ISO/TC 197
Hydrogen technologies

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ISO CD 19880-1.2 - Second CD Ballot Collated Comments

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Background: Here are the collated comments from the CD 19880-1.2 Ballot.

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Template for comments and secretariat observations

Date:2017-06-04	Document:	Project:

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
NZ 001				Ed	The terms 'grounding' and 'earthing' are both used. (Grounding at 5.3.4.1, 8.4.2, 10.1.3, 10.2.4, I.5.2, I.6.4, P.5.3.4, and Table Q1 (3.2).	Ensure the terms are consistent throughout the document.	
US 006 002		01	4	ge	Now that the 2016 SAE J2601 has been published, a reference to the 2014 version is obsolete. I recommend either changing the reference to 2016 or preferably removing the year nomenclature and leaving it just as SAE J2601	This document is applicable to fueling for light duty hydrogen land vehicles, but it can also be used as guidance for fueling buses, trucks, trams, motorcycles, fork-lift trucks, fluvial and marine applications, with hydrogen storage capacities outside of fueling protocol standards, such as SAE J2601.	
GB 003		01	Para 1 & 4	Ge	With the changes in 8.2.1.1 to cover bus, or other heavy duty vehicle fuelling (e.g. 120 g/s flow rate where applicable), is this still applicable to light duty vehicles only?	Reword if considered that the document can be applicable to a fuelling station all land vehicles	
GB 004		01	Para 5	Ge	A request has been made to cover mobile refuelling stations at CEN level, can this be incorporated into this document (for instance as a separate Annex) to prevent the need for a parallel document with HRS requirements?	Develop informative Annex if agreement to explain where differences are, and what additional consideration should be taken.	
US 007 005		02	Last item	te	Also include the ISO document.	ISO 17268:2012, Gaseous hydrogen land vehicle refuelling connection devices	
US 008 006		03	New definitions		Need definitions for SAT and FAT	Site Acceptance Test (SAT) tests performed after installation of the filling station at the site to verify functionality and/or integrity Factory Acceptance Test (FAT) tests performed in the factory on filling station equipment or systems to verify functionality and/or integrity prior to shipment to the site	
NL 007		03.03		Te	Suggest to remove: 'In Germany this is based on §37 chapter 1 Product Safety Act.'	Remove, not relevant to other countries then Germany.	
US 009		03.04		ed	Use the simple definition.	**bleed venting** the intentional expiration ~~or inspiration of air or gas~~	

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008					Intentional is venting, unintentional is a release	~~from, or to, one side of a diaphragm of any accessory, component, or equipment such as a valve, pressure regulator, or switch~~ of a fluid from a fluid system,	
NL 009		03.04		ed	Add word 'or' after diaphragm	New text: one side of a diaphragm **or** of any accessory	
US 010 010		03.06		ed	In common usage Tank denotes low pressure storage; vessel or cylinder denotes high pressure storage. High pressure storage is to be in compliance with local and national safety requirements.	buffer storage ~~tanks~~ vessel any number of suitable pressure vessels designed for the purpose of storing compressed hydrogen, which can be located between a hydrogen generator and a compressor for an even flow of gas to the compressor or between the compressor and dispenser for accumulation of pressurized gas supply for vehicle fueling	
NL 011		03.06		te	Remove first 3 words 'any number of'. It is not relevant how many vessels there are.	New text: Suitable pressure vessels designed for the purpose of….	
NL 012		03.10		te	Remove item 3.10. this definition is already covered by 3.40		
NL 013		03.11		Te	Move this note 1 to section on safety instrumented system 3.67 or add it to both 3.11 ánd 3.67		
US 011 014		03.15			Use new definition of equipment enclosure.	*Modify definition as follows:* ~~protective housing~~ equipment enclosure that encloses process piping and may also enclose measurement, control and ancillary dispenser equipment	
US 012		03.16			"Enclosures," in general, can be occupied or not whereas "equipment enclosures" cannot be occupied.	*Modify definition of enclosure:* structure, not a canopy, ~~which may be a building,~~	

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015						~~protective housing, container, machine cabinet, etc.~~ which encloses or partially encloses equipment of a station *Add new definition:* *Equipment enclosure* *an enclosure that has doors or removable panels for access but not full-body entry during operation.*	
NL 016		03.19		ed	Text seems not correct: 'e.g. how many time the event occurs in a specified time or number of opportunities'	'e.g. how many times the event occurs in a specified period. ' Remove 'number of opportunities'	
US 013 017		03.22		ed	This is common English and does not require a special definition.	Delete this definition.	
US 014 018		03.23		ed	Definition is confusing. Add a NOTE to indicate that other equipment may also be included in assembly.	*Modify definition as follows and add note:* Assembly that connects the dispenser to the vehicle that includes breakaway device(s), a hose(s), a nozzle, and connectors between these components. NOTE The fueling assembly may or may not include a vent line (with break-aways and hoses) depending on the type of nozzle and communications, if used.	
US 015 019		03.25		ed	The pad will have be regional and national requirements on fluid compatibility and minimization of static charge build up as with petroleum.	area with special construction requirements adjacent to the hydrogen dispensers, where customers park their vehicles ~~for~~ during fueling	

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NL 020		03.26		ed	'hydrogen fueling station (HRS)' is incorrect	hydrogen **re**fueling station (HRS)	
US 016 021		03.35			Define housing using new definition of equipment enclosure.	Modify as follows: guard or equipment enclosure for ~~section of a system that encloses, and is intended to protect,~~ operating parts, control mechanisms, or other components, that need not be accessible during normal operation	
NL 022		03.37		te	Remove the note. It has no technical meaning, but instead is confusing.	Delete: 'Note 1 to entry: The numerical value of HSL also matches the number after the "H" in Pressure Class.'	
US 017 023		03.40		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together. ~~Add that it is a system not component term.~~	*Add note:* NOTE: See Annex D for discussion of pressure terminology and its application to dispenser system and filling stations, in general.	
NL 024		03.40		Ed/te	request to secretariat to make sure this is in line with ISO global directory. In addition to request would suggest to replace in 1st sentence: 'vessel' by 'component'	maximum pressure permissible in a component or system	
US 018 025		03.41		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together.	*Add note:* NOTE: See Annex D for discussion of pressure terminology and its application to dispenser system and filling stations, in general.	
US 019 026		03.46		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together.	*Add note:* NOTE: See Annex D for discussion of pressure terminology and the correspondence between vehicle termionolgy and dispensers.	

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NL 027		03.51		te	remove note 2. Double block and bleed is not positive isolation replace note 3: a blind or spade in combination with isolation valves is a method to provide positive isolation.	Delete note2 Replace note3 by: 'a blind or spade in combination with isolation valves is a method to provide positive isolation.'	
US 020 028		03.53		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together.	*Add note:* NOTE: See Annex D for discussion of pressure terminology and its application to dispenser system and filling stations, in general.	
US 021 029		03.54		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together.	*Add note:* NOTE: See Annex D for discussion of pressure terminology and its application to pressure protection of the dispenser system and filling stations, in general.	
NL 030		03.62		te	remove current text 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	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'	
NL 031		03.64		te	remove text, already covered by other definitions like safeguarding and guard	Delete item 3.64	
NL		03.66		te	In first sentence remove 'control system or'	function to be implemented by a safety-	

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032						instrumented system,	
NL 033		03.67		te		Add: Note xx to entry: A separate safety instrumented system (SIS), typically with a greater reliability than the more basic process control system (BPCS), may be required, according to the manufacturer's risk assessment, to respond solely to safety critical alarms. Further information is provided by IEC 61508 and 61511.	
IT 034		03.68 safety-related system	Note 4	Te	These Safety-related systems to prevent hazardous events are covered also by IEC 60079-29-3.	Please, add Note 5 Fixed systems installed in fuelling station shall comply also with IEC 60079-29-3.	
US 022 035		03.71		ed	A reference to Annex D would be beneficial as all pressure terms are discussed together.	*Add note:* NOTE: See Annex D for discussion of pressure terminology and its application to dispenser system.	
US 023 036		05.03.1.1	2	te	Don't preclude based on fluid. The safety analysis should determine a particular valve's "fail-safe" position.	The position to which automatic valves ~~in liquid~~ hydrogen lines move in the event of power or pneumatic pressure loss should be defined by risk assessment and implemented accordingly.	
SE 037		05.03.1.2		te	We strongly advice against using rupture disks and similar PRDs, since they cannot close if opened. A resealable PRD is better. For example, a fire near a hydrogen storage tank can be put out, or the storage cooled, and the resealable PRD will close. With a rupture disk, the rescue services must deal with a leakage situation until the hydrogen runs out.	Change 2nd sentence to: A PRD should be of the resealable type, such as PSV spring-loaded pressure relief valves.	
US 024 038		05.03.1.2	1	ed	Amending definitions to match the various piping codes.	When required, the pressurized gaseous hydrogen systems and equipment should be protected from over-pressure e.g. by use of one or more PRD(s), or by other appropriate means. A PRD can be of the ~~self-destructive type,~~ non-resealable type, such as a PSD (pressure actuated safety device) such	

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						as rupture disks and diaphragms, or of the resealable type, such as PSV (pressure actuated safety valve) ~~spring-loaded pressure relief valves~~.	
US 025 039		05.03.1.2	4	te	Maintenance is key. Where do we use “pressure relief devices”? We seem to just use “PRD”.	The equipment should be protected against excessive pressure at all times during operation. Consideration should also be given in the design of the installation to facilitate the periodic testing of and maintenance on PRDs ~~the pressure relief devices~~, see 15.4.	
US 026 040		05.03.2	3	te	Vent and place sensors at high points.	*Modify as follows:* Enclosures should be designed with high point vents and/or natural or forced ventilation, for example, ~~so as~~ to avoid high points where hydrogen can accumulate undetected. Use of flammable gas sensors should be considered.	
JP1 041		05.03.2.1	Para2	te	The current draft : The position of hydrogen vent stacks shall be taken into account in the layout of the installation and shall be such that the vent may be used for operation, maintenance and emergency response without creating hazardous conditions. What does "emergency response" in the current draft mean ?	Add a definition or an example of emergency response to make reader's understanding of this words clear	
US 027 042		05.03.2.2	New pp	te	Blockage of vents	*Add the following to this clause or (better yet) to 7.8 with a reference from this clause:* Vent stacks shall be designed to avoid the collection of water (ice) and organic debris which may impede or impair the venting process.	
US 028 043		05.03.5.1	2	te	As written infers the need for a flame detector, where a thermal cut-out may be a more robust, cost effective option.	Where identified by the hydrogen fueling station risk assessment; direct or indirect means of detection of hydrogen fires should be provided to avoid escalation due to flame impingement on neighboring equipment by taking an appropriate action.	
US 029		05.03.5.2	7	ed	2 ft of snow might be fine, but 40 mph winds or a seismic 6 might not.	Where applicable, snow, wind and seismic loads shall be considered.	

