



PRELIMINARY REPORT OF VOTING ON ISO/DIS 20100 *Gaseous Hydrogen — Fuelling stations*

Closing date of voting
2011-08-21

ISO/TC 197 N 490

Secretariat
SCC/BNQ

A report shall be returned to ISO/CS no later than 3 months after the closing date of voting on the DIS, whether or not comments have been reviewed and/or a new text has been prepared.



Preliminary report

(submitted in those cases where comments are still to be considered and/or a decision has not yet been taken, or where it is decided that the nature of comments indicates a need for further consultation and/or reversion to a previous project development stage). To be followed by a 'Final report'. Any preliminary report is for ISO/CS for information, and is not circulated to member bodies)



Final report

(submitted either immediately, when all comments have been reviewed and a decision can be taken, or following a 'Preliminary report'. The final report is circulated by ISO/CS to member bodies, and is distributed with any associated DIS or FDIS text)

1 Result of the voting

The above-mentioned document was circulated to member bodies with a request that the ISO Central Secretariat be informed whether or not member bodies were in favour of registration of the DIS as a Final Draft International Standard or for publication in the case of unanimous approval.

The vote closed on the date indicated above. The replies listed in annex A have been received.

2 Comments received

3 Observations of the secretariat

See annex B

4 Decision of the Chairman

Preliminary report (no annexes required)



The comments are under review and/or a decision on further procedure has not yet been taken



The project is to revert to the Preparatory Stage (a new working draft will be developed)



The project is to revert to the Committee Stage (a new committee draft will be developed)

Final report



Having received 100% approval from the member bodies voting, the DIS is approved for direct publication without change other than editorial (no FDIS vote)

(Option not applicable to projects progressing under the Vienna Agreement)



A revised text is to be submitted to ISO/CS for the approval procedure (FDIS vote)



A revised text is to be submitted to ISO/CS for a further enquiry (DIS) vote

Remarks (e.g. observations on how comments were reviewed, date by which a decision is to be taken, date when a text is expected)

We are pleased to inform you that the ISO/DIS 20100 has been approved. You will find attached in Annexes 1 & 2 the results of voting and comments received. Please note that the comments received are to be returned to ISO/TC 197 WG 11 for consideration.

Enclosures



Annex 1 - Voting results on DIS



Annex 2 - Compilation of comments

Signature of the Secretary

Date 2011-08-23

Signature of the Chairman

Date 2011-08-23

Voting results on ISO/DIS 20100 Gaseous Hydrogen — Fuelling stations

Result of voting
<p>P-Members voting: 12 in favour out of 16 = 75 % (requirement \geq 66.66%)</p> <p><i>(P-Members having abstained are not counted in this vote.)</i></p> <p>Member bodies voting: 4 negative votes out of 16 = 25 % (requirement \leq 25%)</p> <p><i>Approved</i></p>

Votes by members					
Country	Member	Status	Approval	Disapproval	Abstention
Argentina	IRAM	P-Member		X *	
Austria	ASI	O-Member			X
Brazil	ABNT	P-Member			X
Canada	SCC	Secretariat	X		
China	SAC	P-Member	X		
Denmark	DS	P-Member			X
Egypt	EOS	P-Member	X		
France	AFNOR	P-Member	X *		
Germany	DIN	P-Member	X		
India	BIS	P-Member	X		
Italy	UNI	P-Member			X *
Japan	JISC	P-Member		X *	
Korea, Republic of	KATS	P-Member	X		
Netherlands	NEN	P-Member	X		
Norway	SN	P-Member	X		
Russian Federation	GOST R	P-Member	X		
Spain	AENOR	P-Member			X
Sweden	SIS	P-Member		X *	
Switzerland	SNV	P-Member	X		
United Kingdom	BSI	P-Member	X *		
USA	ANSI	P-Member		X *	
P-Member TOTALS			12	4	4
Total of P-Members voting: 16					
TOTALS			12	4	5
(*) A comment file was submitted with this vote					

Compilation of comments received on ISO/DIS 20100 Gaseous hydrogen – Fuelling stations					Date:2011-08-23	Document: ISO/DIS 20100
MB ¹	Clause No./ Subclause No./ Annex (e.g. 3.1)	Paragraph/ Figure/ Table/ Note (e.g. Table 1)	Type of comment ²	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
FR 1			ge	Streamline structure to make document easier to read (e.g. avoid having same topic addressed in different clauses)		
IT			ge	Abstention due to lack of interest in this field		
UK			Ge/Te	Rationale for the UK negative vote. The UK has asked, all along, for the WG to include information that describes how the separation distances included in the standard were derived or validated so that the numbers can be justified and to date it has not been done. Without a justification to take back to the other groups (e.g. NFPA and EIGA), there is yet another set of invalidated numbers that have no documented rationale regarding how they were arrived at and it is not clear see how this helps industry. It is feared is that publishing and adopting this document will only cause further confusion.	Include in the standard an Annex that includes details of the data and rationale used in arriving at the safety distances used in the document	
US 1			Ge	The U.S. is aware of a patent issue in ISO/DIS 20100. The patent holder has been requested to complete the appropriate forms regarding this issue and to forward them to ISO in accordance with Annex I of Part 1 of the ISO/IEC Directives.		
**	General		ed	For more help in the drafting and presentation of International Standards, please see the Rice Model, which is an example of a standard: http://www.iso.org/iso/rice_model		
**	Notes		ed	Requirements, recommendations, and giving permission, are not allowed in notes. That is, the use of the verbs "shall", "should" and "may" is not allowed in notes.	Many notes throughout the document contain the verb "may". These notes should be redrafted so that "may" does not appear in them, for example using the verb "can"; or they should be transformed into normal text.	
SE 1	1		ge	Mobile storage containers (e.g. MEG-containers) are not considered in separation distances. The standard does not regulate mobile storage containers, which seldom are equipped with pressure relief devices. They should therefore result in separation distances greater than those presented in the standard.	Add "This standard does not include direct delivery by mobile storage containers." or calculate additional separation distances.	

