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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 22734-1

Hydrogen generators using water electrolysis —

Part 1: General requirements, test protocols and safety requirements

ICS: 71.120.99; 71.100.20

ISO/TC 197

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*.

This first edition revises and replaces ISO 22734:2019 to focus on safety requirements. A new informative [Annex C](#) contains information regarding performance measurement, and operating with variable power input.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In a hydrogen generator electrochemical cell, electricity causes dissociation of water into hydrogen and oxygen molecules. An electric current is passed between two electrodes separated by a conductive electrolyte or “ion transport medium”, producing hydrogen at the negative electrode (cathode) and oxygen at the positive electrode (anode). As water is H_2O , twice the volume of hydrogen is produced compared with oxygen.

Hydrogen gas produced using electrolysis technology can be utilized immediately or stored for later use.

The cell(s), and electrical, gas processing, ventilation, cooling, monitoring equipment and controls are contained within an enclosure. Gas compression, feed water conditioning, and auxiliary equipment may also be included.

This document is intended to be used for certification purposes.

NOTE See ISO/IEC 17000 for further guidance on certification.

Hydrogen generators using water electrolysis —

Part 1:

General requirements, test protocols and safety requirements

1 Scope

This document defines the construction, safety, qualification test and documentation requirements of modular or factory-matched hydrogen gas generation appliances or systems, herein referred to as hydrogen generators, using electrochemical reactions to electrolyse water to produce hydrogen.

This document is applicable to hydrogen generators that use the following types of ion transport medium:

- aqueous alkaline (basic) electrolytes, such as solutions of potassium hydroxide or sodium hydroxide;
- aqueous acidic electrolytes such as dilute sulphuric acid;
- solid polymeric materials with acidic function group additions, such as acid proton exchange membrane (PEM);
- solid polymeric materials with basic function group additions, such as anion exchange membrane (AEM).

This document is applicable to hydrogen generators intended for industrial, commercial and residential uses, in indoor or outdoor environments.

Guidance for hydrogen generators that also provide oxygen used for industrial and commercial applications is provided in this document, however additional considerations may apply.

The following are excluded from the scope of this document:

- residential hydrogen generators that also supply oxygen as a product;
- hydrogen generators that can also be used to generate electricity, such as reversible fuel cells (refer to IEC 62282-8-101, IEC 62282-8-102 and IEC 62282-8-201);
- hydrogen generators that use solid oxide electrolyte (refer to IEC 62282-8-101 and IEC 62282-8-201).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1182, *Reaction to fire tests for products — Non-combustibility test*

ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 3864-2, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 4126-1, *Safety devices for protection against excessive pressure — Part 1: Safety valves*

ISO 4126-2, *Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices*

- ISO 4126-6, *Safety devices for protection against excessive pressure — Part 6: Application, selection and installation of bursting disc safety devices*
- ISO 4126-9, *Safety devices for protection against excessive pressure — Part 9: Application and installation of safety devices excluding bursting disc*
- ISO 4126-10, *Safety devices for protection against excessive pressure — Part 10: Sizing of safety valves for gas-liquid two-phase flow*
- ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*
- ISO 7866, *Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing*
- ISO 9300, *Measurement of gas flow by means of critical flow nozzles*
- ISO 9951, *Measurement of gas flow in closed conduits — Turbine meters*
- ISO 9614-1, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*
- ISO 9809-1, *Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa*
- ISO 10286, *Gas cylinders — Terminology*
- ISO 10790, *Measurement of fluid flow in closed conduits — Guidance to the selection, installation and use of Coriolis flowmeters (mass flow, density and volume flow measurements)*
- ISO 11119-1, *Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing — Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 l*
- ISO 11119-2, *Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing — Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 l with load-sharing metal liners*
- ISO 11119-3, *Gas cylinders — Refillable composite gas cylinders and tubes — Design, construction and testing — Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450L with non-load-sharing metallic or non-metallic liners*
- ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*
- ISO 12499, *Industrial fans — Mechanical safety of fans — Guarding*
- ISO 13709, *Centrifugal pumps for petroleum, petrochemical and natural gas industries*
- ISO 13850, *Safety of machinery — Emergency stop function — Principles for design*
- ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*
- ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*
- ISO 14511, *Measurement of fluid flow in closed conduits — Thermal mass flowmeters*
- ISO 14847, *Rotary positive displacement pumps — Technical requirements*
- ISO 15534-1, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*
- ISO 15534-2, *Ergonomic design for the safety of machinery — Part 2: Principles for determining the dimensions required for access openings*
- ISO 15534-3, *Ergonomic design for the safety of machinery — Part 3: Anthropometric data*
- ISO 15649, *Petroleum and natural gas industries — Piping*
- ISO 16111, *Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride*