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044							
US 030 045		05.03.6.1	1	ed	Re-word slightly.	The layout of a hydrogen fueling station shall 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.	
US 031 046		05.03.6.3	1	ed	Further details for the protection of dispensers from traffic are included in 1.1.1. What or where is 1.1.1?	Change reference to Annex E.1.	
US 032 047		05.03.6.4	3 Note	ed	We want to avoid the possibility of a re-ignition and detonation of the hydrogen. These are the same rules as when dealing with natural gas.	*Modify the note as follows:* The fueling system shall include normally-closed valves (that close when de-energized) to isolate a hydrogen fire from the hydrogen source. The escaping hydrogen shall be either shut off or allowed to burn out prior to addressing any secondary fires.	
US 033 048		05.03.6.4	3 Note 1	ed	Realistically, the fire fighter will not be concerned about the getting the stack(s) wet. Inspect after the event is secured.	~~Water from the firefighting system should not be directed at or introduced into a hydrogen system vent stack.~~ After a fire, the hydrogen system vent stack(s) shall be drained of any accumulated water and inspected for damage prior to release for use.	
US 034 049		05.03.6.5	1	ed	Owner/operators cannot prevent vandalism. But they can attempt to.	The installation shall be designed so that authorised personnel have easy access at all times and have adequate means of escape in the case of emergency. Access to critical equipment (for example, operating valves) shall be restricted to authorized personnel. ~~prevented for all unauthorised persons~~. Emergency exits shall be kept clear at all times.	
US 035 050		05.03.6.5	4	ed	If the fast release is accessible from outside of the fence, it defeats the intent of this requirement.	All gates shall comply with the local fire and building codes. The gates shall be wide enough to provide for easy access and exit of authorized personnel. Gates shall not allow entry without a key or similar locking mechanism during normal operation. Gates should have access outwards and if equipped with a latch, should be equipped on the inside with fast release hardware that can be	

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						operated without a key. The fast release shall not be accessable from outside of the fence.	
US 036 051		05.03.6.5	5	ed	Editorial not needed.	~~onsideration shall be given to the provision of an additional emergency exit where the size of fenced area or equipment location necessitates this.~~ In cases where authorized personnel can be trapped inside the fenced area ~~compounds~~, there shall be at least two points of egress ~~two separate outward opening exits~~, remote from each other, that are strategically placed in relation to the hazard considered.	
US 037 052		05.03.6.5	6	ed	Let's focus on the requirement.	Where ~~a risk remains that~~ critical hydrogen equipment can be ~~dangerously~~ exposed to ~~fire conditions~~, fires, ~~which may originate from non-hydrogen related equipment, despite all the means that can reasonably be taken at design level,~~ the following safety systems should be ~~considered~~ instituted.	
SE 053		05.03.7		te	"It is recommended to carry out a risk assessment to establish the level of safeguarding against the following scenarios: ..." Why only a recommendation? Should be a requirement.	Change to: A risk assessment shall establish the level of safeguarding against the following scenarios:	
US 038 054		05.03.7	1	ed	List of vehicle CHSS limits are incomplete. It is preferable to refer to the normative subclause rather than repeat here.	Change as follows: Adequate measures shall be taken to reduce the risk of subjecting the vehicle high pressure hydrogen system to conditions outside of the operating range defined in GTR #13. See 8.2.~~; in particular, the vehicle high pressure hydrogen system shall not be subjected to:~~ ~~- Pressure higher than 125 % Nominal Working Pressure (NWP) or lower than 0.5 MPa;~~ ~~- Temperature higher than +85°C or lower than -40°C.~~	

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US 039 055		05.03.7	3	ed	Include reference to the normative text that addresses the fueling protocol and dispenser fault management.	Adjust the sentence: … can be found in 8.2 and Appendix P5.3.7.	
US 040 056		05.05			An annex in IEC 62282-3-100 has a list of likely hazards to mitigated with a hydrogen product. This might be an interesting table to review and possibly include.		
US 041 057		05.05.1	1		“Equipment compartment” not defined. Per revised definitions, “enclosures” can be occupied and therefore applicable to this concern.	Change to “equipment compartment” to “enclosure”.	
US 042 058		05.05.1	1		Confined spaces	Add to text as indicated below: When an equipment compartment is intended to be entered and contains or is connected to a source of hydrogen or inert gases, that compartment shall be evaluated for the potential of an oxygen deficient atmosphere during normal or off-normal conditions An occupancy area shall not be allowed to have the local oxygen concertation drop to less than 18.9% due to dilution or consumption without warning to the personnel in the area.	
US 043 059		05.05.1	4		What about piping repair?	Hydrogen piping and equipment shall be isolated, depressurized and made safe prior to repair or replacement ~~of components~~. Vent gas and purge gas shall be exhausted outside of the hydrogen compartment before and after replacement or service work requiring hydrogen depressurization and purge.	
US 044 060		05.05.2	3		New – Access panels - Demonstrates intent and not accidental access.	Access panels shall require tooling to open or remove. Tooling may be as simple as an open-end box wrench.	
US 045 061		05.05.3	1		Determine IP level, design and then verify IP level obtained.	The appropriate enclosure rating shall be determined based of the enclosure installation environment, the system requirements and IEC 60529. The rating shall be verified per the test methods in IEC 60529. ~~Equipment enclosures should be designed and~~	

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						~~tested for the intended installation environment, as defined in IEC 60529. In function of the installation environment, the appropriate rating should be chosen.~~	
US 046 062		05.05.3	Note 1		IP rating is also to keep things out, like fingers.	Components and equipment individually protected to the levels recommended by this Standard (or better) do not need to be enclosed, and subsequently enclosures not intended to provide weather and personnel protection do not need to meet ~~this~~ an IP rating.	
GB 063		05.06.3	Para 1	Ed	Remove 2nd sentence, this duplicates Note 1	Remove	
US 047 064		06.02.1	2		2 requirements, 2 paragraphs.	The tube trailer or MEGC stationing area should be level and shall support the front and rear ends of the tube trailer or MEGC in a designated area or unloading bay. The stationing area shall be kept free of debris and combustible materials.vb	
US 048 065		06.02.1	3		Define “bump stop”.	*Add the following explanation after “bump stop”:* such as lintels	
US 049 066		06.02.1	6		2 requirements, 2 paragraphs.	Means to ground tube trailers and MEGCs to the same potential as the fixed storage hardware shall be provided. When the offloading hose is disconnected, any gaseous hydrogen released shall be discharged through a vent	

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						stack to a safe location.	
US 050 067		06.02.1	7		2 requirements, 2 paragraphs.	A designated temporary tube trailer or MEGC parking location should be provided for carrying out tube trailer or MEGC exchange without interfering with fueling operations, unless the fueling activity is fully suspended during the tube trailer or MEGC exchange operation. The foundation under a tube trailer or the MEGC remaining on site should be made of reinforced concrete, or any other suitable non-combustible material.	
US 051 068		06.02.2.1	2		No comments, just requirements. In many cases, underground storage may be preferable.	~~It is preferable that wherever possible,~~ above ground liquid hydrogen storage and related equipment shall be i~~s~~ located ~~above ground in the open air~~ in a well-ventilated area to minimize the consequence of an accidental leakage. If any protective structures are used to reduce the safety distances, they shall be designed to avoid escalation of an ignited hydrogen release. The consequences on overpressure in case of ignition and Deflagration to Detonation Transition (DDT) should be assessed.	
US 052 069		06.02.2.1	3		No comments, just requirements.	~~However,~~ underground liquid hydrogen storage and related equipment shall require ~~Located installation, e. g. in a vault, may be needed and used when it is beneficial to keep above ground areas free of equipment, such as may be the case for hydrogen vehicle fueling stations. For this layout~~ additional measures ~~may have to~~ be taken according to the risk assessment.	
US 053 070		06.02.2.3	2		Simplify and generalize the requirement	The foundation supporting the Liquid hydrogen storage tanks shall be designed to prevent pooling of liquid hydrogen or any other liquid fuel under the tank. ~~protected from liquid spillage, for instance by a slope to ivert liquid from the support structure of the storage tank, or other means.~~	

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US 054 071		06.02.2.3	4		The use of trap rock to help mitigate a leak.	The area around the foundation shall consist of high surface area, non-combustible material to aid in the vaporization of a liquid hydrogen leak.	
US 055 072		06.02.2.3	4		Control of a leak without pooling (avoidance of a BLEV event)	In the event of a leak, the leak shall be directed to an area that does not increase the hazard (i.e. away from doors, windows, sewers. This can be done using berms and dykes. DO NOT ALLOW THE LEAK TO POOL	
US 056 073		06.02.2.4	New paragraph 4		Ignition due to actuator selection and installation.	The valve actuators shall be suitable for the hazardous area (area classification) in accordance with Clause 10. Actuators shall be installed per the manufactures instruction (Control Drawing)	
SE 074		06.02.2.5		te	We strongly advice against using rupture disks and similar PRDs, since they cannot close if opened. A resealable PRD is better. For example, a fire near a hydrogen storage tank can be put out, or the storage cooled, and the resealable PRD will close. With a rupture disk, the rescue services must deal with a leakage situation until the hydrogen runs out.	Change 2nd sentence to: A PRD should be of the resealable type, such as PSV spring-loaded pressure relief valves.	
US 057 075		06.02.2.5	1		Corrected to match comments in section 3.	Liquid hydrogen systems and equipment shall be protected from over-pressure e.g. by use of one or more PRD(s), or by other appropriate means. A PRD can be of the self-~~destructive type,~~ non-resealable type, such as a PSD (pressure actuated safety device) such as rupture disks ~~self-destructive type, such as rupture disks and diaphragms,~~ or of the resealable type, such as PSV ~~spring-loaded~~ pressure ~~relief~~ actuated safety valves.	
US 058 076		06.02.2.5	3		Corrected to match comments in section 3.	Burst disc safety devices (PSDs) shall meet the requirements of ISO 21013-2 or an equivalent standard recognized in local regulation.	
US 059 077		06.02.2.5	4		ISO does not supersede national regulations.	Sizing and capacity determination of liquid hydrogen system PRDs shall meet the requirements of ISO 21013-3 ~~or~~ unless superseded by ~~be designed in accordance with~~ a national / regional standard, ~~such as a Harmonised standard.~~ The different behaviour of gaseous and liquid phases shall be taken in consideration.	

