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Gaseous hydrogen — Fuelling stations —

Part 1: General requirements

Carburant d'hydrogène gazeux — Stations-service —

Partie 1: Exigences générales

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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 cancels and replaces ISO/TS 19880-1:2016, which has been technically revised.

The main changes compared to the ISO/TS 19880-1:2016 are as follows:

— where appropriate, guidance information from the TS was converted to requirements;

— the difference between the risk assessment and the design requirement clauses were clarified and references were added to ensure that the appropriate clauses were linked;

— Annex A from the TS on safety distances was removed;

— Annex C from the TS on hydrogen quality control was removed to ISO 19880-8;

— the presentation of the information was improved and much of the guidance information was moved to informative annexes.

A list of all parts in the ISO 19880 series can be found on the ISO website.

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.

Gaseous hydrogen — Fuelling stations —

Part 1: General requirements

1 Scope

This document defines the minimum design, installation, commissioning, operation, inspection and maintenance requirements, for the safety, and, where appropriate, for the performance of public and non-public fuelling stations that dispense gaseous hydrogen to light duty road vehicles (e.g. fuel cell electric vehicles).

This document is not applicable to the dispensing of cryogenic hydrogen, or hydrogen to metal hydride applications.

Since this document is intended to provide minimum requirements for fuelling stations, manufacturers can take additional safety precautions as determined by a risk management methodology to address potential safety risks of specific designs and applications.

While this document is targeted for the fuelling of light duty hydrogen road vehicles, requirements and guidance for fuelling medium and heavy duty road vehicles (e.g. buses, trucks) are also covered.

Many of the generic requirements within this document are applicable to fuelling stations for other hydrogen applications, including but not limited to the following:

— fuelling stations for motorcycles, fork-lift trucks, trams, trains, fluvial and marine applications;

— fuelling stations with indoor dispensing;

— residential applications to fuel land vehicles;

— mobile fuelling stations; and

— non-public demonstration fuelling stations.

However, further specific requirements that can be necessary for the safe operation of such fuelling stations are not addressed in this document.

This document provides requirements for and guidance on the following elements of a fuelling station (see Figure 1 and Figure 2):

— hydrogen production/delivery system:

  — delivery of hydrogen by pipeline, trucked in gaseous and/or liquid hydrogen, or metal hydride storage trailers;

  — on-site hydrogen generators using water electrolysis process or hydrogen generators using fuel processing technologies;

  — liquid hydrogen storage;

  — hydrogen purification systems, as applicable;

— compression:

