RESULT OF SYSTEMATIC REVIEW OF ISO 22734-1:2008	
Date **2012-07-24**	**ISO/TC 197 N 558**
Title of TC or SC concerned **Hydrogen technologies**	

This document is to be completed by the committee secretariat and circulated within 6 months of the termination of the review period to (1) all P- and O-members, organizations and committees in liaison, (2) the ISO Central Secretariat, (3) the TC secretariat in the case of review in an SC.

Review Circulation **2011-04-15** Deadline **2011-09-15**

Reference number and title of International Standard

ISO **22734-1:2008**

English title Hydrogen generators using water electrolysis process -- Part 1: Industrial and commercial applications

French title *Générateurs d'hydrogène utilisant le procédé d'électrolyse de l'eau -- Partie 1: Applications industrielles et commerciales*

Results (the compilation of results is given as an annex)

The following criteria have been met

1 A simple majority of voting P-members has proposed the following action:

a ☐ withdrawal **b** ☐ revision/amendment **c** ☒ confirmation (with or without correction)

2 ☒ Has been adopted/is intended to be adopted (with or without change), or is used "per se", by at least 5 P-members

3 ☐ No changes other than corrections are proposed by any P-member

In the light of results, the following action is proposed:

☐ **Withdrawal**

☒ **Revision** ☐ **Amendment**

Note: The choice between revision and amendment is essentially based on an assessment of whether or not the changes are limited (amendment) or if they require the redevelopment the whole document (revision). To be determined by the committee secretariat.

☐ **Confirmation** ☐ **... with a Technical Corrigendum**

☐ **No final decision can yet be taken** for the following reason(s) (indicate when decision is expected):

☐ **Other** (Please describe, e.g. division into Parts, combination with another IS, conversion to another deliverable type)

Further procedures (attribution to TC/SC/WG, Project Leader, development procedure, meetings, etc.)

☐ The proposed amendment/revision is to be registered as a Preliminary Work Item (stage 00.60)

As agreed at the last two plenary meetings of ISO/TC 197, ISO/TC 197 WG 8 will be mandated to look at the harmonization of the requirements of Part 1 and Part 2, where applicable. As a result, the revision work of ISO 22734-1 to come up with a second edition of this International Standard will be added to the ISO/TC 197 work programme. ISO/TC 197 WG 8 will look at the harmonization aspects and address the comments received during this systematic review (see Annex B)

P-mmebers that would like to nominate additional experts to ISO/TC 197 WG 8 are invited to proceed with their nomination through the ISO Global Registry.

Experts (give details below, or as a separate annex)

Other associated information (e.g. documents to be considered. Give details below, or as a separate annex)

Proposed development track ☐ 1 (24 months) ☒ 2 (36 months - default) ☐ 3 (48 months)

Note: Selection of a development track will automatically associate default limit dates with critical stages. If you envisage that you can advance a project quicker than the default limit dates you may indicate your preferred earlier target dates in the field "Target date for submission'. ***Important!*** *Quoting earlier target dates implies a commitment to meeting these dates* ***If you do not want to change the defaults to earlier dates do not put anything in the "Target date for submission" fields****.*

Target date for submission:	as a CD:	as a FDIS:
	as a DIS:	for publication:

Secretariat	Date	Signature of the TC or SC Secretary
SCC/BNQ	**2012-07-24**	

Compilation of the results

Member body	Member status	Q.1 Recommended action					Q.2 National adoption	Q.3 Same as international standard	Q.4 Used "per se"	Q.5 Reference in regulations	Comments enclosed (see Annex A)
	P/O	Confirm	Confirm & correct	Revise/ Amend	Withdraw	Abstain	Y/N	Y/N	Y/N	Y/N	
Argentina	**P-Member**	X					No		Yes	No	
Austria	**O-Member**					X					
Brazil	**P-Member**					X					
Canada	**Secretariat**	X					Yes	Modified		Yes	
China	**P-Member**					X					
Denmark	**P-Member**					X					
Egypt	**P-Member**										
France	**P-Member**			X			No		Yes	No	
Germany	**P-Member**					X					
India	**P-Member**	X					No		No	No	
Italy	**P-Member**					X					
Japan	**P-Member**			X			No		No	No	
Korea, Republic of	**P-Member**	X					No		Yes	No	Y
Netherlands	**P-Member**	X					Yes	Identical		No	
Norway	**P-Member**					X					
Russian Federation	**P-Member**					X					
Spain	**P-Member**					X					
Sweden	**P-Member**					X					
Switzerland	**P-Member**					X					
United Kingdom	**P-Member**			X			Yes	Identical		No	
USA	**P-Member**			X			No		Yes	Yes	
Totals (P-members only)		5	0	4	0	10	3 Yes, 6 No	2 Identical, 1 Modified	4 Yes, 2 No	2 Yes, 7 No	

Abstentions and incomplete votes are not counted

Q2: Has this International Standard been adopted or is it intended to be adopted in the future as a national standard or other publication?

3: Yes

Canada (SCC) - This standard is intended to be adopted in the future as a national standard.
Netherlands (NEN) - Adopted as NEN-ISO 22734-1:2008
United Kingdom (BSI) - Adopted as BS ISO 22734-1:2008

6: No

Argentina (IRAM)
France (AFNOR)
India (BIS)
Japan (JISC)
Korea, Republic of (KATS)
USA (ANSI)

Q.3: Is the national publication identical, or proposed to be identical, to the International Standard or modified?

2: Identical

Netherlands (NEN)
United Kingdom (BSI)

1: Modified

Canada (SCC) - Deviations specific to Canadian conditions are possible during the adoption process.

Q.4: Is this International Standard used in your country without national adoption or are products used in your country based on this standard?

4: Yes

Argentina (IRAM)
France (AFNOR)
Korea, Republic of (KATS)
USA (ANSI)

2: No

India (BIS)
Japan (JISC)

Q.5: Is this International Standard, or its national adoption, referenced in regulations in your country?

2: Yes

Canada (SCC) - It is referenced in the Canadian Hydrogen Installation Code.

USA (ANSI) - It is referenced in NFPA 2

7: No

Argentina (IRAM)
France (AFNOR)
India (BIS)
Japan (JISC)
Korea, Republic of (KATS)
Netherlands (NEN)

United Kingdom (BSI)

Compilation of comments received during the systematic review of ISO 22734-1:2008

Date: 2012-07-24	ISO/TC 197 doc. **N 558 Annex B**
	Reference Document: **ISO 22734-1**