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UK	1	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : The fuelling station (see Figure 1) may comprise of :	
UK	1		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
**	Clause 2		ed	Normative references should only be listed in Clause 2, not in both Clause 2 and in the Bibliography.	Delete ISO 11114-4 from the Bibliography as it appears in the document normatively and is already listed in the Normative References.	
**	Clause 2		ed	Specify which parts of a standard are used normatively in the document and list them separately in Clause 2.	List ISO 14687-1 and ISO 14687-2 in Clause 2, and not "all parts" because part 3 does not appear in the document.	
**	Clause 2		ed	Documents should be listed in Clause 2, Normative References, if they are normative, that is if they are indispensable to the user of the document in implementing the document. Normally this is demonstrated by use of the verb "shall".	Currently ISO 7751, IEC 60079-29-1, IEC 60079-29-2, IEC 60079-30-1, IEC 60364-4-41, IEC 61069-7 and ISO 17262 are used in the document in a informative manner and so should be moved to the Bibliography at the end of the document. Alternatively, parts of the document could be redrafted to indicate that they are normative.	
FR 2	3		te	Standalone fuelling station should be defined.	Add definition of standalone fuelling stations	
**	Clause 3		ed	If the terms and definitions appear in other documents, please cite their sources in square brackets beneath the definitions, giving the document, the date, and the clause/paragraph where the definition appeared, then add the source document to the Bibliography. Additionally, please verify that the terms are used in the document and are relevant to the document.		
UK	3.6b, 3.16, 3.18, 3.19		Ed	Will these be listed alphabetically once finalised?	If so, change position of 3.16, 3.18 and 3.19. If not, should 3.6b become 3.50?	

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AR	3.7		Te	The design pressure is the test pressure for cylinders, as stated in ISO 10286, Gas cylinders – Terminology. A pressure vessel (e.g. buffer storage) must not be used at the design pressure, which is the pressure used for determining the wall thickness.	Replace the term by maximum Allowable operating pressure	
AR	3.9		Te	The dispenser cabinet also encloses the measurement, control & indication devices	Add: measurement, control and ancillary dispenser equipment	
UK	3.38		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
AR	4.1	2 nd paragraph	Te	The last two bullets are not specific fire & explosion risks as stated in the list.	Rephrase putting the two bullets with a separate sentence indicating “measures against personal harm to operators shall be applied in the following order or priority”	
UK	4.1	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : Measures to reduce fire and explosion risks shall be applied, in order of priority, as :	
UK	4.1		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
FR 3	4.2	1 st par	te	One of the aims of risk assessment is to identify root causes.	Replace: The results of the hazard and risk assessment process shall be used both to evaluate the consequences of hazardous events and to determine appropriate risk reduction. With : The results of the hazard and risk assessment process shall be used to determine the possible root causes and consequences of hazardous events and to determine appropriate risk reduction measures.	
UK	4.2		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
AR	5.1.1	8 th pa.	Te	The height shall be at least 1.8 m	Replace should by shall	

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FR 4	5.1.1	7 th par	ed	Prevention of unauthorized access should be mentioned first.	The sentence: Access to the installation shall be prevented to all unauthorised persons. Warning notices shall support. should be moved at the beginning of paragraph 5.1.1	
SE 2	5.1.1	Last paragraph	te	In some countries the minimum height for a fence is 1,8 m, in others 2 m. With 2 m, both requirements are fulfilled.	Change “at least 1,8 m” to “at least 2 m”	
FR 5	5.1.2		ed	Additional requirements are provided by clause 17.5 equipment grounding and bonding	Address all grounding and bonding issues in 17.5	
FR 6	5.1.2		te	Grounding should also be checked after major maintenance	Effectiveness of grounding connection shall be checked at least once every three years and after major maintenance.	
AR	5.2	8 th pa	Te	The sentence is very vague and may be misinterpreted. “Nearby Building may be anything from 5 meters to 100m	Remove the paragraph or be more specific	
FR 7	5.2	5 th par	te	Only authorized persons need to access the pressure reducing station.	The location of the pressure reducing station shall be accessible to authorized persons	
FR 8	5.2	7 th par	te	The temporary parking location also needs to comply with separation distance requirements	Insert : These temporary tube trailer or MCP parking locations shall comply with the separation distances provided in paragraph 14.2.2	
FR 9	5.2		ed	Reference should be made to clause 14.4 for the location of H2 vent systems.	Insert: The location of hydrogen vent system outlet shall comply with clause 14.4	
FR 10	5.3.1	4 th par	te	Partition wall made in bricks is not recommended because of the risk of collapse in case of explosion.	Delete “bricks,”	
FR 11	5.3.1		ed	A drawing would be useful		
SE 3	5.3.2	New paragraph	te	In case of an emergency, the tanker should be able to leave the area quickly.	Add: "Tankers shall be able to leave the transfer area without reversing."	

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FR 12	5.3.3		te	Liquid spillage should not be allowed to accumulate around the support structure of the storage tank	Insert: Liquid spillage shall be diverted from the support structure of the storage tank by a slope or other means.	
FR 13	5.3.4		te	Reference should be made to an anti tow away device.	Insert: Note : An anti tow away device shall be provided to prevent pulling out the flexible hose with the trailer at the end of filling operations	
FR 14	5.3.4.	2 nd par	ed.	Clarification	Means to ensure that emergency isolation valves are actuated shall be provided in case of leaks in the hydrogen supply <u>shall be provided</u>	
FR 15	5.3.5	1 st	te	Clarify the need	Pressure relief devices shall be provided to prevent over-pressure, including overpressure by thermal expansion where liquid can be trapped.	
FR 16	5.3.6		te	Need to cover location of vent outlet – refer to 14.4	The vent stack shall be arranged to discharge in a safe place in the open air so as to prevent impingement of escaping gas on to personnel or any structure. Furthermore, the location of hydrogen vent system outlet shall comply with clause 14.4.	
FR 17	5.3.8		te	Need to cover the risk of cavitation.	Add: Operation in presence of cavitation shall be prevented, for instance by an anti-cavitation system activating automatic shutdown of the pump.	
UK	5.3.8	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : A sign shall be clearly displayed and visible at all times near the cryogenic pump which indicates :	
UK	5.3.8		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
US 2	5.3.8		Te	Components and wiring should be consistent with use in hazardous areas. A reminder should be included as part of general requirements.	Add the following sentence to the clause: Electrical components and wiring shall be consistent with use in hazardous areas per Clause 20.1.	

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FR 18	5.3.9	3 rd par.	te	Reliable operation despite accumulation of ice may be achieved through control. Refer to vaporizer system.	Change to: The vaporizer system shall be designed to function as required despite accumulation of ice due to condensation of ambient moisture	
UK	5.3.9		Ed	Improved ease of reference	Change both the unordered lists to be an ordered lists	
UK	5.3.10	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : Signs shall be clearly displayed and visible at all times on or near the liquid hydrogen storage tank, particularly at access points, indicating :	
UK	5.3.10		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
FR 19	5.3.11	1 st par.	te	Transfer hoses need to be purged as well.	Add: Cold sections of liquid hydrogen installations and transfer flexible hoses shall be purged	
FR 20	5.3.11	2 nd par.	ed	Clarify motive of purge of nitrogen	Change to: Nitrogen shall be purged with helium or warm hydrogen prior to cool down with cold hydrogen for start-up to prevent nitrogen solidification.	
UK	5.4	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : The interface between the hydrogen pipeline and the fuelling station shall include, as applicable :	
UK	5.4		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
FR 21	6.3		ed	Clarification	Add: A separate shutdown device shall be designed for this purpose	
AR	7.1	1 st pa	Te	Requiring that compressors shall not add ANY contaminants is in many cases not necessary or they could be removed by downstream filters or separators. Such a requirement will unnecessarily restrict technology	Remove ANY; rephrase “do not....” by minimize the introduction of contaminants.	
FR 22	7.1	2 nd par.	Te	Provide definition of positive material isolation in Definitions clause		

