TECHNICAL SPECIFICATION

ISO/TS 20100

First edition
2008-12-01

Gaseous hydrogen — Fuelling stations

Carburant d'hydrogène gazeux — Stations-service

Reference number
ISO/TS 20100:2008(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 20100 was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*.

Gaseous hydrogen — Fuelling stations

1 Scope

This Technical Specification specifies the characteristics of outdoor public and non-public fuelling stations that dispense gaseous hydrogen used as fuel onboard land vehicles of all types.

Residential and home applications to fuel land vehicles are excluded from this Technical Specification.

The fuelling station may comprise, as applicable, the following as shown in Figure 1:

— Delivery of hydrogen by pipeline, trucked-in gaseous and/or liquid hydrogen;

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

— Liquid hydrogen storage, pumping and vaporizing systems;

— Gaseous hydrogen compression and purification systems;

NOTE When the fuelling station comprises an on-site hydrogen generator, the compressor/purifier system is commonly integrated into it.

— Gaseous hydrogen buffer storage;

— Gaseous hydrogen dispensers.

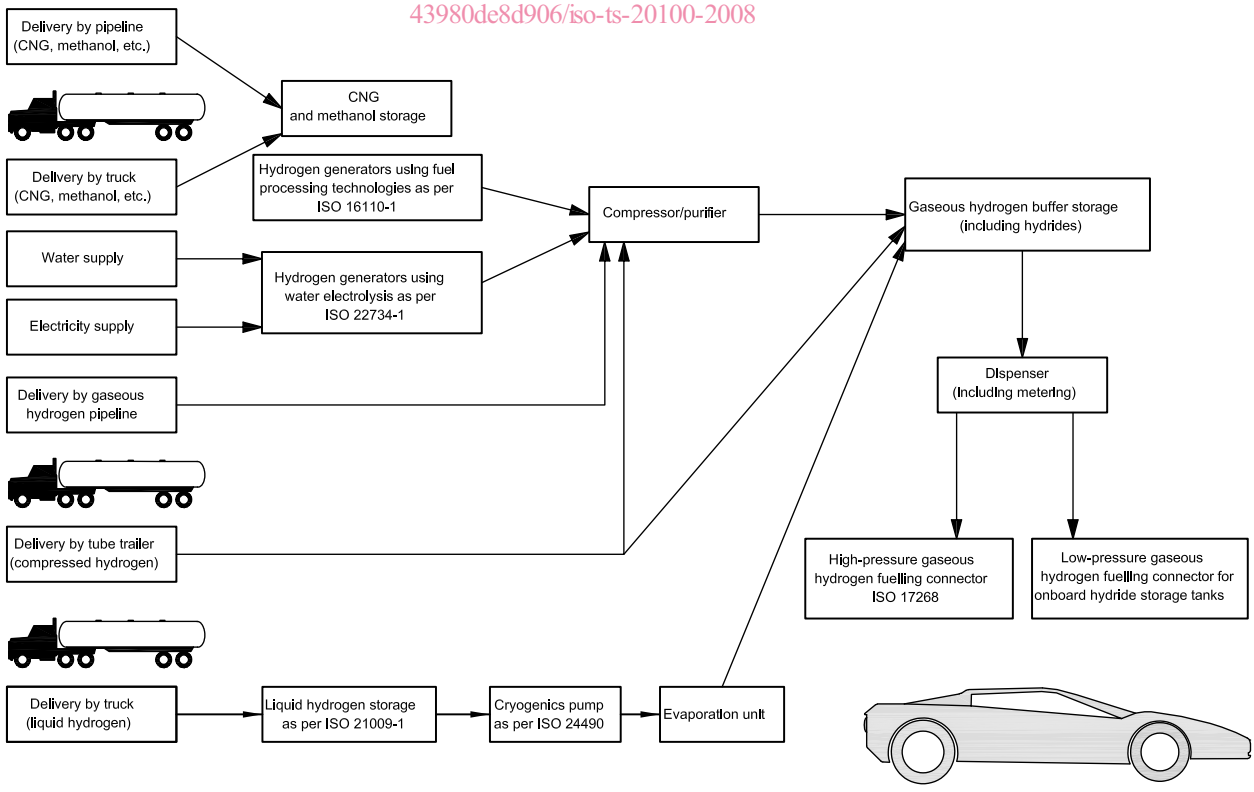

Figure 1 — Gaseous hydrogen — Fuelling station

2 Normative references

The following referenced documents are indispensable for the application 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 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 4414, *Pneumatic fluid power — General rules relating to systems*