ISO 16528-1, *Boilers and pressure vessels — Part 1: Performance requirements*

ISO 17398, *Safety colours and safety signs — Classification, performance and durability of safety signs*

ISO 19353, *Safety of machinery — Fire prevention and fire protection*

ISO 20485, *Non-destructive testing — Leak testing — Tracer gas method*

ISO 26142, *Hydrogen detection apparatus — Stationary applications*

ISO 80079-36, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

ISO 80079-37, *Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres — Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*

IEC 31010:2019, *Risk management — Risk assessment techniques*

IEC 60068-2-18:2017, *Environmental testing — Part 2-18: Tests — Test R and guidance: Water*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60335-1:2010, *Household and similar electrical appliances — Safety — Part 1: General requirements*

IEC 60335-2-41, *Household and similar electrical appliances — Safety — Part 2-41: Particular requirements for pumps*

IEC 60335-2-51, *Household and similar electrical appliances — Safety — Part 2-51: Particular requirements for stationary circulation pumps for heating and service water installations*

IEC 60335-2-80, *Household and similar electrical appliances — Safety — Part 2-80: Particular requirements for fans*

IEC 60364-4-41, *Low voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock*

IEC 60364-4-43, *Low-voltage electrical installations — Part 4-43: Protection for safety — Protection against overcurrent*

IEC 60445, *Basic and safety principles for man-machine interface, marking and identification — Identification of equipment terminals, conductor terminations and conductors*

IEC 60529, *Degrees of protection provided by enclosures (IP Codes)*

IEC 60534 (all parts), *Industrial-process control valves*

IEC 60695-11-10, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods*

IEC 60695-11-20, *Fire hazard testing — Part 11-20: Test flames — 500 W Flame test methods*

IEC 60730-1:2013, *Automatic electrical controls for household and similar use — Part 1: General requirements*

IEC 60947-1, *Low-voltage switchgear and controlgear — Part 1: General rules*

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes — Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 60999-1, *Connecting devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units — Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 60999-2, *Connecting devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units — Part 2: Particular requirements for clamping units for conductors above 35 mm² up to 300 mm² (included)*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements*

IEC 61069-7, *Industrial-process measurement and control — Evaluation of system properties for the purpose of system assessment — Part 7: Assessment of system safety*

IEC 61131-1, *Programmable controllers — Part 1: General information*

IEC 61131-2, *Programmable controllers — Part 2: Equipment requirements and tests*

IEC 61508, *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

IEC 61672-2, *Electroacoustics — Sound level meters — Part 2: Pattern evaluation tests*

IEC 62368-1, *Audio/video, information and communication technology equipment — Part 1: Safety requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 cell stack

assembly of two or more *electrochemical cells* (3.8) electrically connected in series and fluidically connected in parallel within a supporting structure, within or without a process containment vessel.

3.1.1 bipolar cell stack

cell stack (3.1) where each electrode is characterized by acting as an anode on one side, and a cathode on the other side

3.1.2 unipolar cell stack

cell stack (3.1) where each electrode is characterized by acting as either an anode or a cathode

3.2 certification

third-party attestation related to products, processes, systems, or persons

[SOURCE: IEC 60050: 902-04-05, modified]

3.3 clean air

air that is essentially free of combustible dust, and contains no more than trace amounts of flammable vapour or gas

[SOURCE: IEC 60079-13]

3.4 commercial use

use of hydrogen generators by laypersons in non-manufacturing business facilities such as stores, hotels, office buildings, educational institutes, filling stations, warehouses, and other non-residential locations

3.5

containment system

part of the equipment containing a flammable substance that may constitute a source of release

[SOURCE: IEC 60050: IEV 426-09-06, modified]

3.6

critical function component

one part of a system in which a single fault or failure would result in the system entering an unsafe state

3.7

dilution

mixing of flammable vapour or gas with *clean air* (3.2) or a *protective gas* (3.29) which, over time, will reduce the flammable concentration