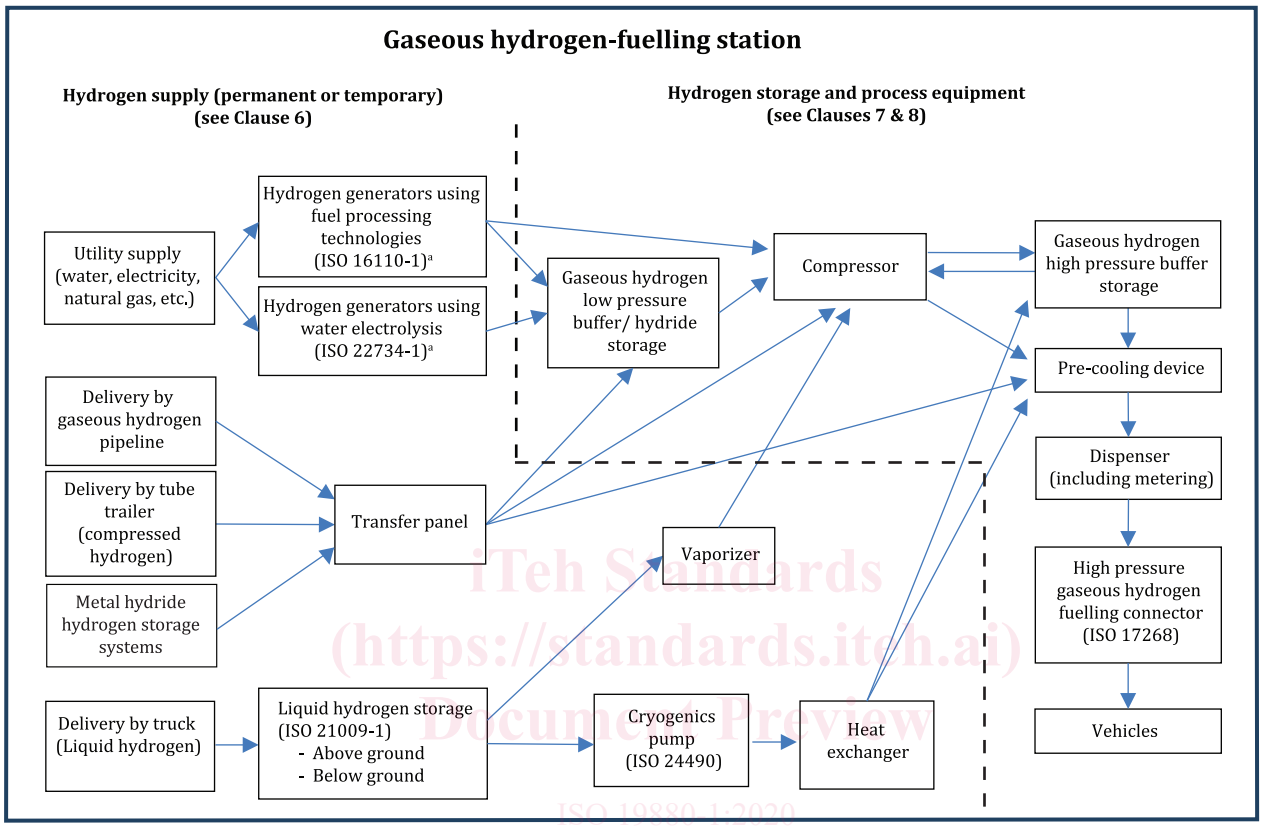
  — gaseous hydrogen compression;

— pumps and vaporizers;

— gaseous hydrogen buffer storage;

— pre-cooling device;

— gaseous hydrogen dispensing systems.



a May include a buffer vessel (or accumulator) for dampening or adjusting flow of compressor suction inlet.

Figure 1 — Example of typical elements that a fuelling station consists of, including hydrogen supply

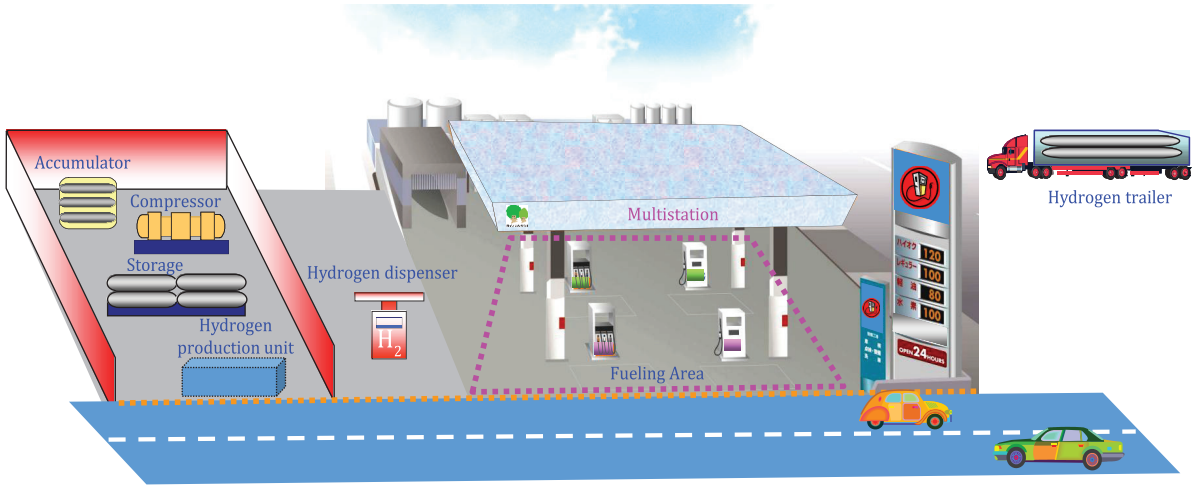


Figure 2 — Image of an example hydrogen fuelling station

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 13850, *Safety of machinery — Emergency stop function — Principles for design*

