the vertical projection of the canopy, except where the canopy is not capable of accumulating gas in pockets or between the canopy ceiling and roof.	
139.	US	8.4.2	Bullet b	te	API RP 2003 requires 100 K-ohms.	Please review units and change “M-ohm” to “K-ohm”, if correct.	
140.	US	8.4.3	Title	ed	“Dispenser” is used generically as the dispenser system in this document. Suggest we adjust the title to "hydrogen fuel dispenser”.	*Change* “dispenser” *to* “hydrogen fuel dispenser”.	
141.	US	8.4.3	3rd pp	ed	The paragraph is complex and should be clarified to improve understanding.	The presence of a flammable atmosphere in the dispensing area is therefore not expected during normal operation, and the need to classify portions fueling area should be established by risk	

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						assessment based on the likelihood and extent of component failures and mitigation measures being used ~~the hazardous area for the case of malfunction should be established by risk assessment based on the components and mitigation measures used, and other dispenser system characteristics~~. See 5.3.4.1.	
142.	US	8.5	2nd pp	ed	There is an issue with the integrity of specialized tooling that needs to be addressed.	*Replace the existing paragraph with the following:* The use of adapters shall be prohibited, with the exception of controlled situations, such as the use of specialized tooling and equipment for dispenser operational verification or hydrogen quality sampling. The specialized tooling and equipment shall be evaluated by risk analysis and suitable for hydrogen service as defined in Clause 7. Hydrogen piping systems and equipment shall comply with the requirements in Clause 7.2. Procedures shall be conducted by trained personnel. See Clauses 9 and 12.8 and Annexes J and K.	
143.	US	8.6	3rd pp	ed	Allowing distributed dispensing and adds frequency of inspection	*Break 3rd paragraph into 2 paragraphs at the last sentence. Start the new 2nd paragraph with the following sentence:* Frequency of inspection shall be set by the lesser of the manufacturer's recommendations and field experience. *Also, replace* "should be used" *to* "may be considered" *in the last sentence. Changes shown:* The fueling assembly shall also be periodically tested for leaks by an appropriate method, such as bubble testing or pressure decay testing. Leak detection fluids, if used, shall be compatible with dispenser fueling assembly components. Fueling hose assemblies that fail visual inspection or leakage test shall be withdrawn from service. Frequency of inspection shall be set by the lesser of the manufacturer's recommendations and field experience. The use of protective covers and/or automatic leak tests ~~should~~ may be ~~used~~	

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						considered to define the frequency of visual inspection.	
144.	US	9	2nd pp	ed	Clarification and elaboration,	Hydrogen quality verification ~~measuring for impurities relevant to the supply chain, whether delivered or onsite production, should be carried out before the onsite~~ shall be conducted as part of the fueling station acceptance test. Verification testing shall be repeated based on the station ~~and repeated after an appropriate period, as defined by the~~ quality assurance system. Verification testing shall be conducted after any breach of containment (i.e. compressor seal replacement).	
145.	**	9 Clause		ed	Add 9.1 General to avoid a hanging paragraph.		
146.	US	9.1	1st pp	ed	Presupposes a solution, leave room for other options. We also think that referring to the fuel standard instead of repeating a requirement which may diverge would be wiser. We also believe it is up to the designer to decide the best location for a filter.	*Replace the existing paragraph with the following:* Hydrogen filters shall be included as part of the dispenser, to prevent hydrogen containing function-impairing impurities (i.e. particulates) that would affect the high pressure hydrogen system of FCEV, specifically the vehicle CHSS valves. See 7.7. There shall be a filter with a capability to prevent particulates of a maximum size of 5 µm with a minimum removal efficiency of 99 % under expected process conditions, or alternatively a 5 µm filter. The filter shall be installed downstream of dispenser components which could create particulates, such as a heat exchanger, flow controller, valves etc. and be as close as possible to the nozzle or hose breakaway device. This shall filter out the particulate concentration in the hydrogen in accordance with ISO 14687-2.	
147.	US	9.2		ed	A clean safety warning.	*Move PP3 to above PP1 and modify as follows:* Sampling equipment ~~used~~ shall ~~be evaluated by risk analysis and approved by regulatory authorities~~	