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US 060 078		06.02.2.5	9		Clarification	Consideration should also be given in the design of the installation to facilitate the periodic inspection and testing of the pressure relief devices.	
US 061 079		06.02.2.5	new		A statement that the installation of PSVs must take in account the reactive loads resulting from venting? Many PSVs have right angle relief ports resulting in a moment being applied to the valve during venting.	Add reference to 7.8 into this clause.	
US 062 080		06.02.2.6	2		In the US, NFPA 2 is considering allowing the use of a facility vent stack to also be used as the vent stack for the delivery tanker. The key issue is not so much the cold nature of LH2 vent systems but the potential problem of high pressure vents being co-mingled with the low pressure (5 to 12 bar) LH2 vent system. The worst case is back-pressure from a 1000 Bar SRV resulting in reverse flow through a rupture disk protecting the LH2 tank from overpressure. Even if the high pressure pulse was just enough to pop the burst disk this is a bad scenario. The first fault, (1000 bar SRV trip) could trigger a loss of containment in the LH2 system.	The vent stacks shall ~~should~~ be dedicated to the liquid hydrogen ~~installation~~ system and may include the delivery tanker. They shall not be connected to ~~other~~ high pressure vent systems ~~stacks~~ to avoid any back feed into the liquid hydrogen system ~~vent stacks.~~	
US 063 081		06.02.2.7	1		Clarification	Cold sections (i.e. below the boiling point of nitrogen) of liquid hydrogen installations and transfer hoses should be purged with warm (i.e. above the boiling point of nitrogen) hydrogen or warm helium prior to being purged with nitrogen.	
US 064 082		06.03	New bullet		Authorities may allow a transmission pipe line to be non-odorized, however, a delivery pipeline running throughout a city is going to be viewed differently. As an example, see natural gas.	*Recognize the possibility of deodorization being needed:* Deodorization equipment	

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US 065 083		07.01	3		Not a Webster definition, pointing pack to section 3 helps the reader.	The ability to carry out maintenance using positive isolation, as defined in 3.51, should be considered in the design of the hydrogen installation.	
US 066 084		07.01.1	4		As written, this would allow materials that would fail due to a flow surge/pressure pulse of a PSV actuating.	Vent lines, where hydrogen is not expected to be present under normal operating conditions~~, or at sustained high pressures,~~ may use other materials not suitable for continuous pressurized hydrogen service.	
US 067 085		07.01.3	1		Incomplete list. Suggest referencing RoHS without mandating RoHS.	Material selection shall be made in accordance with local environment requirements, avoiding the use of materials that do not comply with these requirements such as~~: mercury, lead or asbestos~~ the materials listed in EC Directive 2002.95.EC (RoHS).	
US 068 086		07.01.3	2		Redundant	Care should be taken to prevent contact between dissimilar metals to prevent galvanic corrosion. ~~When an electrolyte is expected to be present, the use of dissimilar metals in tubing, fittings and other components should be avoided. Special consideration should be given to prevent contact between components of anodic metals with cathodic ones.~~ Metal fittings should be compatible with metal tubing materials.	
SE 087		07.03.2		te	Buffer storage tanks should always have venting systems, regardless of thermal shielding/fixed firewater protection.	Change 3rd paragraph to: The design of the buffer storage, installation should include appropriate means to prevent bursting in the case of fire. Suitable prevention method is product venting systems, such as thermally activated pressure relief devices (TPRDs), and may be complemented with thermal shielding and/or fixed firewater protection (where permitted according to national regulations).	

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US 069 088		07.03.2	2		No vessels, under no conditions Tank – ambient storage Vessel – pressurized storage.	If buffer storage ~~tanks~~ vessels of different design pressures are interconnected, they shall be protected in such a way that no vessel ~~tanks rated for a lower pressure~~ can be over-pressurized ~~due to any malfunction~~ under any condition~~,~~	
US 070 089		07.03.2	3		Leak before burst, we don't want a leak.	The design of the buffer storage, installation ~~should~~ shall include appropriate means to prevent rupture ~~bursting~~ in the case of fire. Suitable prevention methods may include:	
US 072 090		07.03.2	4		Failures of vessel coded welds is usually not considered a credible failure. Tank – ambient storage Vessel – pressurized storage	The layout design of the gaseous hydrogen buffer storage ~~tanks~~ vessels ~~should~~ shall prevent direct impingement of any credible gas leak onto an adjacent vessel.	
US 073 091		07.03.2	5		BPVC requirement. Tank – ambient storage Vessel – pressurized storage	Each group of buffer storage ~~tanks~~ vessels that may be isolated with manual or automatic valves, ~~should~~ shall be equipped with their own set of safety devices.	
US 071 092		07.03.2	New bullets		Require the separation of hazards	- Inability to pool a flammable under the vessel. - Inability of a gaseous jet to impinge on a vessel	
US 074 093		07.03.3.1	1		Tank – ambient storage Vessel – pressurized storage	Gaseous hydrogen buffer storage ~~tanks~~ vessels or assemblies ~~should~~ shall be situated in the open air or a suitable hydrogen safe container, see 5.3.5.2.	

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US 075 094		07.03.3.1	2		Tank – ambient storage Vessel – pressurized storage	The foundation for a gaseous hydrogen storage ~~tanks~~ vessels shall be appropriate to accommodate the weight of the equipment placed on it and shall be made of concrete or any other suitable non-combustible material.	
US 076 095		07.03.3.1	New paragraph		Additional requirement new pp	Foundations for gaseous hydrogen storage ~~tanks~~ vessels ~~should~~ shall be designed and constructed to prevent frost heaving.	
US 077 096		07.03.3.1	New paragraph		New requirement new pp	Foundations for gaseous hydrogen storage vessels shall be designed to prevent the floating of the vessel in the event of flooding.	
US 078 097		07.03.3.1	New paragraph		Additional requirement new pp	In addition, if onsite hydro-testing testing is anticipated, then the foundation shall be designed to withstand the weight of the vessel when full with water. Additionally, the	
US 079 098		07.03.3.2	2		Tank – ambient storage Vessel – pressurized storage	The vault walls should be higher than the gaseous hydrogen buffer storage ~~tanks~~ vessels contained therein. There ~~should~~ shall be no openings in the vault enclosure except those necessary for access to, inspection of, and filling, emptying, ventilation and venting of the gaseous hydrogen buffer storage ~~tanks~~ vessels.	
US 082 099		07.03.3.2	4		Tank – ambient storage Vessel – pressurized storage	There shall be sufficient clearance between the gaseous hydrogen buffer storage ~~tanks~~ vessels and the vault to allow for inspection and maintenance of the ~~tanks~~ vessels and their appurtenances.	
US 080		07.03.3.2	New paragraph		Additional requirement new pp	Ventilation or other measures shall be provided to prevent accumulation of leaked hydrogen gas.	

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100							
US 081 101		07.03.3.2	New paragraph		Additional requirement new pp	Ingress of water shall be prevented, or a drainage system to manage water ingress shall be provided. If installed at grade and subject to vehicle loading, the top shall have a metal grating or another roof with sufficient strength to carry vehicle loading.	
US 083 102		07.03.3.3			Amend title	Roof top and Canopy installation of gaseous hydrogen systems	
SE 103		07.03.3.3		ge	Some countries prohibit rooftop installations.	Add note: National authorities may prohibit or strongly advice against roof top storage installations.	
US 084 104		07.03.3.3.1	1		Tank – ambient storage Vessel – pressurized storage	Where hydrogen generators, compressors, gaseous buffer storage ~~tanks~~ vessels, piping systems and their related accessories are located on building or canopy roofs, the installation should meet the recommendations of 7.3.3.3.	
US 085 105		07.03.3.3.2	1		Tank – ambient storage Vessel – pressurized storage	The roof structure supporting the hydrogen equipment and ~~tanks~~ vessels shall be constructed in compliance with the local national building code with due consideration for the added weight of the equipment in addition to other static and dynamic loadings.	
US 086 106		07.03.3.3.3	1		Tank – ambient storage Vessel – pressurized storage	Gaseous hydrogen buffer storage ~~tanks~~ vessels shall be mounted according to the ~~tanks~~ vessels manufacturer's instructions. They should be individually supported in a cradle or similar structure or within a rack that provides individual ~~tanks~~ vessels support.	
US 087 107		07.03.3.3.3	2		Tank – ambient storage Vessel – pressurized storage	The ~~tanks~~ vessels mounting structure shall be securely affixed to the roof.	
US 088		07.03.3.3.5	1		Tank – ambient storage Vessel – pressurized storage	Gaseous hydrogen equipment and buffer storage ~~tanks~~ vessels on the roof of an occupied building	

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108						shall meet the following recommendations to avoid escalation from a building fire:	
US 089 109		07.05	1		Clarification	~~Surfaces located~~ all uninsulated pipe and pump connections carrying hydrogen under cryogenic temperature, with the possibility of air condensation shall be constructed of non-combustible materials as per 7.2.1.	
US 090 110		07.05	New paragraph		New requirement new pp	All uninsulated pipe and pump connections carrying hydrogen under cryogenic temperature shall have guards to protect personnel and the general public. Guards can be a simple as a 2-meter-high chain link fence.	
US 091 111		07.06	New paragraph		New requirement new pp	The rating of pressure-bearing housings in gaseous hydrogen systems of the fueling station shall be consistent with its use in the piping system (as defined in 7.2).	
US 092 112		07.08.1	3	ed	Two entirely different requirements are mixed into one pp. Mechanical loads on the PRDs should be addressed.	Separate into 2 paragraphs. In the new second paragraph add the following sentence: The reaction of this trust on the PRD nozzle forces and moments shall also be addressed to ensure that the PRD is properly supported and that the integrity of the high pressure piping system and the vent pipe are maintained.	
US 093 113		07.08.1	New paragraph		New requirement new pp	All uninsulated pipe potentially carrying hydrogen under cryogenic temperature shall have guards to protect personnel and the general public. Guards can be a simple as a 2-meter-high chain link fence.	
US 094 114		07.08.2	New paragraph		New requirement new pp	Venting is to be directed away from the general public, other structures and.ignition sources. Venting of hydrogen is not to create a new, unmitigated hazard.	
US 095 115		07.11			This section only addresses ventilation of the enclosure. While this is very important, there are design requirements in Clause 5 that are better placed here.	Generalize the title of 7.11 by deleting “Ventilation of”. Add a new subclause (7.11.1) entitled “General Design Requirements” and then either reference some items discussed in 5.3 or move the more detailed items to this new section. 7.11.2 should then discuss the details of the	