1	2	(3)	4	5	(6)	(7)
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
JP				In Japan, we have National Law such as High Pressure Gas Control Law, Electricity Business Act which are to be applied as priorities.		
UK				Following on from the work carried out on ISO 22734-2, it is the intention of WG 8 to update ISO 22734-1 based on lessons learned during the development of ISO 22734-2.		
US				The U.S. recommends that Part 1 be revised when Part 2 is complete. The revision is to address the standardization of format: aligning sections, harmonizing common clauses, and harmonizing definitions with the other parts of this family. Additionally, the revision is to update the normative and non-normative references (e.g. ISO 14121-1, which has been withdrawn). This is consistent with discussions within Working Group 8 to revise Part 1 once Part 2 has been published.		
JP1			ge	There are a few lacks of rules on safety in 22734-1 compared to 22734-2 in spite that both standards shall be at the same level on safety. Japanese NC suggests such safety rules that shall be incorporated into -1 from -2 in the following comments, and casts a vote for " Revise/Amend".		
Jp2	5.2	c)	te		Add the following: — Electrical insulation	
Jp3	5.3.5		te		Add the following:. An enclosure large enough to admit service personnel to the enclosure shall have an access door that opens outwards and if	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					equipped with a latch, shall be equipped on the inside with fast release hardware that can be operated without a key or special tool.	
Jp4	5.3.7		te		Add the following: **5.3.8 Prevention of electrostatic accumulation** A terminal connected to earth shall be installed on the enclosure to prevent electrostatic accumulation.	
Jp5	5.4.2.1		te		Add the following: g) metal hydride cylinders meeting the requirements of ISO 16111.	
Jp6	5.4.5		te		Add the following: To remove oil, pipe, fittings, and joints in oxygen service shall be cleaned per IEC 60877: Procedures for ensuring the cleanliness of industrial-process measurement and control equipment in oxygen service.	
Jp7	5.4.5	end	te		Revise as follows: Any piping system used in classified areas shall prevent static build-up if conveying dry hydrogen or oxygen gases as outlined in ISO 15649.	
Jp8	5.4.6	d)			Revise as follows: d) vibration isolation from the inlet **and/or discharge** pipe to the compressor suction line.	
Jp9	5.4.8	end			Revise as follows: Pressure regulator actuators controlled by a pneumatic power source shall not have a diaphragm that i**s facing hydrogen in the opposite side and that could leak air into hydrogen.**	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
Jp10	5.9				Add the following at the beginning: The quality and supply characteristics of the water to be used in the hydrogen generator shall be specified by the manufacturer.	
Jp11	6.1.4				Add the following in Passive methods: c) natural ventilation	
Jp12	6.1.4				Change to bold type. When ventilation is used as an active protection means, the required minimum ventilation rate shall maintain a volume fraction of **hydrogen not exceeding** 1%…	
Jp13	6.1.4	NOTE			Add the wording indicated by boldface. Sudden and catastrophic failure of vessels or piping systems need not be considered a leak scenario in this analysis when protection against such failures has already been contemplated in the vessel and piping design **and soundness is verified periodically.**	
Jp14	6.1.6				Revise as follows: Whenever ventilation is used as per 6.1.4 or 6.1.5, the manufacturer shall specify **at least** the ventilation rate of the ventilation system.	
Jp15	6.1.7				Change to bold type. Purging need not to be performed if it can be demonstrated by **use of natural ventilation per 6.1.4** that the	
Jp16	6.1.9				Change to bold type. The reliability of a hydrogen gas detection system used for safety purposes shall **be evaluated for safety as required by Clause 7.**	
Jp17	Table 1				Add the wording indicated by boldface.	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					Power supplies, **rectifiers and DC cables**	
Jp18	7.1	Para.5			Change to bold type. If the manufacturer's safety analysis determines that hydrogen in air, hydrogen in oxygen or oxygen in hydrogen combustible gas mixture hazards require an emergency stop function, then the emergency stop shall be initiated when the maximum volume fraction of **2** % hydrogen in air, 2 % hydrogen in oxygen or **3** % oxygen in hydrogen, is exceeded.	
Jp19	7.2.1				Add the wording indicated by boldface. The hydrogen generator shall have a start control that initiates operation of the hydrogen generator only when all safeguards are in place and functional.**Suitable interlocks shall be provided to secure correct sequential starting.** **The hydrogen generator may be started only by intentional actuation of a control provided for this purpose** **NOTE Intentional actuation of a control is not required for restarting from a standby mode that is the result of a normal sequence of an automatic cycle.**	
Jp20	7.2.4				Add the wording indicated by boldface. The hydrogen generator shall have an emergency stop function that immediately removes power from systems that produce an actual or impending hazard that cannot be corrected by controls.**The emergency stop safety circuit shall be designed according to the requirements of IEC 60204-1. When provided, emergency Stop push buttons shall be designed in accordance with ISO**	