ISO 7751, *Rubber and plastics hoses and hose assemblies — Ratios of proof and burst pressure to design working pressure*

ISO 14113, *Gas welding equipment — Rubber and plastic hoses assembled for compressed or liquefied gases up to a maximum design pressure of 450 bar*

ISO 14687 (all parts), *Hydrogen fuel — Product specification*

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

ISO 16110-1, *Hydrogen generators using fuel processing technologies — Part 1: Safety*

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

ISO 17268, *Compressed hydrogen surface vehicle refuelling connection devices*

ISO 21009-1, *Cryogenic vessels — Static vacuum-insulated vessels — Part 1: Design, fabrication, inspection and tests*

ISO 21011, *Cryogenic vessels — Valves for cryogenic service*

ISO 21012, *Cryogenic vessels — Hoses*

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 22734-1, *Hydrogen generators using water electrolysis process — Part 1: Industrial and commercial applications*

IEC 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60079-10, *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas*

IEC 60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*

IEC 60079-29-1, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*

IEC 60079-29-2, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

IEC 60079-30-1, *Explosive atmospheres — Part 30-1: Electrical resistance trace heating — General and testing requirements*

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

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

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

IEC 60446, *Basic and safety principles for man-machine interface, marking and identification — Identification of conductors by colours or alphanumerics*

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

IEC 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments*

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

IEC 61511-1, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements*

IEC 62305-3, *Protection against lightning — Part 3: Physical damage to structures and life hazard*

3 Terms and definitions

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

3.1
accessory
part capable of performing an independent function and contributing to the operations of the equipment that it serves

3.2
authority having jurisdiction
organization, office or individual responsible for approving a facility along with an equipment, an installation or a procedure

3.3
bleed venting
expiration or inspiration of air or gas from, or to, one side of a diaphragm of any accessory, component or equipment such as a valve, pressure regulator or switch

3.4
buffer storage tanks
pressurized tanks, 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 dispenser for accumulation of pressurized gas supply for vehicle fuelling

3.5
control system
system that is intended to automatically operate the fuelling station within its normal operating parameters

NOTE The control system includes the measuring, monitoring and reporting and recording functions, as applicable.

3.6
design pressure
maximum pressure permissible in a storage vessel (at its top) or a piping system for a designated temperature

NOTE 1 The design pressure is the basis for the pressure setting of the pressure relief devices protecting the vessel or piping system.

NOTE 2 The design pressure may also be the maximum allowable operating pressure rating of pressure vessels manufactured in accordance with national pressure vessel codes.

3.7
dispenser
parts of the pressurized-gas fuelling station via which the pressurized gas is dispensed to vehicles

NOTE As an example, the dispenser may include a dispenser cabinet, a gas flow meter, a fuelling hose and fuelling nozzle attachments.

3.8
dispenser cabinet
protective housing that encloses the dispenser gas containing equipment

3.9
dispensing system
system comprising all equipment necessary to carry out the vehicle fuelling operation, downstream of the hydrogen supply system

3.10
enclosure
structure that protects equipment from the environment, provides noise attenuation, or provides safety to the areas surrounding the equipment

3.11
fail-safe
design feature that ensures that safe operating conditions are maintained in the event of a malfunction of control devices or an interruption of a supply source

3.12
fill pressure
pressure attained at the end of filling

NOTE Fill pressure varies according to the gas temperature in the vehicle tank, which is dependent on the changing parameters and the ambient conditions.

3.13
forecourt
hard surfaced area at the front of the vehicle fuelling position, including any area underneath a canopy

3.14
fuelling connector
joined assembly of the fuelling nozzle and fuelling receptacle, which permits quick connect and disconnect of the fuel supply to the vehicle or storage system

3.15
fuelling hose
flexible conduit used for dispensing gaseous hydrogen to vehicles through a fuelling nozzle

3.16
fuelling nozzle
mating part of the fuelling connector at the fuelling station, including shut-off valves, that connects the fuelling hose to the vehicle fuelling receptacle for the transfer of hydrogen fuel

3.17
fuelling receptacle
mating part of the fuelling connector mounted on a vehicle

3.18
fuelling position
area adjacent to the hydrogen dispensers, where customers park their vehicles for fuelling

3.19
fuelling station
facility for the dispensing of compressed hydrogen, which includes all stationary equipment that supplies, compresses, stores and dispenses gaseous hydrogen to fuel a land vehicle

3.20
guard
part of a machine specially used to provide protection by means of a physical barrier

NOTE Depending on its construction, a guard may be called casing, cover, screen, door, enclosed guard, etc.