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FR 23	7.1	3 rd par.	ed	Clarify <i>Each compressor shall be equipped with a pressure relief for maintenance purposes.</i>	Change to: Each compressor shall be equipped with means to fully depressurize all parts of the system for maintenance purposes.	
FR 24	7.1	4 th	te	Need to also cover control of effective inerting, as well as the protection of the inert gas system against overpressure from hydrogen backflow.	Change to : Means to purge the compressor(s) with inert gas and to control the effective inerting prior to maintenance operations shall be provided. A safety device shall protect the inert gas system against overpressure in case of hydrogen back flow	
US 3	7.1		Te	Components and wiring should be consistent with use in hazardous areas. A reminder should be included as part of general requirements.	Add the following sentence to the clause: Electrical components and wiring shall be consistent with use in hazardous areas per Clause 20.1.	
FR 25	7.3.1	2 nd sentence	te	Forced ventilation may not be used.	Change to: Forced ventilation is used, shall be specified for use in a hazardous area.	
FR 26	7.6.3		te	Need to define “low pressure”	Change to: Where the hydrogen comes from a low-pressure source (< 3 barg)	
FR 27	7.6.8		te	Crankcase venting in case of overpressure needs to be in safe location.	Add: If the crankcase is protected by a safety valve, it shall be vented to a safe location.	
US 4	8	2	TE	This is similar language to what is in SAE J-2719 and is a requirement for station builders.	Add “ and nominal rating of 10 µm (micron) or less ” to the end of the second paragraph of Clause 8. Insert the following statement at the end of Clause 8: "See 11.3.5 for additional requirements."	
AR	10		Te	First sentence is very restrictive. Cylinders manufactured under ISO standards should be allowed	Rephrase to accept ISO standards under development for Stationary hydrogen cylinders	

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AR	11.1	4 th pa	Te	Vehicles will always drive through potentially hazardous areas(e.g. close to dispenser hose)	Remove sentence	
JP1	11.1	3	ed	DIS20100 has not been revised despite the comment decision of 2011-02-22: “It was agreed to change 11.1 as follows: Dispensers shall be secured against unauthorized use outside normal operating hours. The hydrogen supply to the dispenser shall be shut-off at the source and dispenser per 11.3.2”	Delete the following sentence: “This requirement shall be deemed to be met when the dispensers are securely leaked or when their electrical power is switched off at a place that is not accessible to unauthorized persons.”	
UK	11.1	5 th paragraph	Te	Stipulates dispensers must be protected by a concrete island or plinth or suspended from a 4.25 m high structure. Other methods can be used to protect the dispenser from vehicular impact.	Consider replacing with text along lines of: “Dispensers shall either be located on a concrete island or plinth at least 120 mm above grade, suspended from a structure where the dispenser is at least 4,25 m above the fuelling pad, or protected using other appropriate means . If the dispensers are located...”	
UK	11.1		Ge	Improved wording	Sections pertaining to protection from vehicular impact are scattered throughout section (paragraph 1, end of paragraph 2, paragraph 5). Consider grouping into one section to avoid repetition.	
FR 28	11.2	2 nd sentence	te	“ <i>The maximum resistance between the fuelling pad and the fuelling station ground shall be 1 10⁶ ohms</i> ” confuses grounding resistance and common grounding.	Change to : The fuelling station and the fuelling pad shall have a common grounding. The electrical resistance of the fuelling pad shall be less than 10 ⁶ ohm.	
AR	11.3.1	6 th pa	Te	Such a requirement needs a standardized interface for each pressure level to be included in this standard. It may be problematic to allow each manufacturer to utilize a design that may lead to misuse when replacement hoses are installed	Standardize interface	

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FR 29	11.3.1	8 th par.	te	Clarify purpose. There is a need to protect the fuelling nozzle from ingress of foreign material	Change to: Dispensers shall be equipped with means to secure and protect the fuelling nozzle and hose when not in use against external mechanical aggression and ingress of foreign materials.	
FR 30	11.3.1		te	Need to have prevention of whipping in case of fuelling hose rupture.	Add: The fuelling hose shall have an anti-whipping system.	
JP2	11.3.1	9	ed	DIS20100 has not been revised despite the comment decision of 2011-02-22: “It was agreed that the text is to be changed as follows: Means shall be provided to ensure that the nozzle is at ground connection before connection.”	Delete the following phrase: “and the receptacles”	
US 5	11.3.1		Te	Dispenser components and wiring should be consistent with use in hazardous areas. A reminder should be included as part of general requirements.	Add the following sentence to the second paragraph: Electrical components and wiring shall be consistent with use in hazardous areas per Clause 20.1.	
JP3	11.3.2	6	te	Valves have polymer in their seal with no durability against 1100 deg C.	Delete the 6 th paragraph, or otherwise change the 6 th , paragraph as follows: The valve <u>body</u> shall be constructed with materials that do not melt below 1100 deg C.	
AR	11.3.3	1 st bullet	Te	The service load should be specified. Industry specifies minimum resistance of the cabinet shall be 2000N	Be able to withstand at least 2000N applied in every direction	
FR 31	11.3.3		te	Consider specifying that the dispenser cabinet should include a gas detector for leak detection.	Consider adding: A hydrogen gas detector shall be installed inside and at the upper part of the dispenser. It shall close the automatic shut off valve when the hydrogen concentration reaches 1% at the most.	
UK	11.3.3		Ed	Improved ease of reference	Change the unordered list to be an ordered list	