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						~~where applicable~~ comply with 12,8.1. *Modify the existing first sentence of PP1 as follows:* Sampling of hydrogen shall only be done by personnel trained in handling of pressurized hydrogen gas and the sampling procedure.	
148.	**	10.2		ed	Add 10.2.1 General to avoid a hanging paragraph.		
149.	FR	10.2.2		ed	"• Conductive enclosures including frames and floors where hydrogen is stored or used." Floor definition to be clarified. Requirement only applies to floors or grating being part of the HRS equipment (skid for instance) and not to the concrete pad on which it is installed.		
150.	DIN	10.2.2		ed	Requirement to bond delivery vehicle to station ground is mentioned twice	Remove one instance	
151.	NL	10.2.2		Te	(prevention of) accumulation of static charge needs to be (better) included in the standard.	(Re)consider to change the value of 1 MΩ and align with the value in the note in 10.1.3 (100 Ω) and table Q.1 Item 3.20 (30Ω).	
152.	US	10.2.2	1st pp		Need to exempt systems (fuel cells, electrolyzers, galvanic protection, etc.) that are intended to be energized from bonding/grounding.	*Replace pp1 with the following:* Hydrogen systems shall be equipotentially bonded and grounded as defined within this clause to prevent electrostatic discharge. Exception: Hydrogen systems, that normally carry-current or are otherwise intended to be operated at a voltage above or below ground potential, shall either meet 10.1.3 and 10.2.1 or meet an approved product standard such as IEC 62282-3-100 (Fuel cell technologies - Stationary Fuel Cell Power Systems – Safety) or ISO 22734-1:2008 (Hydrogen generators using water electrolysis process) and be installed per manufacturer's directions.	
153.	US	10.2.2	4th pp		Re-wording required to make the requirement apply to all equipment.	*Replace first sentence with the following:* The bonding requirement applies to but is not limited to the following equipment: *Add* "skids and" *in front of* "enclosures" *in the third*	

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						bullet.	
154.	US	10.2.2	6th pp	ed	Doesn't connecting electrical sources to ground cause a short? Suggest simplification or the system for clarity.	*Delete* "and electrical sources" *from the paragraph as follows:* Equipment and electrical sources that may unintentionally make contact shall also be equipotentially bonded.	
155.	US	10.2.2	8th pp		Not sufficient or clear. Suggest a separate section but wording could be added here as an alternative.	*Delete pp8 and replace with new section:* 10.2.3 Bonding and grounding for hydrogen delivery All hydrogen delivery vehicles shall be equipotentially bonded to the fixed storage hardware prior to flexible hose the hydrogen connection. All hydrogen delivery vehicles should be grounded to the same earth as the fixed storage hardware prior to flexible hose connection. *Add references to this section from 6.2.2.3 and 7.3 (?).*	
156.	US	10.2.2	Last pp	ed	Why is Zone 2 more restrictive than Zone 1? Zone 2 should apply to only normal operation.	*Modify second bullet as follows:* In Zone 2 areas, non-conductive solid materials should only be used if charging mechanisms capable of generating hazardous potentials will not occur either during normal operation (including maintenance and cleaning) ~~these do not generate electrostatic discharges.~~	
157.	**	10.3		ed	Add 10.3.1 General to avoid a hanging paragraph.		
158.	DIN	11		te	Add that software changes to a station typically require management of change and shall be approved by the station operator. This also applies to changes of (alarm- and trip-) setpoints.	add	
159.	US	11.1	9th pp	ed	What does this mean? As part of the safety system an alarm system can be implemented. The station	As part of the safety system an alarm system ~~can~~ may be implemented. ~~The~~ In the case of an event,	

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					should fall to a safe state by itself, not relying on the alarm system. The alarm system should only be used to give any user or operator notification about the fueling station.	the station should ~~fall~~ default to a safe state without ~~by itself, not~~ relying on the alarm system. The alarm system should only be used to give notification as to the status of the station ~~any user or operator notification about the fueling station~~.	
160.	US	11.2	1st pp	ed	Conceptually, correct: however, it is a mouthful.	*Modify paragraph as follows and split into 3 paragraphs:* ~~The extent and response of the emergency shutdown function, instigated through the control or safety system, whether automatically or by manual actuation of an emergency stop device,~~ The response to an emergency shutdown signal initiated automatically by the control or the safety systems or manually by the emergency stop device(s) shall be determined according to the fueling station risk assessment, see 5.2. The emergency shutdown function shall be so designed that, after actuation, hazardous movements and operations of the fueling station are stopped in an appropriate manner, without creating additional hazards and without requiring any further intervention by any person, and shall comply with ISO 13850 or IEC 60204-1. Where appropriate, activation of emergency isolation valves shutting off the hydrogen supply shall be utilized.	
161.	US	11.2	7th pp	ed	Clarifying requirements	At filling stations with liquid hydrogen storage ~~In the event of an emergency~~, the emergency shutdown ~~also~~ shall shut off the liquid supply and power to the liquid hydrogen transfer equipment necessary for producing gaseous hydrogen from liquid hydrogen. Subsystems isolated by emergency shutdowns shall be provided with overpressure protection. ~~In the event of an emergency shutdown, the design shall allow for pressure relief within any closed system.~~	