1	2	(3)	4	5	(6)	(7)
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
					13850, shall be marked clearly and shall be easily accessible. The emergency stop function shall: **a) stop hydrogen production and de-energize equipment that produced the uncorrectable hazardous condition as quickly as possible without creating additional hazards;** **b) initiate or permit the initiation of certain safeguard actions as determined by safety analysis;** **c) override all other functions and operations in all modes;** **d) be fitted with restart lockouts that require intentional reset before hydrogen generator start is permitted;** **e) not initiate a hazardous condition upon reset.** **Control/monitoring systems that can operate safely in the hazardous situation may be left energised to provide system information.** **A separate emergency stop is not required when emergency switching off is provided as described in IEC 60204-1.** **In addition to the requirements above, the hydrogen generator shall also be provided with a connection for an optional remote ESD.**	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
Jp21	7.2.2				Revise the whole text as follows: The hydrogen generator shall have a stop function, separate from the emergency stop function that initiates a controlled cessation of hydrogen generation. The hydrogen generator may be stopped immediately or in a controlled mode with power remaining available to designated systems as indicated by the manufacturer's safety analysis and the functional requirements of the hydrogen generator.	
Jp22	7.2.5				Add the following: Resetting a hydrogen generator shall not initiate a hazardous condition.	
Jp23	7.4				Change the whole text as follows: Programmable electronic equipment for monitoring testing and non-safety critical functions shall comply with: - IEC 61131-1 and - IEC 61131-2 and - IEC 60204-1 Programmable controllers used for safety critical circuit control shall also comply with IEC 61508. For programmable controllers whose safety functions are fail-safe and low complexity, IEC 60730-1 Annex H shall apply.	
Jp24	7.5				Change the whole text as follows: The hydrogen generator shall be controlled to operate within design limits of pressure, temperature, current, voltage, and composition as established by the	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					manufacturer's safety analysis and the functional requirements of the hydrogen generator, assuring safe operation and rated gas generation capacity and quality. The hydrogen generator may correct operating parameters to operate at a partial rated capacity to stay within safe design limits. The manufacturer's documented technical specifications per Clause 12 shall describe these features. NOTE For example, a high ambient temperature may limit the heat rejection capacity of the generator; the generator control may respond by reducing water electrolysis rate to operate within safe process limits.	
Jp25	7.7				Add the following: When flammable gas detection devices are used for safety related systems, the manufacturer shall ensure that their selections, installation, use and maintenance is in acceptance with IEC 60079-29-2 and reliable in accordance with ISO 26142.	
Jp26	7.9				Add the following: **7.10 Purge gas quantity** When the purge gas is supplied in compressed gas containers, there shall be a readily apparent indication of the remaining gas supply and the generator shall shutdown when insufficient purge gas remains to provide the required purge. If the quantity of purge gas is insufficient for a proper purge, the unit shall not be allowed to start or it shall shut down.	
Jp27	8.2				Add the following: e) provide sufficient mechanical strength for	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					the designed differential pressure between anode and cathode cells when assembled; f) not leach out harmful impurities upon electrolysis operation. g) provide sufficiently low levels of cross-membrane H2 and O2 gas permeability under hydrated operating condition so as to prevent a flammable gas mixture	
Jp28	9	Para.4			Change to bold type. A non-insulated live part in a high-**voltage** circuit within the hydrogen generator	
Jp29	10.1.4.3	Para. 2			Add the wording indicated by boldface. **Where applicable,** the following faults and conditions shall be considered in the analysis and testing for 6.2.4:	
Jp30	10.1.4.3				Add the following: – A cell differential pressure higher than the maximum differential pressure specified by the manufacturer; – An electrolyte flow rate lower than the lowest flow rate specified by the manufacturer; – An oxygen pressure higher than the maximum pressure specified by the manufacturer; –A hydrogen compressor inlet pressure lower than the atmospheric pressure;	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					– Feed-water purity below the minimum level specified by the manufacturer; – Limit switch failure – Emergency stop.	
Jp31	10.1.4.3				– temperature lower than the minimum temperature specified by the manufacturer; – temperature higher than the maximum temperature specified by the manufacturer; shall be changed as follows: – An ambient or process temperature higher/lower than the maximum/minimum temperature specified by the manufacturer;	
Jp32	10.1.4.3				– rupture disk failure; shall be changed as follows: – Operation of pressure relief devices;	
Jp33	10.1.5.3	Title			Add the wording indicated by boldface. Pressure test - Gas **and gas/liquid mixture** containing parts	
Jp34	10.1.5.3	end			Revise as follows: If a pneumatic test is used, non-reactive gas, such as nitrogen or helium, is recommended	
Jp35	10.1.5.4.1	end			Add the following: NOTE 3 Apply safety analysis per 6.2.4.1 to determine applicability of pressure differential monitoring and shut down.	
Jp36	10.1.5.5	end			Add the following as 10.1.5.6: **10.1.5.6 Additional Leakage Testing of hydrogen gas component connections and piping joints**	