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US 6	11.3.3		Te	The discussion of ventilation requirements should refer to the thorough discussion in Clause 15.4. Using the term “explosive” is confusing.	Modify the first sentence in the last paragraph: The equipment and parts within the dispenser cabinet shall comply with Clause 15.4. Replace “explosive” with “flammable” in the last sentence.	
US 7	11.3.5	1	TE	Revising this clause as shown provides harmonization of ISO, CGA, and SAE standards for hydrogen fuel quality. This precludes damage to control surfaces within the dispenser and minimizes particulate load being delivered to the vehicle with the hydrogen fuel.	Insert the following statement into paragraph one following the existing language: "The filter shall be of adequate size and construction for the applications. Particulate concentration shall be minimized to avoid contamination, clogging and erosion of fuel system components. The fuel delivered to the vehicle shall be processed with a filter rated at no greater than 10 µm (micron) nominal (i.e. 98% efficiency) particle size."	
AR	11.4.1	2 nd bullet	Te	The operating temperature is not enough for many countries, and also part of the hose shall be in contact with hot parts of the vehicle (engine)	An operating temperature range of -40°C to 120 °C, or 85°C	
UK	11.4.1		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
AR	11.4.2	Last pa.	Te	The loads must be defined. It should at least withstand in excess of the breakaway pull-away force	Shall resist in excess of 650 N	
AR	11.4.4		Te	The continuity should include the nozzle	Include the nozzle	
FR 32	11.4.4		tc	Grounding resistance should be 25 ohm max	Change 30 ohm value to 25 ohm.	
FR 33	11.4.4		ed	Consider dealing with all grounding and electrical bonding issues in clause 17.5	Consider referring to 17.5	
JP4	11.4.4	1	te	11.7.3 specifies the electrical resistance of breakaway at 1000 ohms, which contradicts 30 ohms for a hose assembly (including breakaway). ISO17268 (Fuelling connector) also specifies 1000 ohms.	Change the sentence as below: ““The electrical resistance between the end fittings of the assembly shall not exceed <u>1000 ohms.</u> ”	
AR	11.5.2	5 th pa-	Te	Same as 11.4.4 comment above	650N	

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FR 34	11.5.2		te	The hose Need to prescribe prevention of whipping	Add: The flexible hose shall be provided with an anti-whipping system	
JP5	11.5.2	2	te	A leak rate of 10 ⁻² Pam ² /s shall be the leak rate per meter of hose.	Change the sentence as follows: Hydrogen leakage by permeability shall not exceed 10-2 Pam3/s per meter of hose.	
JP6	11.5.3	2	Te	Some hoses are not suitable for hydraulic tests. If hydraulic testing is not applicable, a gaseous test at 125% shall be applied instead. (Clause 23.2 is for leak tests but not for pressure resistance tests.)	Change the sentence as follows: “Each fuelling hose shall have been tested by the manufacturer <u>either hydraulically to 150% (by liquid water) or by gaseous mixture to 125% (Nitrogen, etc) of the rated pressure and had a certificate issued to that effect</u> ”	
JP7	11.5.4	1	Te	Marking the date of testing is impossible because the marking is done in a factory before testing.	Delete “date of testing” _	
UK	11.5.6	2 nd paragraph	Ge	Suggests periodicity for leak test of fuelling hose of at least once a year. 11.8.3.2 requires a pressure integrity test of the gas delivery line, fuelling hose and fuelling nozzle before each fuelling operation. Should the difference between a leak test and pressure integrity test be clarified in Chapter 23 and a definition of pressure integrity test be added?	Amend as appropriate	
UK	11.5.6	2 nd paragraph	Ed	Improved wording	Either remove “periodically” or include brackets around “at least once a year”	
AR	11.7		Te	Breakaway force must be specified and be lower than the resistance of the vehicle’s nozzle installation resistance.	Add a clause for breakaway pull away force: The maximum pullaway force shall be 500 N and the minimum force shall be 250 N.	
US 8	11.7.1		te	Change the maximum breakaway force to 667 N to ensure that the breakaway is the weak link in the fuelling system.	The hose breakaway device shall disconnect when subjected to a maximum force of 667 N but not less than 220 N independent of the operating pressure within the device when installed as specified by the manufacturer.	

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JP8	11.7.2		gete	Marking the date of testing is impossible because the marking is done in a factory before testing.	Delete “date of testing”	
FR 35	11.7.3		tc	<i>The electrical resistance between the extreme ends of the hose breakaway device shall not exceed 1000 ohms. How are the 1000 ohm justified? If it is to prevent static electrical discharge it should be 10⁶ ohm</i>		
UK	11.8.1	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : During filling the :	
UK	11.8.1		Ed	Improved ease of reference and improved wording	Change the unordered list to be an ordered list and re-write the list to be : a) maximum vehicle tank pressure shall be less than 125 % of the nominal working pressure; b) maximum vehicle tank gas temperature shall be less than 85 °C; c) minimum vehicle tank gas temperature shall be greater than – 40 °C; d) maximum vehicle state of charge shall be 100 % of the nominal state of charge.	
JP9	11.8.3.2	1	Te	Do we really need to check the pressure integrity for each fuelling? This prolongs the fuelling time extremely and is not realistic.	Change the first sentence as follows: Dispensers shall be designed such that the pressure integrity of the gas delivery line, fuelling hose and fuelling nozzle are verified before the commencement of daily operation or once a day.	
**	11.9.1		ed	Documents which appear in the document in a normative manner should be listed in Clause 2. Documents which appear in the document in an informative manner should be listed in the Bibliography.	In 11.9.1, IEC 61511 appears normatively and so should be added to Clause 2.	
US 9	11.9.1		te/ed	Why highlight only pressure and temp deviations? The requirements would benefit from reorganization.	Modify 11.9.1 as follows: The dispensing system shall be capable, at any point in time during the refuelling process, to detect	

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				Safety measures in Clauses 19.3-19.9 should be referenced along with a connection to their origin (ANNEX B).	<p>a deviation that could be indicative of a fault that leads to a hazardous condition and execute countermeasures that will mitigate the hazard. If the fuelling ramp is determined from an element of information that is either the result of a measurement by the fuelling station or communicated to the fuelling station, then this function shall be shown to be sufficiently reliable to effectively avoid an unacceptable risk of overflow, over-temperature or over-pressure in the vehicle tank.</p> <p>This applies in particular to deviations between: a) the actual and the intended value of the observed pressure, b) the actual and the intended value of the observed gas temperature if pre-cooling is applied.</p> <p>The safety measures intended to prevent a hazardous situation in case of a failure of the dispensing control system hardware or software with regards to pressure and gas temperature shall provide a safety integrity level (SIL) of 2 as defined in IEC 61508 and IEC 61511.</p> <p>As a minimum, Clauses 19.3 through 19.9 shall be addressed. When necessary, an emergency shutdown (ESD) as defined in 11.9.2 shall be automatically executed to isolate the dispenser. NOTE The information in Clauses 19.2 through 19.3 is based on the risk analysis in ANNEX B.</p> <p>Furthermore, if the fuelling ramp is determined from an element of information that is either the result of a measurement by the fuelling station or communicated to the fuelling station, then this function shall be shown to be sufficiently reliable to effectively avoid an unacceptable risk of over-temperature or over-pressure in the vehicle tank.</p>	
FR 36	11.9.2		tc		Consider adding: electrical supply shall be switched off	