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162.	US	11.2.2	last	ed	Diction • instigated versus initiated • extinguished versus cancelled (or reset)	The duration of the audible and visual signals ~~instigated~~ initiated by the hydrogen detection system should be determined by the station manufacturer's risk assessment. Where safe to do so, it is recommended that the visual signals should remain until the alarm condition has been corrected and the fueling station control or safety system has been manually reset. The audible signals may be automatically ~~extinguished~~ cancelled when the concentration of hydrogen falls below a defined set-point, after a specified period of time or when the control system is manually reset.	
163.	DE	11.3	last para., page 64	ge	Following "shall" approach to delete: Any software changes which may affect the operation of the station, including the fueling protocol, shall be re-validated prior to use in accordance with the station's change control process, see 12.9.	Delete, because in the chapter 12.9. considers the modifications/changes which influences the safety of the installation, not the operation Therefore, delete referring or say any software changes which may affects safety of operation, ……	
164.	US	11.3	2nd pp	ed/te	As written, it did not translate well. We believe the propose change was what was intended.	*Replace second paragraph with the following:* Measures shall be taken when the station may be restarted remotely, software may be updated remotely, or control options changed remotely to ensure that the task is successfully planned, executed and verified. This includes consideration of the need for maintenance staff onsite as well as consideration of possible interference with other maintenance activities that may be occurring at the filling station at the same time.	
165.	US	12.1	NOTE 2	ed	If the fluid systems are opened to modify, repair or conduct maintenance (e.g. filter cleaning) minimal SAT testing is needed.	*Replace* NOTE 2 *with the following:* The need to repeat some FAT or SAT after maintenance activities should be identified by risk analysis. These tests should be included as part of appropriate operating and maintenance procedures.	

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166.	US	12.3	1st pp	ed		A leak test shall be conducted on hydrogen and other pressurized fluid subsystems, on the interconnections and on the whole system. The leak test ~~shall~~ should follow or be conducted in conjunction with the pressure test. The leak test shall verify that the system ~~is free of leaks~~ leakage is acceptable as ~~per design of~~ specified by the manufacturer.	
167.	US	12.3	2nd pp	ed	We may elect to design the system for 1000 bar but operate at 900 bar. If the reliefs are set for a 875 operating pressure, the device will crack at 910 and full vent at 962.	*Replace existing second paragraph with the following:* If the pressure safety devices are installed, the leak test shall be carried out to at least 85% of the safety device set point.	
168.	DE	12.6.1	SAT Overview Option 1	te	on the first line of the table the reference in Annex B is “3” for the SAT tests, while in Annex B on Test no 3. is referenced as “NO” for SAT. Is there an inconsistency ?	Correction needed	
169.	DE	12.6.1	SAT Overview Option 1	te	what is referenced as 7 is actually 8 in Annex B 14 is 15, 16 is 17	Correction needed	
170.	DE	12.6.1	SAT Overview Option 1	te	at the end the reference in Annex B 35 and 36 actually don’t exist in Annex B and 33 does not correspond	Correction needed	
171.	GB	12.6.1	Table 2	Ge	Is there a need to confirm the <0.5 MPa threshold? If so include as part of the “Fault: CHSS starting pressure” (If not, removal of this as a European legal requirement in EN 17127 should be considered)	If considered needed, change text to: CHSS with starting pressure greater than the appropriate vehicle NWP (i.e. 35 MPa or 70 MPa) ready to be filled (attempted) or lower than 0,5 MPa and Connect the CHSS to the station and initiate refuelling. Station shall recognize ~~full~~ CHSS is either full or empty, as appropriate, and not start main part of refuelling	
172.	GB	12.6.1	Table 2	Te	Some non-communications fuelling protocols do	Fueling performed to anticipated (e.g. 8~~8~~0 %–95 %)	