ISO 14687, *Hydrogen fuel — Product specification*

ISO 15649, *Petroleum and natural gas industries — Piping*

ISO 17268, *Gaseous hydrogen land vehicle refuelling connection devices*

ISO 19880-8, *Gaseous hydrogen — Fuelling stations — Part 8: Hydrogen quality control*

ISO 21013-1, *Cryogenic vessels — Pressure-relief accessories for cryogenic service — Part 1: Reclosable pressure-relief valves*

ISO 21013-2, *Cryogenic vessels — Pressure-relief accessories for cryogenic service — Part 2: Non-reclosable pressure-relief devices*

ISO 21013-3, *Cryogenic vessels — Pressure-relief accessories for cryogenic service — Part 3: Sizing and capacity determination*

ISO 22734, *Hydrogen generators using water electrolysis*

ISO/IEC 80079 (all parts), *Explosive atmospheres*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

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

IEC 62282-3-100, *Fuel cell technologies. Stationary fuel cell power systems. Safety*

EN 13445-5, *Unfired pressure vessels. Inspection and testing*

SAE J2600: 2015-08, *Compressed Hydrogen Surface Vehicle Fuelling Connection Devices*

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 http://www.electropedia.org/

3.1
acceptance criteria
<risk or harm > acceptable level of risk or *harm* (3.34), locally defined as:

— a tolerable risk value; or

— a specified harm level; or

— requirements in a prescriptive document

3.2
accessory
device with an operational function

3.3
bleed
<venting> intentional expiration of a fluid from a fluid system

3.4
basic process control system
BPCS
system which responds to input signals from the process, its associated equipment, other programmable systems and/or an operator and generates output signals causing the process and its associated equipment to operate in the desired manner but which does not perform any safety-instrumented functions with a claimed *SIL* (3.73) ≥ 1

[SOURCE: IEC 61511-1:2004, 3.2.3]

3.5
breakaway device
device on the *fuelling hose* (3.27) that disconnects the hose from the *dispenser* (3.13) when a tension limit is exceeded and blocks the flow of hydrogen from the dispenser, e.g. if the vehicle moves away with the fuelling hose connected to the vehicle

3.6
buffer storage vessels
pressure vessels designed for the purpose of storing compressed hydrogen, which can be located between a hydrogen generator and a compressor for an even flow of gas to the compressor or between the compressor and *dispensing system* (3.17) for accumulation of pressurized gas supply for vehicle fuelling

3.7
building
structure, usually enclosed by walls and a roof, constructed to provide support or shelter for intended occupancy

3.8
canopy
roof, overhead shelter, or hood which affords a degree of weather protection

3.9
compressed hydrogen storage system
CHSS
hydrogen storage on-board vehicle, as defined in the GTR#13

3.10
component pressure rating
maximum pressure at which it is permissible to operate a component as specified by the manufacturer at a specified temperature

Note 1 to entry: Components designed with a maximum allowable pressure per the European PED represent the component pressure rating by the manufacturer that as indicated by the value of "PS".

Note 2 to entry: This is sometimes referred to as the *maximum allowable working pressure* (3.45) for the component, for example for vessels.

Note 3 to entry: In addition to the specification of the maximum temperature, the manufacturer can define an allowable minimum temperature or temperature range expected for service. For additional thermal conditions and risks potentially experiences during *fires* (3.23), see 5.3.6.4.

Note 4 to entry: Pressures up to 10 % above the rating can occur during fault management by PSV. See E.3 regarding limited cycle testing to 110 % of the rating as part of verification testing to demonstrate capability of the component.

Note 5 to entry: See Annex E for discussion of pressure terminology and its application to *dispensing systems* (3.17) and *fuelling stations* (3.29) in general.

3.11
control system
system which responds to input signals from the process and/or from an operator and generates output signals causing the process to operate in the desired manner

Note 1 to entry: Also see *safety-instrumented system (SIS)* (3.72) and *basic process control system (BPCS)* (3.4).

3.12
connector
matching parts (such as male and female parts) that can be put together to form a "connection" which permits the transfer of fluids, electric power, or control signals

Note 1 to entry: *Fittings* (3.24) are a type of connector used in piping systems.