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						ventilation design with reference to 5.3 as appropriate.	
US 097 116		08.02.1.1	10	ge	This sentence doesn't make sense. What are "hydrogen fueling safety targets"?	Current: Hydrogen fueling safety targets shall be validated at station commissioning using a Hydrogen Station Test Apparatus (HSTA, see Annex K) or equivalent equipment which can perform the tests, see Clause 12. Change to: Correct function of the hydrogen fueling protocol shall be validated at station commissioning using a Hydrogen Station Test Apparatus (HSTA, see Annex K) or equivalent equipment which can perform the tests, see Clause 12.	
US 096 117		08.02.1.1	6 Bullet 8		Current wording is cumbersome.	maximum fuel flow rate (excluding momentary excursions during the initial connection sequence ~~- the process of~~ when connecting the nozzle to the receptacle prior to the start of fueling) shall be no greater than 60 g/s for road vehicles~~, or~~ unless ~~120 g/s for vehicles with this capability provided~~ sufficient lockout measures are provided to allow 120g/s for vehicles designed for this capability;	
GB 118		08.02.1.1	Para 8	Ge	Where these protocol limits are checked before starting fuelling, is it better to say that fuelling should not be initiated? e.g. ambient temperature?, start pressure	Separate list into one for initial checks, in addition to one for continuous checks "The station dispenser shall not initiate a fuelling event if any of the following fuelling protocol limits are exceeded:" Or "The station dispenser shall not initiate a fuelling event, or shall terminate within 5 secs, as appropriate, (but not necessarily initiate an emergency shutdown as per clause 5) if any of the following fuelling protocol limits are exceeded:"	

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GB 119		08.02.1.1	Para 8	Ge	How are vehicles that have undergone maintenance and have been purged, or that have run out of fuel (for instance due to leak test systems running on range extender / dual fuel vehicles) filled? Is it therefore necessary to not allow them to be filled at a public hydrogen station, and have them filled at a private station / using a cylinder?	Guidance requested if possible.	
US 098 120		08.02.1.2	4		What does this say? What does it mean? What did it intend to mean?	Measures should be taken to ensure that fueling subsequent to a previous fueling does not lead to an unsafe situation.	
US 099 121		08.02.1.2	5	ed	The last paragraph of 8.2.1.2 is discussing communication and is better fit for 8.2.1.3	Move to start of 8.2.1.3 The dispenser may either conduct the fill using communication with the vehicle as part of the fueling process or conduct the fueling protocol without communications with the vehicle (See 8.2.1.3). The fueling protocol may have provisions for both communication and non-communications fills, for example see Annex C	
US 101 122		08.02.1.3	4	te	This clause is not clear that the station should either terminate the fueling or continue in non-comm when communication is lost.	If the communications fail during fueling, the station shall either terminate the fueling within 5 seconds or the fueling may continue without communications if allowed by the fueling protocol.	
US 100 123		08.02.1.3	New 4th paragraph (after bullets)	te	An unauthorized communication protocol could lead to issues (e.g., pressure scale is different). The same clause requiring countermeasures for unapproved fueling protocols should be used for communication protocols	Add after last bullet The fueling station operator should take measures to prevent the fueling of vehicles where communication 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 fueling at stations where the protocol has not been approved are provided in Annex J	
GB 124		08.02.1.4	Para 2	Ed	Remove 2nd paragraph, this duplicates Chapter 12.5, but says “should” for performance	Remove, and clarify if performance functional testing is a “shall” or a “should” in 12.5	

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US 102 125		08.02.1.6	1		Is this requiring the vehicle conduct a decay pressure test? The only positive shut offs are in the dispenser, the nozzle and the vehicle. You can't test the connection unless the shutoff is in the vehicle. Additionally, the nozzle is a manual shutoff.	Control systems on fueling stations shall be designed to verify the integrity of the fuel hose, breakaway, nozzle and connection to the vehicle. Integrity shall be checked while the vehicle is connected. The integrity check shall detect a significant degradation of pressure, or other indication of a leak, and shut down in the event of detection of a leak.	
NZ 126		08.02.2.1		Ed	Hyperlinks need tidying up		
SE 127		08.02.2.1		ed	There are two incorrect references in this clause.	Please correct.	
US 103 128		08.02.2.1	1	te	Basic requirement is missing.	*Insert after first paragraph (as the second paragraph):* The dispenser control system including programmable and/or process controllers shall comply with Clause 11.	
US 104 129		08.02.2.2	1	te	Basic description and requirement is missing.	*Modify the existing first paragraph:* The dispenser shall operate in conjunction with an emergency shutdown function, which may be automatically activated by the dispenser control system or manually activated. Refer to 8.2.2.1 and Clause 11.	
US		08.02.2.2	3		A site with multiple dispensers need not shutdown	Activation of the emergency shutdown shall cut off	

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105 130					the site due to a single dispenser fault.	the flow of hydrogen gas to the dispenser and vehicle, which initiated the shutdown, by closing the automatic isolation valves defined in 8.3.2.2.1.	
US 106 131		08.02.2.2	New paragraph		Have each node self-protect without necessarily causing a trip of all dispensers.	If the event area incorporates multiple dispensers, the need to execute ESDs for dispensers other than affected dispenser shall be based on the risk assessment. See 11.2.	
US 107 132		08.02.2.2	New paragraph at end			Operation of the dispenser shall require manual reset after the ESD is tripped.	
US 108 133		08.02.2.5	1		Clarify requirement.	*Add to the end of the sentence:* If the break-away fails to shut-off flow after separation.	
US 109 134		08.02.2.7	1	te	Basic requirement is missing.	*Insert as new first paragraph:* The dispenser control system including programmable and/or process controllers shall comply with Clause 11.	
US 110 135		08.02.2.7	2		Add watch dog timer as an example.	After “means” add the following: such as a watch-dog timer, for example,	
US 111 136		08.03.1	1		Over-temperature protection is a basic requirement which should be noted in the over-view.	The dispenser shall, when necessary, incorporate the required critical safety equipment to safeguard the users and vehicles against any overpressure, over temperature, over-filling and major hydrogen release situations.	
US 112 137		08.03.2	1		The international term is rated pressure.	If components are used that are below the pressure ratings in Table 1, then the MAWP of the dispenser system shall be accordingly lowered to the lowest component ~~rated~~ ~~component~~ pressure rating.	
CA 138	11	08.03.2	First bullet point	te	Defining the ambient temperature range as -40C to 50C for all hydrogen dispensing components may be excessive in some cases and result in extra costs or a restriction of available parts due to the low temperature rating.	Dispenser manufacturers shall determine the dispenser’s ambient temperature operating range based on the local environment and ensure the dispenser does not operate if the ambient temperature is outside of this range.	

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					If for example, a manufacturer was building a dispenser for a location with no historical weather data below 0C. Components that are upstream of the hydrogen heat exchangers should only require a temperature rating of 0C or with a safety margin perhaps -10C.		
US 113 139		08.03.2.2.1	3		What if we elect to use a pneumatic valve? The muscle gas vent should then open mimicking a loss of muscle gas incident.	Replace “unpowered” with “de-energized”.	
US 114 140		08.03.2.2.1	5		Two requirements discussed.	Separate sentences so that location for vehicle impact is discussed in its own paragraph.	
US 115 141		08.03.2.4	New paragraph at end		We’ve seen this mistake much too frequently.	The pressure sensor placement shall insure that an accurate static pressure is detected/measured.	
US 116 142		08.04.3	1		meniscal. What does meniscal mean?	Consider change from “meniscal” to “insignificant”.	
US 117 143		08.04.4	1		Clarity	~~Between fueling,~~ the hose assembly and nozzle should be ~~stored~~ stowed between use in such a way that they are protected from damage by vehicles. The fueling nozzle should be securely supported and protected from the accumulation of foreign matter (e.g. snow, ice or sand) that could impede operation.	
US		08.04.4	2		Clarity	The length of the fueling hoses shall be adequate	

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118 144						~~should be long enough~~ to fill vehicles, but not excessive for ~~should not be longer than necessary to fill vehicles at~~ the intended location. The hose assembly should be prevented from contacting the ground unless appropriate measures are taken to protect the hose from any damage resulting from contact with the ground.	
US 119 145		08.04.5			At what voltage? We want a leakage current to avoid static charge. Why does the hose need to be pressurized? We are either using a conductive or bonded hose, neither should be a function of process pressure.	Modify paragraph 2 to define an acceptable test voltage and delete the specification of pressure.	
US 120 146		08.05	1		This should be a requirement.	~~When necessary,~~ dispensers shall ~~should~~ be secured against unauthorized use. Outside of normal operating hours, the hydrogen supply to the dispenser shall ~~should~~ be isolated at the source, and where appropriate, at the dispenser.	
US 121 147		08.05	2		Clarification	*Modify text as follows:* The use of adapters shall be prohibited with the exception of controlled situations such as the specialized tooling approved by regulatory authorities for hydrogen quality sampling by trained personnel. See Annex I.	
US 122 148		08.06	2		This should be a requirement.	The dispenser and fueling assembly shall ~~should~~ be visually inspected regularly to check that the assembly is free from damage. The fueling hose shall ~~should~~ be free from cuts, cracks, bulges or blisters, and kinks.	
US 123 149		08.06	3		This should be a requirement.	The fueling assembly shall ~~should~~ 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. Any leakage above the limit specified by the manufacturer shall ~~should~~ be reason for	

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						rejection	
US 124 150		08.06	5		This should be a requirement.	Fueling hose assemblies that fail visual inspection or leakage test shall ~~should~~ be withdrawn from service.	
GB 151		08.06	All	Ge	Move maintenance section to Chapter 15 unless it needs to be located here?	Clarify, and move if appropriate	
US 125 152		09	1		19880-8 is inadequate and will not ensure clean fuel as written. Other methods exist that would result in clean fuel. The piping code requires cleanliness be address. For example, ASME B31.3 Appendix F Clause F335.9.	The hydrogen quality at the nozzle shall meet the ISO 14687-2. The means of achieving these requirements ~~shall~~ may be based upon ISO 19880-8.	
US 126 153		09	Note	te	This note belongs in ISO 14687-2, not in this document.	Delete entire note ~~NOTE As the Fuel Cell Electric Vehicles (FCEV) industry matures, the list of impurities in ISO 14687-2 and their thresholds should be revised appropriately and according to technical progress, taking into account:~~ ~~— Proven detrimental effect to fuel cell vehicle systems;~~ ~~— Feasibility of measurement of very low concentrations;~~ ~~— Complexity of appropriate purification, sampling and analysis.~~	
US 127 154		09	Note		Add a bullet	Changes in composition and loading of the fuel cell vehicle cell catalyst	
US 128 155		09.01	1		Redundant and potential to diverge. State one requirement and then refer to the requirement. The requirement is and belongs in 14687.	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, hydrogen filters shall be included as part of the dispenser,	

