ORG	Clause/ Subclause (e.g. 3.1)	Paragraph/ Figure/ Table/ (e.g. Table 1)	Type of comment[2]	Current text / Comments	Proposed change	Observations/Actions
ISO/TC 197	I.E.1 (b) (*i*) (Preamble)	61 (f) (i)	te	**Fuelling station over-pressurization constrained by fuelling station requirements to less than or equal to 150 per cent NWP. (This requirement for fuelling stations shall be established within local codes and/or regulations for fuelling stations.);** There is currently an undefined gap between vehicle's CHSS maximum developed pressure during fault management and dispenser's MAWP and PSV setpoint. This gap has already caused misinterpretation of the Rationale Para 61 (f) subclause (i). This relationship, thus, needs to be clearly explained. (Ref. ISO/DIS 19880-1:2017).	Fuelling station over-pressurization constrained by fuelling station requirements to less than or equal to 150 per cent NWP. (This requirement is based on a dispenser systems designed to a MAWP of 137.5% NWP with pressure protection set to activate the highest permitted value of 137.5% and limit dispensing faults to no more than 150% NWP. ~~for fuelling stations shall be established within local~~ Local codes and/or regulations for fuelling stations may lower the permitted value for pressure protection, but 150 per cent is expected to be the worst case and, given dispenser protections with the control system, expected to occur only under multiple fault situations.);	Agreed by TF meeting on June 13, 2018. Approved by IWG meeting on June 27, 2018.
ISO/TC 197	I.E.2 (a) (*v*) (Preamble)	81	te	**Detectable leakage is not permitted.** The current text is too short for the Rationale section and needs to be expanded to be more specific.	Detectable leakage of the hydrogen fuelling line and delivery system is not permitted.	Agreed by TF meeting on June 13, 2018. Approved by IWG meeting on June 27, 2018.
ISO/TC 197	II.3 Definitions (Regulation)	3.28	te	**Hydrogen-fuelled vehicle" indicates any motor vehicle that uses compressed gaseous or liquefied hydrogen as a fuel to propel the vehicle, including fuel cell and internal combustion engine vehicles. Hydrogen fuel for passenger vehicles is specified in ISO 14687-2 and SAE J2719.** The current text contains incorrect reference to "passenger vehicles". Also, ISO standard reference needs to be updated.	Hydrogen-fuelled vehicle" indicates any motor vehicle that uses compressed gaseous or liquefied hydrogen as a fuel to propel the vehicle, including fuel cell and internal combustion engine vehicle~~s~~. Hydrogen fuel for ~~passenger~~ the vehicles is specified in ISO 14687~~-2~~ and SAE J2719.	Agreed by TF meeting on June 13, 2018. Approved by IWG meeting on June 27, 2018.
ISO/TC 197	II.3 Definitions (Regulation)	3.34	te	**Lower flammability limit (LFL)" is the lowest concentration of fuel at which a gaseous fuel mixture is flammable at normal temperature and pressure. The lower flammability limit for hydrogen gas**	Lower flammability limit (LFL)" is the lowest concentration of fuel at which a gaseous fuel mixture is flammable at normal temperature and pressure. The lower flammability limit for hydrogen gas in air is conservatively 4 per	Agreed by TF meeting on June 13, 2018. Approved by IWG meeting on June 27, 2018. IWG also agreed updating