1	2	(3)	4	5	(6)	(7)
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
					In addition to the normal leakage test of 10.1.5.5, test hydrogen gas conveying piping connections by use of a bubble test or use of hydrogen or helium tracer gas leak detectors. **10.1.5.6.1 Bubble Test** Using an inert test gas such as nitrogen or helium, hydrogen gas components systems shall be subjected to a test pressure of no less than the maximum normal operating pressure. Once the test pressure has been achieved, hydrogen conveying piping joints and component connections shall be completely covered with a leak detection liquid suitable for the surface. The leak detection liquid shall be applied in a manner to prevent bubbles as a result of the application process. Each hydrogen gas connection shall be pressurized for a minimum of 10 minutes while no visible bubbles produced by gas leakage shall be observed. EXCEPTION – electrochemical cells may be excluded from bubble test and contact with leak detection liquid. NOTE If the component to be tested has parts made of stainless steel, nickel, or chromium alloys, the test fluid must have a sulfur and halogen content of less than 10 ppm of each. If the component to be tested has parts made of polyethylene or structural plastic, the test fluid must not promote environmental stress cracking (E.S.C). **10.1.5.6.2 Tracer gas leak detection** As an alternative to the bubble test, a calibrated trace gas detector using a non flammable tracer gas per ISO 10156, such as	

1	2	(3)	4	5	(6)	(7)
MB[1]	**Clause No./ Subclause No./ Annex** (e.g. 3.1)	**Paragraph/ Figure/Table/ Note** (e.g. Table 1)	**Type of com-ment[2]**	**Comment (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations** on each comment submitted
					a hydrogen and nitrogen mixture containing less that 5,7 % H2 in N2, or a helium mass spectrometer with helium gas, may be used to detect hydrogen conveying connection, cell stack and pipe joint leaks when used in accordance with instructions provided by the tracer gas detector manufacturer and the hydrogen generator manufacturer's requirements.	
Jp37	10.1.6	Para.1			Add the wording indicated by boldface. Where **mechanical** ventilation is used…	
Jp38	10.2.5				Add the following: The integrity of each hydrogen generator's cell stack shall be tested as specified in 10.1.5.4, except temperature shall be per manufacturer's standard routine test protocol .	
Jp39	11.2	d)			Add the wording indicated by boldface. electrical input range in volts **(single value or range);**	
Jp40	11.2				Add the following q) the hydrogen quality	
Jp41	11.3				Add the wording indicated by boldface. Piping and tubing shall be marked to identify contents and flow direction.**Inlet and outlet ports and manual controls shall be marked to identify them. Convenience outlet, if provided shall be marked with maximum current ratings. Replaceable fuses shall have fuse replacement markings near the fuse.**	
JP42	11.4				Add the wording indicated by boldface. Warning signs shall be placed to identify vented hydrogen and oxygen, electrical	

1	2	(3)	4	5	(6)	(7)
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
					hazards, contents from drain valves, **potential hazards associated with the liquids contained in the hydrogen generator,** hot components and mechanical hazards. Warning signs shall conform to ISO 3864.	