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						see 7.7. The filter shall meet the particulate requirements stated in ISO 14687-2. ~~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 as per ISO 14687-2.~~	
US 129 156		09.01	3	te	Liquid and aerosol particulates are common occurrences in stations and should be protected against.	If removal of other contaminants such as condensates or liquids is deemed necessary in accordance with either ISO 19880-8 or a risk assessment of the process, appropriate means to remove the contaminant shall be installed upstream of the dispenser.	
US 130 157		09.02	1		Procedures exist, follow them.	Sampling of hydrogen shall only be done by personnel trained in handling of pressurized hydrogen gas to procedures and test equipment approved by the regulatory authority. Guidance on test methods (including sample size) is included in ISO 14687. Sampling shall be at the nozzle. The owner/operator or the regulatory authority may elect to sample at additional points. ~~A representative sample should be considered utilizing hydrogen from all hydrogen banks at fueling station.~~	
SE 158		10.02		te	Canopies could be used for other installations than dispensers.	Change third paragraph, last sentence, to: Where the classified area above a dispenser or other hydrogen installation reaches up to a canopy, the canopy shall be designed to prevent the accumulation of hydrogen in pockets or between the canopy ceiling and roof, unless other means of protection have been taken.	

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US 131 159		10.02	1		Needs to be a requirement	Hazardous areas shall be classified in accordance with IEC 60079-10-1.	
US 132 160		10.02	New paragraph		For example; if petroleum and hydrogen share the same hazardous areas or zones, the equipment within the areas or zones shall be appropriate for both petroleum and hydrogen areas or zones	Stations with multiple defined hazardous areas due to multiple fuels shall require equipment located in contiguous areas to meet the requirements of all of the contiguous areas.	
SE 161		10.02.1		te/ed	In many cases mechanical parts of electrical equipment are covered by appropriate requirements in the IEC 60079 series of standards for electrical equipment. See for example requirements for metallic parts of enclosures (clause 8 in IEC 60079-0:2011) and requirements for rotating machines (incl. electrical ventilating fans) according to clause 17 in IEC 60079-0:2011. Therefore, to refer only to ISO 80079-36 and -37 for mechanical parts of electrical equipment, or for fans, is misleading. Furthermore, "ISO/IEC 80079" should read: "ISO 80079".	Amend the last para ("Mechanical parts of electrical equipment…and ISO/IEC 80079-37.2."), to read: "Mechanical parts of electrical equipment installed in hazardous (classified) areas should be protected in accordance with ISO 80079-36 and, if applicable, ISO 80079-37, if such parts are not protected according to the requirements in the IEC 60079 series of standards for electrical equipment, Electrical ventilating fans ranging up to 5 kW with impellor directly mounted to an electrical motor, being part of a fan with EPL Gb and Gc, are examples of rotating machines which are wholly covered (incl. non-electrical ignition sources) by the IEC 60079 series of standards for electrical equipment."	
US 133 162		10.02.1	1		Needs to be a requirement	All electrical equipment in hazardous (classified) areas shall ~~should~~ be protected in accordance with the IEC 60079 series of standards, i.e. IEC 60079-0 and the appropriate other section of IEC 60079 for the type of protection used. For example, an intrinsically safe electrical system should comply with IEC 60079-0 and IEC 60079-11, and IEC 60079-25.	
US 134		10.02.1	2		Needs to be a requirement	All electrical equipment in hazardous (classified) areas shall ~~should~~ be installed in accordance with the	

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163						manufacturer's instructions and with IEC 60079-14.	
US 135 164		10.02.1	3		Needs to be a requirement	All electrical equipment installed in hazardous (classified) areas shall ~~should~~ be inspected and maintained in accordance with IEC 60079-17.	
US 136 165		10.02.1	4		Needs to be a requirement	All electrical equipment installed in hazardous (classified) areas shall ~~should~~ be serviced, repaired, overhauled, and reclaimed in accordance with IEC 60079-19.	
US 137 166		10.02.1	4		Needs to be a requirement	Mechanical parts of electrical equipment installed in hazardous (classified) areas shall ~~should~~ be protected in accordance with the ISO/IEC 80079 series of standards, i.e. ISO/IEC 80079-36, and the appropriate other section of ISO/IEC 80079 for the type of protection used. For example, a fan protected by construction shall ~~should~~ comply with ISO/IEC 80079-36 and ISO/IEC 80079-37.2.	
US 138 167		10.02.2			Needs to be a requirement	Mechanical equipment and mechanical parts of electrical equipment installed in hazardous (classified) areas shall ~~should~~ be protected in accordance with the ISO/IEC 80079 series of standards, i.e. ISO/IEC 80079-36, and the appropriate other section of ISO/IEC 80079 for the type of protection used. For example, a fan protected by construction shall ~~should~~ comply with ISO/IEC 80079-36 and ISO/IEC 80079-37.2.	
SE 168		10.02.2		te/ed	See our comment on 10.2.1 above. Clause 10.2.1 deals with electrical equipment, and 10.2.2 deals with other equipment. Therefore, to avoid confusion, electrical equipment should be addressed/mentioned in clause 10.2.1 but not in clause10.2.2.	Amend the para ("Mechanical equipment…and ISO/IEC 80079-37.2."), to read: "Non-electrical equipment installed in hazardous (classified) areas should be protected in accordance with ISO 80079-36 and, if applicable, ISO 80079-37."	

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					Furthermore, ”ISO/IEC 80079” should read: “ISO 80079”.		
US 139 169		10.02.3	1		Needs to be a requirement, See comment 10.2, New pp	Flammable gases shall ~~should~~ be prevented from entering adjacent areas or compartments unless the equipment within the adjacent area or compartment is suitable for the resulting area classification.	
US 140 170		10.02.3	3		Needs to be a requirement	When multiple purged hydrogen equipment enclosures are located in one area, the exhaust of ventilation from one hazardous area shall ~~should~~ not be introduced into adjacent enclosure compartments.	
US 150 171		10.02.4	1		The requirement needs to be clarified to avoid confusion with 10.1.3.	Insert the following as a new paragraph 1: “The following equipment shall be grounded and bonded together to prevent electrostatic discharge: • Conductive hydrogen tanks and vessels; • Hydrogen piping and systems including flanges and joints; and • Conductive enclosures including frames and floors where hydrogen is stored or used. Both halves of a joint or flange connection shall be bonded if there is an isolating seal (for example, a polymer seal). The bonding system resistance shall be less than or equal to 10 Ω.” Modify existing paragraph 1 as follows: “All other ~~and extraneous~~ conductive parts shall ~~should~~ be ~~connected to the~~ bonded to the bonding/grounding system in accordance with IEC 60079-14.”	
US 151 172		10.02.4	3		Needs to be a requirement. At what voltage, this is a leakage current requirement.	The total resistance of the bond from the other conductive parts to the bonding/grounding system shall ~~should~~ be sufficient to dissipate charges that are otherwise likely to be present. The bonding system resistance shall ~~should~~ be less than or equal to 1 MΩ.	

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US 152 173		11.01	1	te	Should be written as a requirement.	This clause defines the minimum ~~recommendations~~ requirements for the functional safety of the control and safety system.	
US 153 174		11.01	3	te	Should be written as a requirement.	The individual risk assessment ~~will~~ shall dictate what to do when there is a system fault on the process control or safety system.	
US 154 175		11.01	5	te	This is the basic requirement. It should be referenced earlier in the clause and written as a requirement.	*Move up under existing 2 and edit as follows:* Electrical control systems, components of hydrogen fueling stations, and devices determined by the manufacturer to be safety related control systems, ~~should~~ shall comply with the requirements of IEC 60204-1.	
US 155 176		11.01	7-8	te	This is the basic requirement. It should be referenced earlier in the clause and written as a requirement.	The configurations of process control and safety systems ~~should~~ shall be documented. There ~~should~~ shall be restrictions regarding admittance to the control and safety systems such as by using password protection. Where specific operations require safety systems to be non-functional, a risk assessment ~~should~~ shall be executed and documented before the start of the operation.	
US		11.02.2	1		Amended for grammar. ISO 26142 has not been reviewed by the U.S.	Hydrogen detection apparatus used in hydrogen sensing and monitoring systems shall meet ~~should~~	

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156 177					TAG of TC 197. The excuse is that it is a draft. ISO documents do not reference drafts. Review of this document adversely effects review of 14687, 19880-1 and 19880-8.	~~comply with, and meet~~ the accuracy requirements of ISO 26142.	
US 157 178		11.02.2	2		Needs to be a requirement.	Hydrogen detection apparatus and/or hydrogen detection systems shall ~~should~~ have a suitable range for the concentration set-points used to initiate a response through the control or safety system.	
US 158 179		11.02.2	3		Needs to be a requirement based the safety analyses.	When used, hydrogen detection apparatus shall ~~should~~ be installed where the risk analyses indicated that there is ~~it has~~ the highest likelihood of detecting the foreseeable leaks, such as:	
US 159 180		11.02.2	4		Needs to be a requirement based the safety analyses.	The appropriate response sequence and signal shall ~~should~~ be determined by the manufacturer's risk assessment.	
US 160 181		11.02.2	7		Needs to be a requirement based the safety analyses.	The duration of the audible and visual signals instigated by the hydrogen detection system shall ~~should~~ be determined by the station manufacturer's risk assessment	
IT 182	1 and 2	11.02.2 Hydrogen detection systems		Te	These Safety-related systems to prevent hazardous events are covered by IEC 60079-29-1.	Hydrogen detection apparatus used in hydrogen sensing and monitoring systems shall comply with, and meet the accuracy requirements of ISO 26142 or IEC 60079-29-1.	
IT 183	3 and 4	11.02.2 Hydrogen detection systems		Ed	The term "Should" expresses a possibility. In this case, it has to be replaced by "shall".	Hydrogen detection apparatus and/or Hydrogen detection systems shall have a suitable range for the concentration set-points used to initiate…	