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					not achieve 88% SOC - this should not be regarded as a failed refuelling test, and therefore a station that does not meet ISO 19880-1. If it is considered critical that a non-comms fuelling protocol does not exceed 95 % SOC, this should be clearly stated in the document – otherwise it is just an example.	SOC / pressure ± 2MPa and no abort – to be verified from station data or vehicle data	
173.	GB	12.6.1	Table 2	Te	Some communications fuelling protocols do not achieve 95% SOC - this should not be regarded as a failed refuelling test, and therefore a station that does not meet ISO 19880-1.	Fueling performed to anticipated (e.g. 9~~5~~0 %–100 %) SOC/pressure and no abort – to be verified from station data or vehicle data Also correct typo: Two different starting conditions, one of which is below 2MPa starting pressure	
174.	JP	12.6.1	Table-2	ed	*See Table B.3 for example	*See Table C.2 for example	
175.	US	12.7	1st pp	ed	This section is not a requirement. Was that the intent (should vs shall)?	As part of the process of commissioning a station, in addition to the SAT and FAT testing detailed above, the station fueling and cooling capacity related to back-to-back fuelings ~~should~~ shall be evaluated by analysis or test relative to ~~in conjunction with~~ the station specification.	
176.	US	12.8	1st pp	ed	This is a requirement - shall	At first commissioning, periodically, and after maintenance procedures that may impact hydrogen quality, the hydrogen ~~should~~ shall be sampled at the dispenser nozzle to determine the impurity levels and ensure compliance with ISO 14687-2 fuel cell grade impurity threshold limits, as per chapter 9.	
177.	US	12.8	2nd pp	ed	Refer to 9.2 for details of sampling with a special adapter.	Gas phase impurities in the dispensed hydrogen may be captured with a sampling adapter (see 9.2) and taken off site for laboratory analysis.	
178.	US	12.8.1		ed	Need to ensure integrity of equipment and connections.	*Insert the following as a new 1st PP:* Sampling equipment used shall be evaluated by risk analysis and suitable for hydrogen service as defined in Clause 7. Hydrogen piping systems and	

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						equipment shall comply with the requirements in Clause 7.2. *Revise the existing 1st PP as follows:* The Hydrogen Quality test apparatus ~~should connect~~ shall securely attach to the dispenser nozzle, for further guidance see Annex K.	
179.	US	12.8.2	1st pp	ed	Shall not should, vessels not tanks, dedicated equipment	*Replace the existing 1st PP with the following:* When testing for compliance with gaseous impurity threshold limits, the sampling system shall attach to the dispenser nozzle and fill dedicated sample vessels.	
180.	US	12.8.2	2nd pp	ed	Liquid and particulate, shall not should	The evaluation of liquid and particulate entrained in the fuel and included in the dispenser flow shall ~~should~~ be measured using a suitable adapter and test method, for further guidance see Annex K.	
181.	US	12.8.3		ed	Shall not should	Metering ~~should~~ shall be tested ~~according to local regulations if applicable~~.	
182.	US	12.9	1st pp	ed	Owner/operator should be making significant decisions relative to safety.	Following any service, maintenance or repair work having an impact on the safety or fuel quality of the fueling station, the ~~fueling station~~ responsible owner/operator shall assess based on the requirements herein the need for inspection and any functional testing, as defined in Chapter 12 above, to be performed after this modification.	
183.	US	13.1	1st pp	ed	Shall not should	Instructions for use of the dispenser by the general public ~~should~~ shall be included on or in the vicinity of each dispenser. These instructions ~~should~~ shall include prohibitions against:	
184.	US	13.1	1st pp, 2nd bullet	ed	Clean up language.	the filling of cylinder systems (whether in vehicle or not) that are incompatible with the fueling protocol employed at the station, see 8.2 ~~(whether in vehicle or not)~~	
185.	US	13.2	8th pp, 2nd bullet	ed	Turn the truck off and apply the parking brake or chocks.	POWER OFF ~~OR~~ AND IMMOBILISE VEHICLE DURING FUELLING;	