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UK	11.9.2	Introductory sentence to the unordered list	Ed	Improved wording	Delete the existing sentence and add : The dispenser shall operate in conjunction with an emergency shutdown device (ESD). Activation of the ESD shall :	
UK	11.9.2		Ed	Improved ease of reference and improved wording	Change the unordered list to be an ordered list and re-write the list to be : a) cut off the flow of hydrogen gas to the dispenser and vehicle by closing the automatic isolation valves defined in 11.3.2; b) vent any remaining gas in the dispenser lines to a safe location; c) shut down the upstream compression systems.	
SE 5	11.9.6	2 nd para	te	Since a lot of the safety in this standard (e.g. safety distances) relies on leak detection and leak limitation, it is very important that these systems functions at all times. There should be at least two safety functions to ensure a reliable system.	Change 2 nd sentence to: "At least two items is required to achieve the required level of safety..."	
UK	11.9.6	Introductory sentences to the unordered list	Ed	Improved wording	Delete the existing sentences and add : One or more means may be required to achieve the required level of safety defined in 11.9.1 based on the specific system being protected. Examples of possible means to detect the leak are :	
UK	11.9.6		Ed	Improved ease of reference	Change the unordered list to be an ordered list	
UK	11.9.6		Ed	Improved ease of reference	Change the unordered list to be an ordered list	

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US 10	11.9.6		Te	An allowable reaction time should be included. Allowable separation distances are based on limited exposure and therefore the allowable time of that exposure should be specified or controlled. This allowable reaction time is based on a similar proposal at NFPA.	Modify the second sentence as follows: The minimum leak flow and maximum allowable reaction time that is required for such means to actuate shall be determined. Add the following to the end of the clause: The reaction time shall be such that the ESD is executed within 3 seconds of the fault appearing (at trigger level) unless a risk analysis is performed to support a longer time.	
SE 4	11.10	New para	te	Some people don't understand the difference between gases, for example LPG and CNG. In combination with the frequent use of adapters in some parts of Europe (since there are many different LPG-cylinders) there have been accidents where people have been using home-made adapters to fill a LPG bottle and LPG-car with CNG. The same might happen with hydrogen.	Add: "A sign shall inform that the use of adapters is prohibited and dangerous."	
UK	11.10		Ed	Improved wording	Delete the clause and list as written and add : Safety notices shall be prominently displayed within 3 m of the fuelling point showing either : a) NO SMOKING and TURN IGNITION OFF DURING VEHICLE FUELLING; or b) the International symbols for NO SMOKING and IGNITION OFF.	
UK	12	Introductory sentences to the unordered list and the unordered list	Ed	Improved wording	Delete the existing introductory sentence and list and add : The refuelling station shall distribute gaseous hydrogen that complies with the requirements of : a) ISO 14687-1, Type 1, grade A, B or C; and b) ISO 14687-2, Type 1, Grade D	
FR 37	13		ed	A drawing would be useful		

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FR 38	13	Last par.	ed		The refuelling station operator shall have an impact assessment conducted ... Split first sentence in two sentences	
FR 39	14		ge	Section 14 is confusing, it should be simpler. The general hypothesis to calculate the separation distances should be provided for every table.		
UK	14	Table 2, Table 3, Table 4, Table 6	te	The safety distances in the document are not consistent with published separation distances promulgated by respected organisations (e.g. EIGA, NFPA). Analysis performed to validate the distances selected has not been provided in sufficient detail to facilitate proposals to EIGA, NFPA and others to harmonise the numbers. Using these distances will cause this specification to be in conflict with many other standards, codes and regulations. Include the Task Group work prior to recirculation for comments.	Provide detailed annex that includes data and rationale for the distances used in the document. Include the Task Group work prior to recirculation for comments. Add information to Annex to demonstrate the various approaches considered by TG 1, and show how these approaches all converge on the same set of distances. This will add credibility to the numbers and facilitate harmonisation by allowing different analytical approaches to be used to get to the same set of distances.	
US 11	14 and Annex A		Te	While we agree that there is value in having an international document to address this topic, we have concerns that the inclusion of set-back distances that are not harmonized with either the distances used by participating countries or the methodologies used by participating countries may create additional confusion, rather than facilitating siting hydrogen stations. Fortunately, the ISO separation distances are probably acceptable but <u>not at the cited ISO risk criteria</u> . The underlying risks being assumed by the ISO analysis are inconsistent with the separation distances. We continue to request the inclusion of the rationale for the numbers depicted in the document for separation distances so these can be evaluated and consideration can be given to national adoption.	Annex A should be modified to document the rationale and calculations for the separation distances included in this document. The ISO risk analysis should then be upgraded to address the data issues cited in the comment so that the separation distances are consistent with the stated risk criteria. The paper by Jeff LaChance of Sandia National Laboratories entitled " Comparison of NFPA and ISO Approaches for Evaluating Separation Distances", available for download at http://www.hydrogenandfuelcellsafety.info/2010/aug/separationDistances.asp should be included in the bibliography.	
FR 40	14.1		ed	There is still confusion between safety and separation distances in the different paragraphs		

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SE 6	14.1	New para	te	A jet flame from a leaking flange shall not cause a rupture of a hydrogen storage cylinder due to local heating of the steel.	Add: "Pipes shall be arranged so that the hydrogen storage cylinders are protected from a fire at a leaking flange."	
FR 41	14.2.2.1.1		te	<i>Hydrogen supply installations implementing not more than two cylinders or cylinder-packs, with a total maximum inventory of 3 kg or less, may be qualified as Very Simple (VS type) is in conflict with Systems with a maximum inventory of 3 kg or less that would be qualified Simple or Complex</i>		
FR 42	14.2.2.1.1		te		Add: Hydrogen supply installations implementing not more than two cylinders or cylinder-packs, with a minimum inventory of 3 kg , may be qualified as Simple (S type).	
UK	14.2.2.1.1	Table 1	ge	Regarding Secretariat observations in compilation of comments on 2011-02-18 for this clause – concerning J. LaChance first question - the total LPI appears to also directly influence separation distance calculations of Category 1 & 2 systems when the LPI is above 135 (see 14.2.2.4a)), rather than just distinguish between simple or complex? Would this calculation require taking into account of other components including compressors, or is the extended distance of a process system over a storage system enough to cover the LPI of a compressor?	Amend Table 1 to include other components if appropriate	
UK	14.2.2.1.1	First paragraph	Ed	Improved wording	Change the last sentence to: "They may or may not include controls and instrumentation"	
UK	14.2.2.1.1	Second paragraph	Ed	Improved wording	At the end of the second line delete ...as follows and add ...as	
UK	14.2.2.1.1		Ed	Improved ease of reference	Change all the unordered lists to be an ordered lists	