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IT 184	5 and 6	11.02.2 Hydrogen detection systems		Ed	The term “Should” expresses a possibility. In this case, it has to be replaced by “shall”.	Hydrogen detection apparatus shall be installed where it has the highest likelihood of detecting the foreseeable leaks…	
US 161 185		11.03	2		This is not a requirement. Additionally, what does “safely”, a subjective term, mean?	Where the capability for the manufacturer, or the operator, to restart the station after a fault, or modify the control logic remotely is provided, the measures that shall be taken to ensure this is carried out safely shall be defined, including consideration of the need for presence of maintenance staff on-site.	
US 162 186		12.02	Note 1		Why isn’t clean air allowed on new construction? Flammables probably have not been injected into the system	If a pneumatic test is used, air, nitrogen, helium, or non-flammable hydrogen mix, is recommended.	
US 163 187		12.02	Note 2		It is not necessary to reference ASME	The test procedure shall be based on a recognized standard such as ISO 15649 ~~(ASME B31)~~ or EN 13445-5. No permanent deformation or mechanical failure shall be allowed.	
US 164 188		12.02	Note 6	te	Data from APCI website.	*After dry nitrogen add the following:* with a dew point less than -90 C (3.5 μmole/mole).	
US 165 189		12.03	1		Needs to be a requirement.	The leak test shall verify that the system is free of leaks when examined using commercially available leak detection fluid or as per design of the manufacturer.	
US 166 190		12.03	Note X		Let’s relax the pressures a tad to save time and inspect the PRD installation joint(s). Test just below cracking,	For systems with PRD already installed, leakage tests can be conducted at pressures approximate to 85% of the PRD set point.	
US 167 191		12.04			Many of the items on the list are typically performed during installation as defined in Clause 10. Additionally, several of these tests seem unnecessary as requirements are met through use of approved electrical equipment.	Require, as a minimum, only the “Functional tests which are safety related mitigation measures (see clauses 5 and 8). The other tests shall be performed if tests were not performed as part of component or system approval process or if required by regulatory authorities.	

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CA 192	5	12.04	2nd bullet point	te	Please clarify requirements for insulation resistance tests. There may be the potential to damage the station control system with this test.	Clarify or recommend a test procedure.	
GB 193		12.05	Para 3	Ge	In 8.2.1.4, performance testing was a “should”, however, here it is a “shall”. Which is correct?	Clarify if performance functional testing is a “shall” or a “should”	
US 168 194		12.05.1	1	ge	The fueling protocol needs to be tested to confirm that it is applying a compliant fueling protocol correctly and all safety limits are adhered to. This can be done as a SAT or FAT. So, I think the FAT option should be reflected in the language. I also think the only “shall’ statement should pertain to ensuring that all safety related functions are being adhered to. Performance functions should be a “should” statement, not a “shall” statement, as performance is more a marketability issue, not a safety issue.	Current: The fueling protocol test shall be tested at each dispenser nozzle to confirm that the dispenser is using an approved fueling protocol to control the rate of fill, the fuel temperature, and the target pressure, etc. Safety related fueling process limits and performance targets shall be evaluated. Change to: The fueling protocol ~~test~~ shall be tested ~~at each dispenser nozzle~~ to confirm that the dispenser is ~~using~~ adhering to the safety related process requirements of an approved fueling protocol as defined in Section 8.2. If a standard fueling protocol is utilized, (e.g. SAE J2601), then a protocol validation standard (e.g. CSA HGV 4.3) corresponding to the protocol standard shall be used for this testing. ~~to control the rate of fill, the fuel temperature, and the target pressure, etc.~~ The required testing can be conducted at either a factory level (i.e. factory acceptance test or FAT) , a site level (i.e. site acceptance test or SAT), or a combination of the two. For FAT acceptance, appropriate documentation shall be provided. ~~Safety related fueling process limits and performance targets shall be evaluated.~~ The performance of the fueling protocol should also be tested through an appropriate site acceptance test.	
US 169 195		12.05.1	3	ge	Annex B is just an example of the type of testing that is typically conducted to validate SAE J2601. Also, it should be repeated that if a station is	Current: NOTE: Annex B offers an example of the	

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					utilizing SAE J2601, then the acceptance testing should adhere to a test standard that is appropriate for SAE J2601.	Acceptance Testing recommended for stations that utilise the SAE J2601 fueling protocol. Change to: NOTE: Annex B offers an example of the type of Acceptance Testing ~~recommended~~ typically conducted for stations that utilise the SAE J2601 fueling protocol, although the actual acceptance testing for any fueling protocol should adhere to an appropriate test standard for that protocol.	
US 170 196		12.05.2	2	ge	Since a reference is being made to clause 8, it is not necessary to qualify the process limits as safety vs. performance. Also, as mentioned in an above comment, only safety related process requirements should have associated “shall” statements.	The station terminates the fueling within 5 seconds if the ~~safety and/or performance~~ process limits for the fueling protocol, as listed in clause 8, are exceeded;	
US 180 197		12.05.2	5	ge	My comments below are proposing that Annex B be revised such that is gives an example of typical acceptance testing for the 2016 version of SAE J2601, which includes both the table-based protocol and MC Formula based protocol. So, this “NOTE” should be more general in nature.	NOTE: Refer to Annex B for an example of a ~~table-based~~ test procedure to verify SAE J-2601.	
US 182 198		12.06	1	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the factory level or the site level, section 12.6 should be generalized to allow both options.	Table 2 defines the first option for a set of minimum ~~SAT~~ Acceptance Tests.	
US 184 199		12.06	Asterisk text below Table 2	ge	A “T” rating is nomenclature used in SAE J2601 and may not be appropriate for an alternative fueling protocol.	See Table B.3 for an example that is applicable to the T rating requirements as used in SAE J-2601	
US 183 200		12.06	Table 2 Title	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the factory level or the site level, section 12.6 should be generalized to allow both options.	Table 2 – Option 1 for minimum ~~Site~~ Acceptance Testing	
US 181 201		12.06	Title	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the factory level or the site level, section 12.6 should be generalized to allow both options.	Current: 12.6 SAT Test Overview – Option 1 Change to: 12.6 Acceptance Test Overview – Option 1	
US 186		12.07	1	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the	Table 3 defines the second option for a set of	

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202					factory level or the site level, section 12.7 should be generalized to allow both options.	minimum ~~SAT~~ Acceptance Tests.	
US 188 203		12.07	Table 3	ge	Table 3 has many tests that are specific to SAE J2601. Since SAE J2601 is not a requirement in 19880-1, then these minimum set of acceptance tests should be written in more general terms and align with the specific requirement of Section 8.2. For example, APRR, is specific to the table-based protocol in SAE J2601. Other protocols may or may not use an APRR approach. Likewise, for "fallback" fueling and "top-off" fueling.	Modify Table 3 to eliminate acceptance tests that are specific to SAE J2601. Or, alternatively, make a footnote for those tests that are specific to J2601 and indicate that this test is only applicable to stations utilizing the J2601 standard.	
US 187 204		12.07	Table 3 Title	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the factory level or the site level, section 12.7 should be generalized to allow both options.	Table 3 - Option 2 for minimum ~~Site~~ Acceptance Testing	
US 185 205		12.07	Title	ge	To align with my proposal above to allow the acceptance testing to be conducted at either the factory level or the site level, section 12.7 should be generalized to allow both options.	12.7 ~~SAT~~ Acceptance Test Overview – Option 2	
US 189 206		12.10	1		When to inspect; commissioning, major repairs (re-commissioning), modification, service, maintenance or repair.	An inspection prior to commissioning or recommissioning as descried in 12.1 is required. ~~putting into service described in 12.1 is initially necessary.~~ Any kind of modification or repair of an inspected installation which breaches containment requires re-inspection ~~subject to monitoring means any activity which influences the safety of an installation.~~ Any service, maintenance or repair work influencing the safety of the installation shall ~~also~~ be considered as a modification.	
US 190 207		12.10	2		clarity	For modifications which may affect ~~influences~~ the safety of an installation, the HRS operator has to define the minimum qualification and contact the responsible agent ~~independency of the responsible personnel~~ for this ~~type of~~ inspection. For example, in Germany safety related modifications are in the scope of accredited inspection body.	
US		13.01	1, 2nd bullet	te	Undersize implies a size. The main concern is	the filling of underrated ~~undersized~~ cylinder	

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191 208					fueling tanks not designed for the appropriate pressure	systems	
US 192 209		13.01	Note 2		Please add for clarity	The use of adapters and under-sized tanks is permitted as part of special test equipment required for sampling, if approved by regulatory authorities and carried out by trained personnel. See Clauses 8.5 and 9 and Annex I.	
GB 210		13.01	Para 1	Ed	Remove typo "/ on"	Remove	
US 193 211		13.02	2		Clean up. Identification of all hazards may be unnecessary.	Warning signs ~~should~~ shall be placed to identify ~~all~~ hazards identified in the risk assessment of ~~**Error! eference source not found.**~~ including	
US 194 212		13.02	4		Clarify requirements.	Warning signs ~~should~~ shall be clearly displayed and visible at all times, particularly at access points. ~~, and~~ The design of the placard (size, color, font, etc.) shall conform to the local or state regulations or requirements for vehicle fueling stations. If such regulations or requirements do not exist then ~~should have~~ black letters with a minimum height of 50 mm on a white or contrasted background shall be used. International symbols ~~should~~may be used where appropriate.	
US 195 213		13.02	7-9			Similar, additional signage ~~should~~ shall be displayed during deliveries of gaseous or liquid hydrogen as appropriate. The maximum filling pressure and the filling capacity, as appropriate, of the storage system ~~should~~ shall be indicated at the fill point. For dispensing points, warning signs ~~should~~ shall be located within 3 m of the fueling point, and should indicate:	

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GB 214		13.02	Para 1	Ge	This is a general requirement. Also, are all these documents relevant?	Move to 13.1, and check validity of references	
GB 215		13.02	Para 3	Ed	Should read “Hazardous area signage, as applicable”?	Change as appropriate	
US 196 216		13.03	1		Also follow the local AHJ instructions.	Such markings may be as agreed between the user and the supplier of the equipment or as instructed by regulatory authorities. Preference should be given to the use of standard symbols given in IEC 60417 and ISO 7000	
US 197 217		13.03	2		As a min. mark components with the TAG markings that match the P&I or equivalent schematic.	Fueling assembly components should be marked ~~per 8.3.4.3~~ for identification (e.g. P&I Tag).	
US 198 218		13.04	1		Grammar	Each major assembly ~~Each fueling station major supplied assembly should~~ shall bear a data plate or combination of adjacent labels located so as to be easily read when the equipment is in a normally installed position.	
US 199 219		13.04	1		One of most important categories are missing – pressure and temperature ratings.	*Add a new item after d:* e) Component or assembly process ratings - pressure rating - temperature rating	
CA 220	1	13.04	1	Ed	Consider re-wording the start of the first sentence for clarity.	Change to “Each major component in the fueling station should bear a data plate….”	
US 200 221		13.05			AHJ needs to be considered too.	All enclosures, assemblies, control devices, and components should be plainly identified with the same reference designation as shown in the technical documentation unless otherwise directed by regulatory authorities.	
US		14.12	2		new	Control diagrams supplied by the component	