[SOURCE: IEC 60079-10-1:2020 © IEC 2020, modified]

3.8

dilution volume

volume in the vicinity of a source of release where the concentration of flammable gas or vapour is not diluted to a safe level

Note 1 to entry: A "safe level" is typically the lower flammability limit (LFL) or lower, and in some cases the safe level is defined as 2 % vol. or 1 % vol. of hydrogen in air, which corresponds to 50 % or 25 % of the LFL. See [Annex B](#) for information on the flammability limits of hydrogen. For further information about a suitable factor to use for defining a safe level, see IEC 60079-10-1

[SOURCE: IEC 60079-10-1:2020 © IEC 2020, modified with removal of note 1 to entry, and replacement with alternative note 1 to entry]

3.9

electrochemical cell

assembly of electrodes, fluid containment, flow means, and electrical current conduction means that may include product gas separation *membranes* (3.21), for the purpose of producing hydrogen or oxygen from water

Note 1 to entry: Cells may be arranged as single unipolar cells or in bipolar cell stacks within or without a process containment vessel

3.10

enclosure

a part of an assembly providing a specified degree of protection of equipment against external influences and a specified degree of protection against approach to or contact with hazardous parts of the hydrogen generator

[SOURCE: IEC 60050: IEV 441-13-01]

3.11

enriched oxygen atmosphere

gas that contains a volume fraction of more than 23,5 % oxygen with the remainder of its constituents being inert

3.12

factory-matched

engineered in a factory to correspond with each other and work together, separately packed for storage and transportation, and intended to be assembled together at the point of utilization

[SOURCE: ISO 16110-1:2007, 3.21, modified — The term has been changed from "factory matched unit" to "factory-matched"; the words "system components" have been removed.]

3.13

gas crossover

in a water electrolysis *electrochemical cell* (3.8), gas permeation or leakage across cell membranes or porous separators separating hydrogen and oxygen compartments. Gas crossover may also take place by gas, dissolved or dispersed, in electrolyte or feedwater transport from one separator to the other side of the cell stack

Note 1 to entry: excessive oxygen crossover into hydrogen cell compartments or hydrogen crossover into oxygen cell compartments can form flammable gas mixtures

3.14

harm

injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51]

3.15

hazard

potential source of *harm* (3.13)

Note 1 to entry: The term “hazard” may be qualified in order to define its origin or the nature of the expected harm (for example, electric shock hazard, crushing hazard, cutting hazard, toxic hazard, fire hazard, drowning hazard)

[SOURCE: ISO/IEC Guide 51, IEC 60050: IEV 351-57-01]

3.16

hazardous area

three-dimensional region or space in which an explosive atmosphere is present, or can be expected to be present, in quantities such that special precautions for the construction, installation and use of equipment are required

Note 1 to entry: IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*, gives a classification of hazardous areas containing explosive gas atmospheres (see IEV 426-03-03, IEV 426-03-04 and IEV 426-03-05).

[SOURCE: IEC 60050, modified — The term combines IEV 426-03-01 & IEV 426-03-28, and removes Note 2 to entry]

3.17

hazardous situation

circumstance in which people, property or the environment is/are exposed to one or more *hazards* (3.14)

[SOURCE: ISO/IEC Guide 51]

Note 1 to entry: Examples of hazardous situations include having an *enriched oxygen atmosphere* (3.10), a hydrogen concentration exceeding the lower flammability limit, an ignition source in a hazardous area, an overpressure, or an over temperature.

3.18

industrial use

use of hydrogen generators by qualified and experienced personnel in a controlled manufacturing or processing environment

3.19

ion transport medium

medium that provides ionic transport within the cell

3.20

live (energised) part

a part at an electric potential different from that of earth at the worksite and which presents an electrical hazard

Note 1 to entry: A part is energized when it is electrically connected to a source of electric energy. It can also be energized when it is electrically charged and/or under the influence of an electric or magnetic field.

[SOURCE: IEC 60050: IEV 651-21-08, modified]

3.21

maximum allowable working pressure

MAWP

maximum pressure permissible in a vessel or system at the temperature specified for the pressure

Note 1 to entry: The maximum allowable working pressure can also be defined as the design pressure, the maximum allowable operating pressure, the maximum permissible working pressure, or the maximum allowable pressure for the rating of pressure vessels and equipment manufactured in accordance with national pressure vessel codes.