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UK	14.2.2.1.1		Ed	Improved wording in section: “For the evaluation of the LPI: - Multiple hydrogen systems.....when points of potential leak of different systems are separated by less than 2,5 m.”	Delete “points of potential leak of” and add “potential leakage points from”	
UK	14.2.2.1.1		Ed	Improved wording	Delete Category 1 and category 2 systems are sub-categorized as follows : and add Category 1 and category 2 systems are sub-categorized as :	
UK	14.2.2.1.1		Ed	Improved wording	Delete Category 3 systems are sub-categorized as follows : and add Category 3 systems are sub-categorized as :	
US 12	14.2.2.1.1		Te	The leak probability indicator (LPI) is used to categorize systems and represents the number of likely components in a system that could leak. Table 1 indicates that the LPI evaluation is limited to joints, valves, and hoses. It is not documented why other components such as pipes, tubes, cylinders and compressors are not included in this table. For example, if the risk contribution from pipes and cylinders are low, then it may warrant a statement indicating that these components do not have to be included in the LPI evaluation as long as the number of cylinders and feet of pipe were less than some specified values. With regard to compressors, they cannot be ignored but an LPI is not needed for the evaluations performed in Clause 14.2.3. Also, how to treat other active components such as electrolyzers probably should be addressed in this clause.	Add a footnote to Table 1 indicating that pipes, tubes, and cylinders are not typically included in the LPI evaluation since they have low leak frequencies compared to joints, valves, and hoses. Also indicate why active components such as compressors and electrolyzers do not have to be included in the LPI evaluation	

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US 13	14.2.2.1.1		Te	The guidance for evaluating the LPI related to the 2.5 m separation distance between multiple hydrogen systems seems to be incomplete. Even with this separation distances, the systems could be arranged such that risk to a target could occur from each system. Since Clause 14.2.2.1.1 states that if the distance between systems is less than 2.5 m the systems must be treated as one, the result is a longer separation distance which accounts for the combined risk from each system. Presumably, when the separation between two systems is greater than 2.5 m, the systems can be treated as independent systems. However, the risk to a target from these “independent systems” is not necessarily independent. In a risk-informed approach, the total risk from multiple systems should be addressed.	To maintain an acceptable level of risk even with 2.5 m separation between systems, additional guidance on the system layout seems warranted in order to maintain consistency with the risk levels when the systems are treated as one. Without such guidance, a facility layout could result in unacceptably high risk values to different targets/exposures.	
US 14	14.2.2.1.1		te	Related to the comment above, there is no statement in the guidance that indicates that the separation distance to a target should be based on the maximum distance calculated for each system. This seems logical but probably should be clearly stated.	Add a statement to the guidance that indicates that the separation distance to a target should be based on the maximum distance calculated for each system.	
US 15	14.2.2.1.1		Te	It is not clear why LPI values provided for the Category 3 systems (LS and LC) are less than the maximum values for simple and complex systems (S and C, respectively). In fact, it is not clear why LPI values are needed to define the LS and LC systems since Category 3 systems are defined by the quantity of hydrogen only and LPI values are not used in Clause 14.2.3 to adjust separation distances for Category 3 systems. Furthermore, the separation distances for the Category 3 systems are based on subjectively obtained values for leak flows and diameters.	The LPI values for LS and LC systems should be made consistent with those of the S and C systems. Adjustment of the separation distances for LS and LC systems should be allowed in Clause 14.2.3 based on the LPI. To be consistent with the evaluation of other systems, a risk evaluation should be performed for the LS and LC systems to determine if the separation distances result in acceptable levels of risk.	

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US 16	14.2.2.1.1		Te	This clause also allows reduction of the separation distances for Simple and Complex subsystems to Very Simple (VS) and Simple (S) subsystems, respectively, if the subsystem inventory is less than 3 kg. This is a crude method to try and address the impact of a limited hydrogen volume on the separation distance. Although the safety distance would decrease as the volume and pressure of a hydrogen release decreases, it is not clear that this approach for accounting for this has been properly validated.	The associated risk associated with the release should be mechanistically evaluated and used to determine the separation distance (e.g., the risk from thermal exposures could be based on an integrated thermal dose) or validate the treatment specified in this clause. A subsequent statement that indicates that a system with less than 3 kg can be treated as a VS system and a system with less than two cylinders can also be treated as an S system also needs to be validated using a risk-informed approach.	
FR 43	14.2.2.1.2		ed	<i>The NOTE</i> is not understandable		
FR 44	14.2.2.1.2		te	<i>Vacant bordering area may be considered as part of the lot for application of the distance to the lot line. In this case, these areas shall be explicitly defined.</i> It is not possible to manage a non proprietary zone		
UK	14.2.2.1.2	Table 2	ed	Heading above Cat 1, 2, 3 – should “passive” be defined as/replaced by “storage/transfer”?		
UK	14.2.2.1.2	Table 2	ge	Without clarification that proximity to flammable gas storage > 500Nm ³ used to determine separation distances does not include hydrogen storage (which could be Cat 1, 2 or 3), there is the possibility of confusion between which distances to use, for example where a Category 3 gaseous hydrogen storage system is the larger storage system for a < 50 kg process system.	Assuming this is the intention, there may be some benefit to the following : 14.2.2.1.2 - Table 2 - Clarify that “flammable gas storage above ground > 500 Nm ³ ” does not include hydrogen, 14.2.5 – Paragraph 3 - Clarify that “a flammable gas storage > 500 Nm ³ ” does not include hydrogen, 14.2.5 – Paragraph 5 – Clarify to this extent. For instance : “Active hydrogen systems shall not include a hydrogen storage system exceeding 50 kg. The minimum distance between an active hydrogen system and additional hydrogen storage can be established from Table 3.”	

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FR 45	14.2.2.2		te	Why the active process systems are not equivalent to the category 1 or 2 as complex system to determine the separation distances or be more specific on the elements which justify bigger separation distances		
SE 7	14.2.2.2	1 st para after table 3	te	Leak detection devices are not reliable enough to allow shorter safety distances.	Remove paragraph.	
UK	14.2.2.2	Table 3	ed	Heading above Cat 1, 2, 3 – should “active” be defined as/replaced by “process”?		
UK	14.2.2.2	Second paragraph		Improved wording	Delete Two categories are defined for process systems according to service pressure as follows : and add Two categories are defined for process systems according to service pressure as :	
UK	14.2.2.2		Ed	Improved wording in section: “For the evaluation of the separation distances when points of potential leak of different systems are spatially separated by less than 2,5 m.”	Delete “points of potential leak of different systems are spatially separated” and add “potential leakage points from different systems are separated”	
FR 46	14.2.2.4		ed	<i>If the above reference values for the MID and for the LMI are exceeded by more than 15 % or when the reference value for the SP or the LPI are exceeded by more than 30 %... Be more specific; if LPI is higher than 30% of 135 or SP is higher than 15% of 110 MPa or LMI is 15% higher than 55 , the separation distances shall be determined according to 14.2.3</i>		
UK	14.2.2.4	Clauses and NOTES	ed	Improved ease of reference	Change the unordered lists to be ordered lists of the correct type (e.g.1, 2)	
US 17	14.2.2.4		Te	In Clause 14.2.2.4, the value for the LMI is specified as 55. The basis for this value seems to be purely subjective. Since it is indicative of the magnitude of potential leak rates (the values are provided in Annex A), the basis for the selected leak rates (and value for the LMI) should be clearly identified.	Document the basis for the LMI of 55 for category 3 systems in this clause and/or Annex A.	