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201 222						manufacturer shall be included in the station documentation.	
US 202 223		14.12	2		new	Components not on the supplied parts list shall not be used without the manufacturer's written concurrence which shall be retained by the owner as a response to any questions from the AHJ.	
US 203 224		14.12	New subclause	te	Having a hydrogen quality plan is required by 19880-8 and is important to ensure the gas will always meet the hydrogen quality requirements	Insert new subclause: 14.13 Hydrogen Quality Plan The technical documentation shall contain a hydrogen quality plan as specified in ISO 19880-8	
US 204 225		15			Should a Lock-Out/Tag-Out procedure be required in the manuals? Should inerting/charging procedure be included also?	Consider adding the following statement: "The manufacturer shall provide instructions that include the following procedures: 1) Lock-out/Tag-out; 2) Purging; and 3) Depressurization and inerting."	
JP2 226		15.05	1st sentence	te	In general, detector is categorized to fixed, portable, and transportable. For hot work, there is no need to restrict the type of hydrogen detector to portable.	Change as following . Maintenance operations requiring the generation of an ignition source within the restriction distances while the installation is in operation or pressurized with hydrogen should only be performed in case of service necessity and the atmosphere in the work area should be continuously analysed using **a hydrogen detector such as portable, transportable, or, if applicable, fixed**.	
GB 227		A.1	All	Ge	Provide more general introduction to the Annex	Consider: A.1 General The requirements for permitting (as applicable) and/or the justification for the safe design of a hydrogen fueling station differ from country to country. In some countries/regions, specific hydrogen fueling station regulations, codes or guidance documents exist, typically detailing	

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						prescriptive requirements or recommendations to be followed in the design, installation or operation of a fueling station. A non-comprehensive list of examples is included in A.1.1. Alternatively, the justification for the safe design of a station can utilise the process of risk assessment. This Annex provides guidance on risk assessment in the specific context of informing site specific considerations to be taken for the safety of hydrogen fueling stations. With the current list in A.1 moved to A.1.1, and the final paragraph removed.	
GB 228		A.2	All	Ge	Discussion of semi-quantitative and fully quantitative risk assessment should probably include reference to other documents, for instance IEC 61508 & 61511?	Include note at end: NOTE 1: Further guidance relevant to semi-quantitative and fully quantitative risk assessment can be found in IEC 61508, IEC 61511	
US 001 229		All		ge	This document should consider referencing J2601 2016 which is now published. If so, then this section will need to be updated with MC Method	Sections which may need to be updated include Section 8.2.1 Annex B Annex C	
US 205 230		Annex B		ge	It is not clear to me how Annex B is intended to be used in this document. It is noted that Annex B is "informative", so I understand these are not requirements. The information provided is guidance on validation of the J2601 fueling protocol. Yet, actual J2601 protocol validation requires a standardized procedure with specific and well documented test procedures and requirements as well as pass/fail criteria, which is not provided in Annex B. It would seem that if someone were to validate a J2601 protocol, they should utilize an existing published validation standard to do so.	Carefully consider the intended use of Annex B, and revise it accordingly. Annex B and C should be combined into a streamlined description of SAE J2601 and updated to reflect the latest approved version of the document including the addition of the MC Formula as an alternative to the table-based fueling protocol. After consideration by WG 24, it may be determined that some of the information should be moved into an alternative document such as 19880-7.	
US 206 231		Annex B		ge	Annex B is specifically tailored to the 2014 version of SAE J2601. Yet, 2014 SAE J2601 is now obsolete with the publication of the 2016 SAE J2601. 2016 SAE J2601 also now provides two protocol choices: a) table-based, and b) MC	WG24 should consider revising Annex B so that it is general enough to be applicable to both the table-based and MC Formula-based protocols. Alternatively, the requirements for table-based and MC Formula-based should be included and clearly	

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					Formula-based. If Annex B is kept in the 19880-1 document, it should be revised such that it is either general enough to encompass both protocols, or the MC Formula related validation requirements should be added where appropriate.	differentiated.	
US 220 232		Annex C		ge	Annex C needs to be updated to reflect the latest version of SAE J2601.	Annex B and C should be combined into a streamlined description of SAE J2601 and updated to reflect the latest approved version of the document including the addition of the MC Formula as an alternative to the table-based fueling protocol. After consideration by WG 24, it may be determined that some of the information should be moved into an alternative document such as 19880-7.	
GB 233		Annex C	All	Ge	Include an overview of SAE TIR J2601: 2010, and SAE J2601: 2016, including any specific considerations that need to be taken. For instance – if the TIR doesn't account for the temperature of the tank during a 700 bar fill straight after a 350 bar fill, but this isn't included in the TIR, where is this information clear to station designers and operators using these protocols? Also consider a summary of SAE J2601-2 as the document is not simply aimed at light duty vehicle fuelling stations. Also consider a summary of existing region specific protocols based on SAE J2601 protocols (i.e. Japan, CEP)	Consider, and add appropriate text.	
US 223 234		Annex I			Now that ISO 19880-8 is working, why does this level of detail appear in this document. Annex I is better included in 19880-8.	Recommend that ISO19880-8 WG incorporate ANNEX I in their document. If agreed to and implemented, then ANNEX I can be deleted and replaced by a reference to 19880-1.	
JP3 235		Annex N	Whole	Ge	There are not a few "shall" in Annex N though Annex N is an informative.	Change all "shall" to "should".	
US 225 236		Annex P			Formatting and text need significant upgrade.	Clean up Annex P!	

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US 230 237		Annex Q 3.18 Column 4	Emergency stop		It is important to verify the ESD system is working at the SAT	~~SAT / FAT~~ SAT and FAT	
US 228 238		Annex Q 3.11 Column 4	Flammable gas vent	te	Change to “SAT and FAT”	~~SAT / FAT~~ SAT and FAT	
US 227 239		Annex Q	Q.1 Note	te	General note when FAT / SAT is shown some requirements may be satisfied by the FAT, however all requirements not met at the FAT must be met by SAT Some requirements require both FAT (if done) and SAT and those should be changed to “SAT and FAT”	NOTE 1: Wherever FAT is specified, testing at the manufacturer’s (factory) site is recommended, but this can be deferred to SAT. This shift should be agreed upon by the involved parties… Note 2: when FAT / SAT is shown, some requirements may be satisfied by the FAT, however all requirements not validated during the FAT must be validated at the SAT. Note 3: When FAT and SAT is specified, SAT validation is required	
US 229 240		Annex Q 3.15 Column 4	Warning Signs		It is important to verify signage at the SAT	~~SAT / FAT~~ SAT and FAT	
US 207 241		B.2	1	ge	Not all conditions will be “above” the limits – revise wording to make it clearer.	Current: The objective is to simulate a condition above the limits prescribed in SAE J2601 through modification of HSTA and station signals, etc. Change to: The objective is to emulate conditions which	

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						exceed the limits prescribed in SAE J2601 through modification of HSTA and station signals, etc.	
US 218 242		B.5.01	1	ed	Correct term is “hardware-in-the-loop”	This should include simulated software testing, hardware-in-the-loop testing but can optionally include hydrogen fueling with a Hydrogen station testing apparatus (HSTA).	
US 219 243		B.5.01	3	ge	There may be more than simply pressure and temperature signals necessary to conduct the FAT process.	It is assumed that the required data from the ~~pressure and temperature signals of~~ dispenser will be provided from the station owner/operator.	
US 210 244		B.5.03	35	te	The language in this section is misleading. It implies that the only judgement for this test is SOC (not used on non-comm fills). The most important judgement on this test is that the process limits were not exceeded. Therefore, this test is a safety test.	~~Fueling performed to anticipated (88%-95%) SOC/pressure +/- 2MPa and no abort - to be verified from station data or vehicle data~~ Fueling did not exceed any process limits, fuelled at the correct APRR and terminated the fueling at the target pressure. Change non-comm fueling test to Safety (i.e., change P to S on last column)	
US 211 245		B.5.03	36	te	The language in this section is misleading. It implies that the only judgement for this test is SOC. The most important judgement on this test is that the process limits were not exceeded. Therefore, this test is a safety test.	Fueling did not exceed any process limits, fuelled at the correct APRR and terminated the fueling at the target pressure or density. Change comm fueling test to Safety (i.e., change P to S on last column)	
US 212 246		B.6.01	2nd bullet	te	115% SOC is not a normal condition and should not be considered a tolerance. Having this bullet implies it is acceptable behaviour	Either delete entire bullet or In a fault condition, it is permissible to have up to 115 % SOC only with communications. Corrective action should be taken if this occurs.	
US 213 247		B.6.01	3rd bullet	te	Not exceeding the upper tolerance is important	Non-Communications fills to stop at the target pressure is +0/- 2MPa	

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US 214 248		B.6.01	4th bullet	te	The 4th clause is discussing sensor tolerance which is covered in the 3rd clause and is not needed.	Delete ~~Dispenser software may have a target APRR programmed that meets the corridor, but the actual hose pressure falls below the target. However, the dispenser pressure sensor reading (with tolerances within section 8) should stay within the pressure corridor.~~	
US 215 249		B.6.01	Last bullet	te	The start of fill covered in the 5th clause and is not needed. In addition, a 3 second pause could cause confusion for the customer.	Delete ~~It is suggested to have a minimum 3 second pause before start of fueling (after startup sequence). Start pressure (P0) is defined as start of APRR using dispenser pressure sensor. This will allow fueling validation to have a clear definition of APRR Start for the testing.~~	
US 208 250		B5.03	13	te	If the station cannot respond properly to invalid signals, it is a major concern	Change Invalid communication signal test to Safety (i.e., change P to S on last column)	
US 209 251		B5.03	31	te	It is unclear if this section applies to fallback or top-off. Also, top-off does not apply to non-comm. If the station does not comply with topoff it should terminate the fueling (not switch to non-comm)	Calculate expected APRR and target pressure based on observed starting conditions and expected precooling top-off ~~fallback~~ category fueling complies with a top-off fueling, ~~or fueling continues with a noncom fueling targets~~	
GB 252		C.1	All	Ge	Make more general following the publication of SAE J2601: 2016, also indicate any considerations necessary where SAE TIR J2601: 2010 is used? (which also are relevant to the CEP protocol based on this?)	Consider: Where fueling stations dispensing gaseous hydrogen to light-duty vehicles use ~~the~~ SAE J2601~~: 2014~~ fueling protocols, ~~this includes~~ these include a number of requirements for the station relevant to fueling of hydrogen vehicles which in some cases should be taken into account in addition to those requirements included ~~found~~ in Chapter 8 of this document. ~~and~~ The SAE J2601 fueling protocols make~~s~~ assumptions about the vehicle CHSS system specification relative to the GTR#13, further details are included in Annex D.	