Note 2 to entry: Examples of connectors commonly used in hydrogen systems are as follows:

a) The fuelling *nozzle* (3.53) "connector" mates with the *receptacle* (3.64) "connector" on the vehicle to form the connection for transfer of compressed hydrogen between the *dispenser* (3.13) and the vehicle, as defined in ISO 17268 for this specific application;

b) The hose assemblies have connectors on each end that allow coupling to the hoses and connection to the piping system, e.g. hose *breakaway device* (3.5) or fuelling nozzle;

c) *Control systems* (3.11) often use electrical connectors to allow rapid and secure assembly or replacement.

3.13
dispenser
equipment in the *dispensing system* (3.17), including the *dispenser cabinet(s)* (3.14) and support structure, that is physically located in the fuelling area

Note 1 to entry: The hydrogen dispenser typically includes, as a minimum, the *fuelling assembly* (3.26), required temperature and pressure instrumentation, filters, and the user interface to conduct vehicle fuelling.

Note 2 to entry: The manufacturer of the hydrogen dispenser can elect to include additional equipment in the dispenser, including the possibility of all equipment in the dispensing system.

3.14
dispenser cabinet
protective *housing* (3.40) that encloses process piping and can also enclose measurement, control and ancillary *dispenser* (3.13) equipment

3.15
dispenser fuel pressure
pressure of the hydrogen gas supplied to the vehicle by the station

Note 1 to entry: See Annex E for discussion of pressure terminology and its application to *dispensing systems* (3.17).

3.16
dispenser fuel temperature
temperature of the hydrogen gas supplied to the vehicle by the station

3.17
dispensing system
system downstream of the hydrogen supply system comprising all equipment necessary to carry out the vehicle fuelling operation, through which the compressed hydrogen is supplied to the vehicle

3.18
enclosure
structure, protective *housing* (3.40), container, machine cabinet, etc. which encloses or partially encloses equipment of a station that may have access for maintenance but is not intended to be occupied

Note 1 to entry: The use of an enclosure could be to protect equipment from the environment, provide noise attenuation, or provide *safety* (3.69) to the areas surrounding the equipment.

Note 2 to entry: A *canopy* (3.8) without walls is not regarded as an enclosure in this context.

3.19
explosion
ignition and rapid combustion that causes an over-pressure

Note 1 to entry: A rapid deflagration and/or a detonation are explosions.

Note 2 to entry: Slow deflagrations or jet flames do not create an over-pressure and are therefore not considered to be explosions.

3.20
explosive gas atmosphere
mixture with air, under atmospheric conditions, of flammable substances in the form of gas or vapour, which, after ignition, permits self-sustaining flame propagation

Note 1 to entry: Although a mixture which has a concentration above the upper flammable limit (UFL) is not an explosive gas atmosphere, it can readily become so and, generally for area classification purposes, it is advisable to consider it as an explosive gas atmosphere.

[SOURCE: IEC 60079-10-1:2015, 3.2]

3.21
factory acceptance testing
FAT
tests performed in the factory on *fuelling station* (3.29) equipment or systems to verify functionality and/or integrity prior to shipment to the site, (or an appropriate alternative type acceptance methodology)

3.22
fallback
back-up control strategy, for example in the fuelling protocol when the anticipated precooling of hydrogen to within a specified range of temperatures is not achieved, however fuelling is able to continue, typically at a different fuelling rate

3.23
fire
non-premixed combustion process of a solid, liquid pool, or a jet plume of flammable substance

Note 1 to entry: A fire is the combustion of a solid or liquid of a process first of pyrolysis or evaporation to a combustible gas where a non-premixed combustion process ensues. Also, a non-premixed combustion of a flammable plume (jet fire) is also covered by this definition as is combustion of metals and of hydrogen released by a metal hydride. A fire as defined here does not create an over-pressure therefore is not an *explosion* (3.19), nor is it a deflagration or a detonation which are premixed combustion phenomena.

3.24
fitting
part or design feature on a component used to join (i.e. connect) any pressure retaining components in the system

3.25
forecourt
surfaced area where vehicle dispensing operations are conducted including the *fuelling pad* (3.28) and any area underneath a *canopy* (3.8)