3.22

maximum operating pressure

MOP

maximum pressure that can be expected by the pressure containing equipment when the hydrogen generator is functioning within its design and control parameters, including anticipated transients

3.23

membrane

material that provides separation between oxygen and hydrogen product gases while allowing ionic transport within the cell

3.24

normal condition

condition in which all means for protection against *hazards* (3.14) are intact

3.25

normal use

operation, including stand-by, according to the instructions for use or for the obvious intended purpose

Note 1 to entry: In most cases, normal use also implies *normal condition* (3.22), because the instructions for use will warn against using the hydrogen generator when it is not in normal condition.

3.26

permanently connected

electrically connected to a supply by means of a permanent connection, which can be detached only by the use of a *tool* (3.36)

3.27

permeation

flow of a fluid (gas) through another (usually solid) material by diffusion without a defect or opening of the latter

Note 1 to entry: To be distinguished from leak flow which is not based on diffusion.

[SOURCE: ISO/TR 15916:2015]

Note 2 to entry: electrochemical cell electrolyte and membranes can permeate hydrogen into oxygen cell compartments and oxygen into hydrogen cell compartments, and polymeric system materials can permeate hydrogen or oxygen gas to atmosphere, at rates determined by material properties, temperature, and absolute pressure.

3.28

portable hydrogen generator

hydrogen generator that is not intended to be permanently fastened or otherwise secured in a specific location and can be carried easily by a person

[SOURCE: IEC 60050: IEV 485-09-23, modified]

3.29

pressure-bearing component

part subject to a positive internal pressure of 100 kPa or greater

3.30**pressure relief device****PRD**

device designed to release pressure in order to prevent a rise in pressure above a specified value due to emergency or abnormal conditions

Note 1 to entry: PRDs are activated by pressure or another parameter, such as temperature, and are either re-closing devices (such as valves) or non-re-closing devices (such as rupture disks and fusible plugs). Common designations for these specific types of PRDs are as follows:

- Pressure safety valve (PSV) — pressure activated valve that opens at a specified set point to protect a system from rupture and re-closes when the pressure falls below the set point.
- Temperature-activated pressure relief device (TPRD) — PRD that opens at a specified temperature to protect a system from rupture and remains open.

3.31**protective gas**

clean air (3.2) or inert gas used for maintaining an overpressure and, if required, dilution and purging

[SOURCE: IEC 60050, IEV 426-09-04, modified]

3.32**purging**

operation of passing a quantity of *protective gas* (3.29) through the enclosure and ducts, so that the concentration of the explosive gas atmosphere is brought to a safe level

Note 1 to entry: A “safe level” is typically the lower flammability limit (LFL) or lower, and in some cases the safe level is defined as 2 % vol. or 1 % vol. of hydrogen in air, which corresponds to 50 % or 25 % of the LFL. See [Annex B](#) for information on the flammability limits of hydrogen. For further information about a suitable factor to use for defining a safe level, see IEC 60079-10-1

[SOURCE: IEC 60050, IEV 426-09-03, modified, with addition of Note 1 to entry]

3.33**residential use**

use of hydrogen generators by laypersons in private households (non-commercial and non-industrial use), for instance car-ports, garages, utility rooms and similar areas of a residence

3.34**risk assessment**

overall process of risk identification, risk analysis, risk evaluation, and risk mitigation

Note 1 to entry: For terminology relating to risk assessment, see ISO/IEC Guide 51

3.35**single fault**

condition in which one means for protection against *hazards* (3.14) is defective or one fault is present which could cause a *hazard* (3.14)

Note 1 to entry: If a single fault condition results unavoidably in another single fault condition, the two failures are considered as one single fault condition.

3.36**standard conditions**

conditions to which the volume or other properties of a gas are referred, and which are represented by a temperature of 273,15 K (0 °C) and an absolute pressure of 100 kPa

3.37**supply cord**

flexible cord, for supply purposes, that is fixed to the hydrogen generator

3.38

tool

external device, including keys and coins, used to aid a person to perform a mechanical function

3.39

ventilation

movement of air and its replacement with fresh air due to the effects of wind, temperature gradients, or mechanical means (for example, fans or extractors)

Note 1 to entry: IEC 60079-10-1, Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres, gives types and degrees of ventilation

Note 2 to entry: Fresh air is intended to be synonymous with the term 'clean air' used in IEC 60079-13. Both terms mean air that is essentially free of flammable gas or vapour.