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						Where different fueling protocols are used, the assumptions made about the vehicles being fueled should be identified, and the appropriate requirements for the ~~automakers and~~ hydrogen stations should be ~~identified and~~ implemented.	
US 221 253		C.2.01	2nd Para	te	This clause is not clear that the station should either terminate the fueling or continue in non-comm when communication is lost.	In the case of a break in communications during the fueling, SAE J2601: 2014 requires the station to terminate the fueling or permits the dispenser control system to switch to a non-communicative fueling table ~~without needing to stop the fueling~~.	
GB 254		D.1	7, Note a	Ed	Tidy up language	Components designed with a Maximum Allowable Pressure as per the European Pressure Equipment Directive (PED) represent the component pressure rating using the term “PS”	
US 222 255		D.1.03	Maximum Developed Pressure	ed/te	There is an error in the note. The maximum developed pressure (and not the maximum fueling pressure) is 1.50xNWP.	Modify note: NOTE—Per the GTR, the maximum ~~fueling~~ developed pressure is 1.50xNWP. See Annex M.	
GB 256		E.1	All	Ge	Change normative text to informative		
GB 257		E.1	Para 5	Ge	No impact forces provided	Change to: …applicable impact forces that can reasonably be anticipated.	
GB 258		E.2	Paras 8-10	Ge	These are not impact protection related, and should be in the main body of the document. Is the final statement even true now? Why can it not be zoned if the canopy can accumulate hydrogen?	Move to an appropriate place, and remove Para 10 if appropriate.	

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GB 259		F.1	All	Ge	Do a, b & c not contradict g?	Consider what is most appropriate	
GB 260		I 6.01	Para 5 Final two sentences	Ed	As the reduction valve low-pressure manometer is upstream the throttle the dynamic pressure is displayed. Only at the end of sampling does this manometer displays the actual sample cylinder pressure.	Upstream of the throttle ….. display	
GB 261		I.1.02	Para 2	Ed	Change ‘should have’ to ‘has’	This annex assumes that the hydrogen station has a dedicated fixed vent line for hydrogen venting/purging during sampling	
GB 262		I.1.02	Para 3	Ed	Clarification and grammar	Safety precautions should be taken when sampling hydrogen gas and particulates at a hydrogen station. Only trained personnel with the proper equipment should be allowed to carry this out. For sampling of hydrogen, it is important to understand that the hydrogen provided by the station is at a very high pressure. In many cases (depending on the method), the sample cylinder pressure rating may be lower than the supplied pressure, and in this case pressure reduction must be carried out. Sampling requires not only training, but also the proper protective equipment such as ear defenders and safety glasses.	
GB 263		I.3	Figure I.2	Ed	What is CHSS	Expand CHSS when mentioned the first time	
GB 264		I.3	Figure I.3	Te	What pressure?	Mention sampling pressure for this figure	

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GB 265		I.3	Figure I.4	Te	Provide additional information important for safety	Indicate when the system is connected to the vent. What pressure is the PRV set at?	
GB 266		I.3	Figure I.6	Te	Provide additional information important for safety	Indicate when the system is connected to the vent. What pressure is the PRV set at?	
GB 267		I.4.01	Table I.1	Ed	Suggestions for improving table	Move particulate to the start and include a new column for section (i.e. Section I.3.1.1 – I.3.1.4)	
GB 268		I.5.02	Para 2	Ed	Suggested improvement	Personal protective equipment, i.e. safety glasses, gloves and hearing protection, should be worn at all times when sampling hydrogen.	
GB 269		I.5.02	Para 5	Te	Vague mention of gloves	Specifically mention type of gloves required	
GB 270		I.7.03	Section 3	Te	Mention challenges of purging water	Include additional text: Water is very difficult to remove if saturated onto the walls of the sampling device, ideally the purges will be carried out whilst connected to an online hygrometer to monitor the change in water level	
GB 271		I.7.03	Section 4	Te	Mention water ingress	To avoid water ingress ensure the sampling system is closed and air tight when not in use	
GB		I6.02	Para 4	Ed	Arching could also originate	Change to: Arcing….	

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272							
GB 273		I6.04	All	Ed	1) Initiate sampling as normal but abort refuelling by press dispenser 'STOP' button within 15 seconds in order to isolate test pulse. Then depressurize sampling device with bleed valve. 2) Perform operational procedure without connecting sampler to FCHEV. HRS safety will shut off hydrogen dispensing. Depressurize with bleed valve, before attaching to FCHEV receptacle and performing operational procedure for gas sampling.	Replace with: 1) Initiate sampling as normal but abort refuelling by pressing the dispenser 'STOP' button within 15 seconds in order to isolate the test pulse. Then depressurize the sampling device with the bleed valve. 2) Perform the operational procedure without connecting the sampler to FCHEV. HRS safety will shut off hydrogen dispensing. Depressurize with the bleed valve prior to attaching to the FCHEV receptacle and performing the operational procedure for gas sampling.	
GB 274		I7.01	Para 2	Ed	A ball valve rated at 100 MPa is placed upstream a reduction valve also rated at 100 MPa. The reduction valve are equipped with manometers indicating upstream and downstream pressures. Downstream the sample container a ventilation assembly should be connected	A ball valve rated at 100 MPa is placed upstream with a reduction valve also rated at 100 MPa. The reduction valve is equipped with manometers indicating upstream and downstream pressures. Downstream of the sample container a ventilation assembly should be connected	
GB 275		I7.03	Section 2	Ed	Leak tests, now including the downstream assembly, is repeated	Leak tests, now including the downstream assembly, are repeated	
GB 276		I9,2	Para 1	Ed	Figure I-13 shows application of Direct method hydrogen sampling equipment).	Figure I-13 illustrates the application of direct method hydrogen sampling equipment.	
GB 277		I9.01	Para 1	Ed	Pressure sensor and temperature sensor should be	A pressure sensor and a temperature sensor should be positioned and operating in close proximity to the gas	

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					equipped near gas cylinder for safety.	cylinder for safety reasons.	
GB 278		I9.05	Para 1	Ed	When sampling high-pressure gas at the end of a nozzle, use sampling cylinder that complies with relevant laws and regulations (Seamless steel gas cylinder).	When sampling high-pressure gas at the end of a nozzle, use a sampling cylinder that complies with the relevant laws and regulations (Seamless steel gas cylinder).	
GB 279		I9.06	Para 2	Ed and ge	2) Exceeding the filling gas temperature ▪ Monitor the temperature of the sampling cylinder while sampling and trigger alarm or suspend filling automatically if it is abnormal. ・Cover the sampling cylinder system with a shields or the like to shield it from direct sunlight.	2) Exceeding the filling gas temperature. Monitor the temperature of the sampling cylinder while sampling and trigger the alarm and suspend the filling immediately if it is abnormal. ・Cover the sampling cylinder system with a shield or the like to shield it from direct sunlight.	
GB 280		J	Title and Para 1	Ge	Presumably these protocols are “known” to the station designer…. Is “non-standard” a better description?	Change as appropriate	
GB 281		K.1	Para 1	Ge	Clarify what this Annex is about. Needs to be general, rather than SAE J2601 specific.	This Annex includes recommendations as guidance to those using HSTA to simulate a vehicle for the testing and evaluation of a hydrogen dispenser. The HSTA may be a simple device that uses a single size tank system, or may be fitted with multiple tanks to be able to test all applicable vehicle CHSS fuelling categories relevant to the fuelling protocol being tested, see for example Annex C. The HSTA should have an IrDA communication interface….	
GB		K.2.02	Bullet 3	Ge	I’d have thought a PRV is recommended for such a system (if not a requirement under most	Remove (Optional)	

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282					regulations)		
GB 283		K.2.02	Bullet 6	Ed	Tidy up language	Means of venting (through appropriately sized flow restriction)	
GB 284		K.2.03	Bullet 3	Ed	Tidy up language	- Compressed hydrogen storage system tank temperature and pressure (with sensors located in a position representative of a vehicle)	
US 224 285		N.1	4	ed	Data from APCI website.	*Add a note after the paragraph:* NOTE—The APCI website defines dry nitrogen as having a dew point less than -90 C (3.5 μmole/mole).	
US 226 286		P5.03.7			Since the reliabilities and risks are not well understood (yet), it would be helpful to address items as likely ranges of input and the corresponding outcomes with regard to ranges of likely SIL rating.	Continue to work this area!	
US 004 287		Scope	Figure 1-1	ed	pp3 indicates Figure 1	Change to Figure 1	
US 005 288		Scope	Figure 1-2	ed	pp3 indicates Figure 2	Change to Figure 2	
US 002 289		Scope	Note 1	te	Rephrase.	*Change as follows:* maintenance ~~characteristics~~ requirements~~,~~ for safety, and, where appropriate,	

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US 003 290		Scope	Note 2	ed	Clarity.	The dispensing of hydrogen outside the limits ~~temperatures and boundaries~~ defined within this document, is outside the scope of this document.	
US 216 291		Table B.2		ge	The references to Sections in J2601 (third column of the table) should be updated to the 2016 version since that is the latest published version. There were changes to the Chapter numbers in the 2016 revision.	Check each reference in Table B2 to make sure it aligns with the 2016 version of J2601.	
US 217 292		Table B.2	Column Header	ge	The 3rd column header nomenclature should be consistent (it is different on pages 105 and 106. It also should be changed to reflect the 2016 version of J2601.	SAE J2601:2016 Clause Reference	
GB 293		Table G.1	All	Ge	Check final version of ISO 16923 and update if needed. Some errors in this: No need to replace fire extinguishers every week! How does one check the fire extinguisher pressure? Is this a service? Probably not monthly in that case? Is the quality (gas dryer) section relevant with ISO 19880-8? Is the documentation section appropriate?	Consider combining 2 & 4 years into general ">1 year" Address other points as appropriate.	

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