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				in air is 4 per cent by volume. (Para 83 of the Preamble). The current text does not adequately represent the background information contained in Para 83 of the Preamble and, hence, needs to be refined to preclude misinterpretation.	cent by volume <u>based on quiescent environment</u>. (Para 83 of the Preamble).	Para 83 of the Preamble per recommendations of the TF5 in regards to the meaning of "flammable" presented on June 27, 2018.
ISO/TC 197	I.E.2 (a) (*vii*) (Preamble)	83	te	**(Background for paragraph 3.34.): Lowest concentration of fuel in which a gas mixture is flammable. National and international standard bodies (such as National Fire Protection Association (NFPA) and IEC) recognize 4 per cent hydrogen by volume in air as the LFL (US Department of Interior, Bureau of Mines Bulletin 503, 1952; Houf and Schefer, "Predicting Radiative Heat Fluxes and Flammability Envelopes from Unintended Releases of Hydrogen," International Journal of Hydrogen Energy 31, pp 136-151, 2007; NASA RD-WSTF-0001, 1988). The LFL, which depends on the temperature, pressure and presence of dilution gases, has been assessed using specific test methods (e.g. American Society for Testing (ASTM) E681-04). While the LFL value of 4 per cent is appropriate for evaluating flammability in general surroundings of vehicles or inside passenger compartments, this criterion may be overly restrictive for flowing gas situations where ignition requires more than 4 per cent hydrogen in many cases. Whether an ignition source at a given location can ignite the leaking gas plume depends on the flow**	(Background for paragraph 3.34.): Lowest concentration of fuel in which a gas mixture ~~is flammable~~ <u>will sustain propagation of the combustion wave (flammable mixture)</u>. National and international standard bodies (such as National Fire Protection Association (NFPA) and IEC) recognize 4 per cent hydrogen by volume in air as the LFL (US Department of Interior, Bureau of Mines Bulletin 503, 1952; Houf and Schefer, "Predicting Radiative Heat Fluxes and Flammability Envelopes from Unintended Releases of Hydrogen," International Journal of Hydrogen Energy 31, pp 136-151, 2007; NASA RD-WSTF-0001, 1988). The LFL, which depends on the temperature, pressure, <u>flame propagation direction</u> and presence of dilution gases, has been assessed using specific test methods <u>in a fully premixed quiescent mixture</u> (e.g. American Society for Testing (ASTM) E681-04). <u>Hence, the definition of LFL is restricted to fully premixed quiescent environments. Under realistic (non-quiescent) conditions flame propagation is a function of the fluid dynamic environment, which always increases the apparent LFL.</u> While the LFL value of 4 per cent is appropriate for evaluating flammability in general surroundings of vehicles or inside	Agreed by TF meeting on June 13, 2018. Updated per agreement from IWG meeting on June 27, 2018.

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				conditions and the type of ignition. At 4 per cent hydrogen in a stagnant room-temperature mixture, combustion can only propagate in the upward direction. At approximately 8 to 10 per cent hydrogen in the mixture, combustion can also be propagated in the downward and horizontal directions and the mixture is readily combustible regardless of location of ignition source. Coward, H.F. et al, "Limits of flammability of gases and vapors," Bureau of Mines Bulletin 503; 1952, USA; Benz, F.J. et al, "Ignition and thermal hazards of selected aerospace fluids", RD-WSTF-0001, NASA Johnson Space Center White Sands Test Facility, Las Cruces, NM, USA, October 1988; Houf, W.G. et al, "Predicting radiative heat fluxes and flammability envelopes from unintended releases of hydrogen,", International Journal of Hydrogen Energy, 32 pp136-141, 2007. The current text needs to be expanded and refined to better explain flammability of hydrogen-air mixtures per the state of the art of research and ISO/TR 15916:2015 Basic considerations for safety of hydrogen systems.	passenger compartments, this criterion may be overly restrictive for flowing gas situations where ignition requires more than 4 per cent hydrogen in many cases. Whether an ignition source at a given location can ignite the leaking gas plume depends on the flow conditions and the type of ignition. At 4 per cent hydrogen in a stagnant room-temperature mixture, combustion can only propagate in the upward direction. At approximately 8 to 10 per cent hydrogen in the mixture, combustion can also be propagated in the downward and horizontal directions and the mixture is readily combustible regardless of location of ignition source. <u>LFL is usually expressed as percent (%) (volume fraction of the fuel gas in the mixture).</u> Coward, H.F. et al, "Limits of flammability of gases and vapors," Bureau of Mines Bulletin 503; 1952, USA; Benz, F.J. et al, "Ignition and thermal hazards of selected aerospace fluids", RD-WSTF-0001, NASA Johnson Space Center White Sands Test Facility, Las Cruces, NM, USA, October 1988; Houf, W.G. et al, "Predicting radiative heat fluxes and flammability envelopes from unintended releases of hydrogen,", International Journal of Hydrogen Energy, 32 pp136-141, 2007.	

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