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SE 8	14.2.3	NOTE 2	te	The risk of electrostatic charging of metallic objects that might ignite a release of hydrogen has to be addressed.	Calculate distances for power lines/high voltage lines, or use the following (from Swedish regulations, distance between classified area and power line): 12,0-72,5 kV: 15 m 82,5 kV: 30 m 145-170 kV: 30 m 245 kV: 45 m 420 kV: 60 m	
UK	14.2.3		ed	Improved ease of reference	Change the unordered lists to be ordered lists of the correct type (e.g.1, 2)	
UK	14.2.3	Table 4	ed	Heading above VS, S, C – should “passive” be defined as / replaced by “storage/transfer”? Heading above A – should “active” be defined as / replaced by “process”?	Change if appropriate	
US 19	14.2.3		Te	The first sentence in Clause 14.2.3 begins by stating that systems with larger distances than those given in Table 2 should be adjusted using the equations in this Clause (the wording is confusing). It seems that a person would not know the separation distances are necessarily larger until they evaluated the equations presented in the section.	Recommend that this sentence should indicate that the provided equations in 14.2.3 can be used to modify the separation distances in Table 2 to reflect actual subsystem pressures, diameters, and LPIs.	
US 20	14.2.3		Te	The LPI modification in Clause 14.2.3 is only allowed for complex systems. We believe this modification can also be applied for other Category 1 and 2 subsystems.	Change the LPI modification to include Category 1 and 2 systems. It should also be clearly indicated that the pressure and diameter adjustments for Category 1 and 2 subsystems can be applied to active as well as storage and transfer subsystems.	

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US 21	14.2.3		Te	Clause 14.2.3 states that the separation distances for four exposures including overhead power lines and high voltage lines cannot be modified using the equations in this section because they are independent of the hydrogen system's design parameters. These separation distances were not based on a risk assessment using system parameters but were arbitrarily selected. It seems that power lines are possible ignition sources (whether they fall down or remain in place) and thus the extent of a hydrogen cloud is important in determining the potential for its ignition. The extent of the hydrogen cloud is a function of the leak pressure and diameter. Similarly, it seems that the exposure concern on roadways is human beings (the roadway is also a source of hazards to the facility although it is not evaluate as such in the current risk assessment). Exposure of human beings is also a function of the leak pressure and diameter.	The basis for the separation distance in Table 2 and the treatment in Clause 14.2.3 for these exposures should be revisited taking into account leak pressure and diameter.	
US 18	14.2.4		Te	The last paragraph in Clause 14.2.2.4 seems to imply that the adjustment methods in Clause 14.2.3 only are applied when the MID, LMI, SP, or LPI exceed the reference values by more than 15% or 30%, dependent upon the parameter (Clause 14.2.3 seems to reinforce this conclusion). It seems that a reduction in separation distances should also be allowed when the parameters are substantially less than the reference values.	Revise the requirement to also allow reduction of separation distances when the parameters are less than the reference values by more than 15% or 30%, dependent upon the parameter.	
UK	14.2.5	Second paragraph	ed	Typo – double full stop at end of sentence	Remove second full stop at end of sentence	
US 22	14.2.5		Te	The statement in Clause 14.2.5 that “no separation distance is required between Large Storage Systems if they are installed in parallel, with all points of potential leak located at system extremity in a way that minimizes risk of mutual impact.” It is doubtful that this is possible as leaks can develop in any orientation in most components.	Recommend deleting this paragraph.	
SE 10	14.2.6	2 nd para	ed	Use the same pressure unit as in 14.4.1.	Change “15 kPa” to “150 mbar”	

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SE 9	14.2.6	1 st para	te	A fire wall should not reduce a safety distance to zero.	Change “separation distance requirements are waived” to “separation distances may be halved” or “a risk analysis may present shorter distances”	
UK	14.2.6	Introductory sentence to the unordered list	ed	Improved wording	Delete When used in conjunction with an outdoor storage system, such a protective structure is subject to the following limitations : and add When used in conjunction with an outdoor storage system :	
UK	14.2.6		ed	Improved ease of reference	Change the unordered list to be an ordered list	
US 23	14.2.6		Te	The exposures for which a barrier wall can be used to the exposures listed in Clause 14.2.6 seems too limiting. It is not clear why a barrier wall cannot be used to protect other targets including people at the lot line. In addition, the requirements for the barrier wall seem to be missing an important parameter, the specified height of the wall.	A definition of line of sight needs to be provided to address this concern.	
US 24	14.4		Te	In Clause 14.4 it seems that an additional requirement for the vent location should include that there is no accumulation points for the vented gas.	Add a requirement that vents shall be located to prevent accumulation of vented gas.	
UK	14.4.1		ed	Improved ease of reference	Change the unordered lists to be ordered lists of the correct type (e.g.1, 2)	
SE 11	14.4.2		te	Leak detection devices are not reliable enough to allow shorter safety distances.	Remove 14.4.2	
UK	14.4.2		ed	Improved ease of reference	Change the unordered lists to be ordered lists of the correct type (e.g.1, 2)	
FR 48	15.2		ge	It should be more pragmatic to provide a typical drawing of the explosive hazardous zones which shall have been assessed following the IEC 60079-10 as example for an open space; valves and non welded connections zone 2, temporary vent zone 1 with zone 2		
FR 47	15.2.1		ed	<i>The hazardous area shall extend vertically above the highest point of leak to a height of at least 3 times the specified horizontal extension.</i> The table 7 defined a radius and not as an horizontal extension	Change “radius” to “horizontal extension” in title of table 7	