Note 3 to entry: For example, ventilation can be used to dilute and remove hydrogen, oxygen, or purge gas from within a system enclosure or installation area

[SOURCE: IEC 60050, IEV 426-03-14, modified – Inclusion of note in IEC 60079-10-1: 2020 3.5.1 as Note 2 to entry, and addition of Note 3 to entry]

3.40

volume under consideration

volume served by the ventilation in the vicinity of the release being considered

Note 1 to entry: For an enclosed space this could be an entire room or part of a larger space where the considered ventilation will dilute the gas or vapour from a given source of release. Outdoors, this is the volume around a source of release where an explosive mixture could form. In congested outdoor places this volume could be dictated by the partial enclosure provided by the surrounding objects.

[SOURCE: IEC 60079-10-1:2020 © IEC 2020]

4 Requirements

4.1 Operating conditions

4.1.1 Energy input specification

4.1.1.1 Electrical

The manufacturer shall specify, as outlined in IEC 60204-1 or IEC 61010-1, the electrical input rating for the hydrogen generator.

4.1.1.2 Other utilities

The manufacturer shall specify any other energy inputs required.

NOTE An example of another energy input is pneumatic air for device actuation

4.1.2 Feed water specifications

The manufacturer shall define the specifications, including quality and supply characteristics, for the feed water to be used in the hydrogen generator.

The hydrogen generator shall be provided with means to prevent any back-feeding into the feed water supply.

In addition, means shall be provided to prevent any coolant from the heat transfer system from back-feeding into the potable water supply.

4.1.3 Ambient environment

The manufacturer shall specify the physical environment conditions for which the hydrogen generator is designed. These shall include indoor or outdoor operation, the ambient temperature range, and the barometric and humidity specifications.

4.1.4 Protective gas

Where the use of protective gas is required for purging of enclosures, or system equipment, for example, piping and vessels, the manufacturer shall specify the type of protective gas, its specifications, for example, the minimum ventilation rate required, and any alternatives permitted.

Purging of system equipment to remove air shall only be performed using inert gases.

The protective gas should not, by reason of its chemical characteristics or the impurities that it might contain, reduce the effectiveness of the protection or adversely affect the satisfactory operation and integrity of the enclosed equipment.

NOTE 1 Air of normal instrument quality, nitrogen, or other non-flammable gas is considered acceptable as a protective gas.

When a protective gas other than air is used, a risk of asphyxiation exists. Therefore, a suitable warning should be affixed to the enclosure, see [6.4](#). Alternatively, a suitable means of purging the enclosure to remove the protective gas prior to the opening of doors or covers should be provided.

NOTE 2 Guidance of the hazards of oxygen deficient atmospheres is available in EIGA Doc 44.

The temperature of the protective gas shall not normally exceed 40 °C at the inlet of the enclosure. In special circumstances, a higher temperature may be permitted or a lower temperature might be required. In this case, the temperature shall be marked on the enclosure.

NOTE 3 Where the protective gas is clean air, the ambient temperature rating marked on the nameplate satisfies this requirement.

If necessary, measures should be taken to avoid condensation and freezing.

The protective gas shall be essentially free of contaminants or foreign matter and shall contain no more than trace amounts of flammable vapor or gas. All protective gas supplies shall be designed to minimize chances for contamination.

NOTE 4 Air filtration might be desirable.

NOTE 5 Ordinary plant compressed air is usually not suitable for purge or pressurizing systems, due to contaminants that can cause equipment to malfunction.

Piping for the protective gas shall be protected against mechanical damage.

Where compressed air is used, the compressor intake shall be located in an unclassified location. Where the compressor intake line passes through a classified location, it shall be constructed of non-combustible material, designed to prevent leakage of flammable gases, vapours, or dusts into the protective gas, and it shall be protected against mechanical damage and corrosion.

Systems providing protective gas supplied in compressed gas containers shall also comply with [4.6.13](#).

4.1.5 Delivery of hydrogen

The manufacturer shall specify:

- a) the maximum hydrogen production rate,
- b) the maximum allowable working pressure of the hydrogen output,
- c) the minimum and maximum hydrogen output temperature, and