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186.	US	13.4	3rd pp	ed	Clean up wording.	Where an IEC or ISO product safety standard does not exist~~s~~ for the equipment, the data plate/label(s) should include the following information, as applicable:	
187.	US	13.4	New pp	ed	This is usually the responsibility of the AHJ. In California it is the Department of Weights and Measures.	*Insert the following as a new paragraph at the end of 13.4:* The dispenser shall be marked with last dates of metering and hydrogen quality verification as required by regulatory authorities.	
188.	US	13.6	1st pp	ed	While training of station operators, maintenance personnel and fueling attendants is a reasonable requirement, we can't expect the general public to attend hydrogen safety training. The instructions provided to public dispenser users should be clear enough to not require additional training.	Add a note at end of paragraph for clarity: NOTE This requirement does not apply to public users of a commercial fueling station.	
189.	US	14.2	3rd pp	ed	Won't happen as written	~~It is recommended that~~ The manufacturer and/or integrator should assemble the documentation for the hydrogen fueling station components, subsystems, assembly compliances, intended installation environment, and maintenance and service requirements into ~~the~~ a technical file.	
190.	DIN	14.2		te	Add requirement to supply the following information to the operator by the station manufacturer: - Hazop (or underlying risk assessment) - Variable table (list of alarm and trip setpoints) - Safeguarding memorandum - Cause&effect matrix	- Hazop (or underlying risk assessment) - Variable table (list of alarm and trip setpoints) - Safeguarding memorandum - Cause&effect matrix Shall be supplied to the operator by the station manufacturer.	
191.	US	14.4.4	1st pp	ed	Seismic-4 requires more than a note. May require earthquake valves.	The seismic rating and related installation information, where applicable, shall be included in the installation documentation.	
192.	DIN	14.7		te	Add marking of safety critical elements	On P&IDs, safety critical elements should be marked accordingly.	

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193.	JP	14.9	Paragraph 2	ed	(for instance positive or proved isolation where necessary, see 3.49 and 3.54)	(for instance positive or proved isolation where necessary, see 3.50 and 3.55)	
194.	JP	15.1	Paragraph 8	ed	See 3.49 and 3.54, shall be used…	See 3.50 and 3.55, shall be used…	
195.	US	15.3	title	ed	Particulates, fluids and slurries have been found in the lines at existing stations. Do not limit to particulates.	Maintenance and inspection frequency of particulate filters and for fuel contaminants and operating debris (e.g. seal, gasket, desiccant materials)	
196.	**	15.4	Figure 15-1	ed	Figure 15-1 should be Figure 3.	Correct the label in the document and on the separate figure file submission.	
197.	US	15.6	2nd pp	ed	Won't happen as written	Where applicable, components not on the supplied parts list ~~should~~ shall not be used without the fuelling station manufacturer's ~~written~~ approval ~~where possible, which should be retained by the fuelling station operator~~. Changes shall be documented and retained in the technical file by the fuelling station owner/operator.	
198.	DE	A.4.1	Para 6, page 95	ed	Some Changes in following text: Phast / Phast Risk: A process hazard analysis software tool for all stages of design and operation. Phast examines the progress of a potential incident from the initial release to far-field dispersion analysis including modelling of pool spreading and evaporation, and flammable and toxic effects.	Change&add beginning of this paragraph: Phast/Phast Risk (proposed by DNV GL): Phast is the ……	
199.	GB	A.6.1	All	te	The draft is inconsistent in pressure units. By default it uses the SI unit pascal but it sometimes uses non-SI units such as "bar" and "atm". For example "700 bar", "1 atm". I propose all references to "bar" and "1 atm" are replaced with the equivalent in pascals. Thus "700 bar" becomes "70 MPa" and "1 atm" becomes "100 kPa" or "101 kPa" depending on the precision intended.	Replace all references to "bar" and "atm" with the equivalent value in pascals.	

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200.	GB	A.6.1	Table A.4 - Expected operating parameters of the example station	te	The draft refers to largest pipe diameters in terms of inches. I propose all values in inches are replaced with the equivalent in mm. ISO directives part 2 section 9 requires compliance with SI. The SI unit of length is the mm. Any suitably qualified user of the standard is capable of working in mm. Anyone that wants to use inches is capable of the trivial task of conversion.	Replace all largest pipe diameters in inches with the equivalent in mm.	
201.	GB	A.6.3.2	Table A.6 - HyRAM model and input parameters used in these analyses	te	The draft uses the symbol "sec" to mean seconds. I propose this is replaced with "s". ISO directives part 2 section 9 requires compliance with SI and with ISO 80000. The SI and ISO 80000 compliant symbol for second is "s", not "sec".	Replace all instances of "sec" with "s" where it refers to second.	
202.	**	A.6.3.3	Table A.7	ed	Table A.7 appears to be a landscape table (too wide for portrait view). We encourage portrait tables if possible.		
203.	NO	Annex B		ge	Annex B does not really stress the need to avoid full confinement of hydrogen equipment if possible. Confinement increases the potential for a flammable mixture and also the severity of the explosion. An inherently safe measure is to either have equipment in the open or at least remove some walls from any enclosure. Natural ventilation would be preferred to forced and combined with the buoyancy driven air movements can be much higher than would likely be achieved by forced ventilation.	Mention that the design of the filling station should be as open as possible, try to avoid enclosed spaces where hydrogen is present, etc.	
204.	DE	Annex B	Table B.2	te	in “Fault Test” n° 5,6,7,8 the “Acceptable	now should be replaced by not x2, which	