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UK	15.2.1	3 Sentences under Table 7	ed	Improved wording	Delete the existing sentences and add : When the extensions provided by Table 7 are applied : a) the hazardous area shall extend vertically above the highest point of leak to a height of at least 3 times the specified horizontal extension; b) if there is a canopy within the height of the classified area as it would be defined without the canopy, the classified area shall extend to the border of the canopy.	
UK	15.3.1		ed	Improved ease of reference	Change the unordered list to be an ordered list	
UK	15.5		ed	Improved ease of reference	Change the unordered list to be an ordered list	
FR 49	15.7		te	Purge prior to start-up needs to be performed at the nominal rate.	Change to: Enclosures that rely on active ventilation for protection against accumulation of ignitable mixtures as per 15.5 shall be purged with a minimum of 4 air changes at the nominal rate prior to	
FR 50	15.8		ge	The adjacent areas openings are defined in IEC 60079-10	refer to 60079 10	
UK	15.8		ed	Improved ease of reference	Change the unordered list to be an ordered list	
UK	15.9		ed	Improved ease of reference	Change the unordered lists to be ordered lists	
SE 12	16.3		te	Canopy top storage is not allowed in some countries.	Add “NOTE Canopy top storage is not allowed in some countries.”	
UK	16.4.7		ed	Improved ease of reference	Change the unordered list to be an ordered list	
UK	16.4.9	Introductory sentence to the unordered list	ed	Improved wording	Delete : Rooftop installations of gaseous hydrogen systems shall be identified with the following sign and add Rooftop installations of gaseous hydrogen systems shall be identified with a sign showing :	

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SE 13	17.2	4 th para	te	550 degrees C sounds as a very low melting point for brazed connections. Especially when the next paragraph forbids aluminium to be used for fittings (melting point 660 degrees C).	Change to 1000 degrees C.	
FR 51	17.3		Te	<i>Pressure relief device shall be directly connected to the equipment, which is the potential source of overpressure with no interconnected isolation devices.</i> A three way valve can be accepted when there are two pressure relief devices in parallel. In Japan and in US the isolation devices of pressure relieve systems are accepted!		
FR 52	17.4		Te		Add: At the design stage, the fuelling station shall be examined to identify possible electrostatic hazards and the requirements of earthing and electrical continuity shall be determined.	
UK	17.4		ed	Improved ease of reference	Change the unordered list to be an ordered list	
FR 53	17.5		te	The minimum ignition energy is very low for hydrogen 0.017mijoules, 0.25mimlijoules for saturated hydrocarbons. Subsequently electrostatic energy accumulation has to be avoided as it is a potential source of ignition. The best industrial practice is to ensure an electrical continuity between equipment and pipes by grounding and by bonding with electrical straps (API 2003, NFPA 77). So it is recommended to measure electrical continuity where bonding is not installed on every flammable gas circuit equipped with flanges. Test of the high resistance paths should be made with an applied potential of 500 volts on either side of gasket. A measured resistance less than 10 ⁶ ohms is entirely adequate following API 2003 (chap A.8.1) and NFPA 77-8 (1.8). If measured resistance is higher than 10 ⁶ ohms a bonding has to be set up		
FR 54	17.6		te	One isolation valve to isolate a high pressure source is not safe. A removable spool piece , double block and bleed or blind flange are safer		

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FR 55	18.2		te	The vent stack shall be size to prevent an excessive pressure drop that will restrict the flow of the pressure relief systems		
FR 56	18.2		te	The vent stack thickness shall be calculated to withstand an hydrogen detonation inside its header.		
FR 57	18.5		te	The maximum flow of the vent stack $Q_s > \Sigma Q_v + Q_a$ where: Q_s = max flow of the vent stack Q_v = the sum of all the flows in normal operating conditions Q_v that are expected to be simultaneous, and Q_a = the highest flow generated by upset conditions		
FR 58	18.5		te	loss of vacuum combined with an external fire should be a scenario taken into account;		
UK	18.5		ed	Improved ease of reference	Change the unordered lists to be ordered lists	
UK	18.5	Introductory sentence to the second unordered list	ed	Improved wording	Delete : Upset and accidental conditions maximum flow rate should include the largest of the following independent upset conditions such as and add Upset and accidental conditions maximum flow rate shall include the largest independent upset conditions such as :	
FR 59	19.2		te	Are the control system and safety system separated? This point is not clearly expressed.		
FR 60	19.3		ed	Critical unit shall be defined.		
FR 61	19.3		te	<i>Faults on critical units of electric and automatic instruments systems shall release an alarm signal.</i> Be more specific about the meaning of faults		
FR 62	19.4	1 st par, 2 nd sentence	te		If the supply lapses, the pressure level of air shall be kept by a buffer volume to allow a shutdown of the units in safe conditions	

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**	19.6		ed	Reference documents which are normative, that is imperative in implementing the document, should be listed in the Normative References clause, Clause 2.	In 19.6, the following sentence appears: "The equipments and components shall be in accordance with specific standards mentioned in IEC 60079-14." Specify which standards mentioned in IEC 60079-14 are normative and list them in Clause 2.	
SE 14	21.4	1 st para	te	Thermally activated valves must be non reclosing in order to adequately prevent a scenario where the steel of the storage container is heated to a temperature at which it loses durability (probably around 600-800 degrees Celsius), which might result in a container burst. This is a requirement for accepting the suggested safety distances, since these rely on the prevention of container bursts (according to mr. Frederic Barth of WG 11).	Change to: "If gaseous hydrogen buffer storage tanks may be exposed to fire conditions that could lead to rupture, thermally activated (non reclosing) and manually activated valves shall be provided to safely vent all the content of the hydrogen buffer storage."	
UK	23.1 & 23.2		ge	Should target pressures relative to maximum working pressure for pressure and leak tests be defined or is this left to national regulations?		
UK	A.2	Table A.1	ed	Left hand column, defining grouping of rows: Should "passive" be defined as / replaced by "storage/transfer"? Should "active" be defined as / replaced by "process"?	Change if appropriate	
UK	A.5	Introductory sentence to the ordered list	ed	Improved wording	Delete : The exposures for which the separation requirements are determined with regards to thermal effects are the following : and add The exposures for which the separation requirements are determined with regard to thermal effects are :	

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US 25	Annex A	Table A.2	Te	The designation of exposures in Table A.2 has some apparent inconsistencies. For example, a flammable liquid area above ground with > 4000 L is a critical exposure because of the concern for escalation. It seems that a large gas storage area above ground with a large volume would have the same concern and should be treated as a critical exposure. Also, occupied buildings and areas of occupancy are treated as critical exposures because people could be subjected to harm. However, areas not subjected to restriction of activity are not. If the area is not restricted, can there not be large number of people? It seems like areas of unrestricted activity can be both a concern as an exposure (i.e., multiple people) as well as a hazard to the facility (e.g., some activity that can damage the facility).	A footnote explaining the meaning of restricted activity would be useful. Finally, the criteria for being a critical versus non-critical exposure should be better defined and the table revisited for compliance with those definitions.	
**	Annexes		ed	Annexes should be cited in the main body of the document; they should be cited normatively if they are normative and informatively if they are informative.	Redraft portions of the document to indicate that Annex A is normative and that Annex B is informative.	