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					Criteria" is "The dispenser shall **now** allow main fueling…"	actually changes the meaning of the sentence	
205.	DE	Annex B	Table B.2	ed	in "Fault Test" n° 11 and 12 (x3) " states "the testing agency should use a means which"	shouldn't "mean" be singular ?	
206.	DE	Annex B	Table B.2	te	Test n° 15 the "Acceptable Criteria" would require some homogenization on the stop criteria sometimes it is "stops fueling within 5s", or "Fueling Stop within 5s of signal received" or "Fueling Stop within 5s of the limit being exceeded"	Homogenization of the acceptable criteria	
207.	DE	Annex B	Table B.2	ed	At the end of the table the first * is not in the table	Guess it might be Test N°3	
208.	JP	Annex E E.2	Paragraph 6	ed	It shall be deleted "See Annex M"	deleted	
209.	GB	E.2	Figure E.1	Ed	Maximum fill pressure is not defined within the document (Also, if needed for Note 1: GTR#13 reference is Clause II-3.36, on Page 54)	Consider adding to definition of Maximum fuelling pressure: **"MFP"** Note 2 to entry: Also referred to as Maximum fill pressure.	
210.	**	Annexes		Ed	Annex F is not cited in the document.	Add citation in the main part of the document, to Annex F making it clear whether it is informative or normative.	
211.	GB	F.1	1	Ge	Needs a better, more general description	The following are examples of counter measures for hydrogen stations that can be used in order to avoid overheating of light duty hydrogen vehicles (CHSS) from unknown protocols, etc. in conjunction with the use of conservative refuelling protocols. Change to The following are examples of counter measures for hydrogen stations that can be used in order to	

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2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial

Line number	MB/ NC[1]	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
						avoid damage to vehicles using the station, for example, the overheating of light duty hydrogen vehicles (CHSS) from unsuitable protocols, or damage to the vehicle high pressure hydrogen system due to unsuitable flow rates.~~, etc. in conjunction with the use of conservative refuelling protocols~~.	
212.	GB	F.1	2	Ge	Not clear what this section is saying. Seems to repeat the text above.	Delete: ~~Public stations, residential and service HRS which use protocols or hardware are currently out of scope from published recognized standards development organizations (SDOs) such as ISO, SAE, JPI, etc., should have a countermeasure to prevent light duty vehicles from fueling and/or default to a conservative fueling in order to prevent overheating of the CHSS~~. Human factors should be taken into account when defining countermeasures against fueling protocols that deviate from recognised standards.	
213.	GB	F.2	1	Ge	Strictly, this is for hydrogen vehicles in general, not just light duty vehicles, unless hydride systems are only limited to light duty vehicles (and if indeed they are limited to 11 MPa NWP only)	Change to: Below are some “Lock Out” Countermeasure examples for refuelling ~~light duty~~ hydrogen vehicles:	
214.	US	K.3.1.2	1st pp		In piping “T-connector” doesn’t exist. A “specialty tee” or “specialty fitting” is common usage.	~~Below~~ Figure K.4 is an example schematic for the a “Parallel Method” of H2 hydrogen gas sampling, where the sample can be taken which is done using a “T” ~~connector~~ fitting to fuel a CHSS (FCEV, or representative hydrogen storage system) and whilst filling a sample vessel at the same time (typically this vessel should be appropriately rated for transportation with hydrogen inside).	
215.	US	K.6.1	2nd pp		In piping “T-connector” doesn’t exist. A “specialty tee” or “specialty fitting” is common usage	The reduction valve is connected to a sampling cylinder, typically a 10 L aluminium canister with a DIN477/1 ~~connector~~ fitting.	
216.	US	K.6.7	1st pp		Grammar. What is a DIN 1?	It is important that all ~~connectors~~ connections have the proper sealing. For instance, the pressure reduction ~~DIN 1~~ DIN 477 no. 1 fitting ~~connector~~ for	

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						the 10L cylinder rated at 16 MPa requires a sealing washer. The DOT sample cylinder (1L16MPa, 0.3L-35MPa) use quick disconnect (QD) ~~connector~~ fittings currently.	
217.							

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