3.21
harm
physical injury or damage to the health of people, or damage to property or to the environment

3.22
hazard
potential source of harm

3.23
hazardous event
occurrence in which a hazardous situation results in harm

3.24
hazardous situation
circumstance in which people, property or the environment are exposed to one or more hazards

3.25
hose breakaway device
component installed downstream of the dispenser outlet connection to protect the dispenser assembly from damage by vehicles driving away while still connected to the dispenser nozzle

3.26
housing
section of a system that encloses, and is intended to protect, operating parts, control mechanisms, or other components, which need not be accessible during normal operation

3.27
hydrogen purifier
equipment to remove oxygen, moisture and other impurities from the hydrogen

3.28
manufacturer
person or organization responsible for the design, fabrication and testing of equipment and components

3.29
maximum fill pressure
maximum pressure to which a vehicle tank may be filled

3.30
mechanically actuating safety equipment
mechanically actuating equipment that prevents fuelling station operation outside specified acceptable maximum or minimum operating pressures or that prevents a gas leakage in the event of an incident

3.31
nominal working pressure
nominal working pressure is the vehicle tank pressure, as specified by the manufacturer, at a uniform gas temperature of 15 °C or as specified and at full gas content

3.32
non-public fuelling station
fuelling station that does not sell or dispense gaseous hydrogen to the general public, e.g. private or municipal vehicle fleet operation

3.33
operator
licensed person or organization responsible for the safe operation, maintenance and housekeeping of the fuelling station

3.34
outdoors
location outside of any building or structure, or locations under a roof, weather shelter, or canopy provided this area is not enclosed on more than two sides

3.35
plinth
raised area on the forecourt, supporting and protecting the dispensers and associated equipment

3.36
pressure relief device
device designed to open to prevent a rise of internal pressure in excess of a specified value due to emergency or abnormal conditions

NOTE The pressure relief device can be of the re-closing or other type, such as one having a rupture disk and/or fusible plug that requires replacement after each use.

3.37
public fuelling station
fuelling station that sells gaseous hydrogen to the general public

3.38
risk
combination of the probability of occurrence of harm and the severity of that harm

3.39
safeguarding
use of specific technical means to protect persons from the hazards which cannot reasonably be removed or sufficiently limited by design

3.40
safety
freedom from unacceptable risk

3.41
safety device
device other than a guard, which eliminates or reduces risk, alone or associated with the guard

3.42
safety distance
minimum separation between a hazard source and an object (human, equipment or environment), which will mitigate the effect of a likely foreseeable incident and prevent a minor incident from escalating into a larger incident

3.43
safety function
function to be implemented by a safety-instrumented system, other technology safety-related system or external risk reduction facilities, which is intended to achieve or maintain a safe state for the process with respect to a specific hazardous situation

3.44
safety-instrumented system
instrumented system used to implement one or more safety-instrumented functions

NOTE A safety-instrument system is composed of any combination of sensors, logic solvers, and final elements.

3.45
safety measures
combination of the measures incorporated at the design stage and those measures required to be implemented by the user

3.46
vaporizer
device other than a tank that receives hydrogen in a liquid form and adds sufficient heat to convert the liquid to a gaseous state

NOTE Hydrogen purifiers may comprise purification vessels, dryers, filters and separators.

4 General design requirements

The hydrogen fuelling station installation shall be sited to minimize risk to users, operating personnel, and neighbouring personnel, residents and property.

Consideration shall be given to any potential hazard or risk in relation to the location and operation of the facility.

More specifically, measures to reduce fire and explosion risks shall be applied in the following order of priority:

— prevention of the formation of a flammable or explosive mixture and reduction of the explosion strength potential of explosive atmospheres generated by potential leaks or releases;

— avoidance of ignition sources;

— mitigation of the effects of a fire or explosion.

Installation and equipment design shall minimize the number of connections and other possible points of leakage or release to atmosphere.

Configurations generating the possibility of a hazardous confined explosive atmosphere shall be avoided.

Fire and explosion risk prevention shall take into account foreseeable malfunctions and misuse.

The installation shall be such that, for any foreseeable deviation involving fire and explosion hazards, it shall be possible to define a safe action towards prevention of escalation.

Where an explosive mixture could persist within a fuelling station enclosure after an accidental release of hydrogen despite existing means of detection, isolation and ventilation, explosion relief shall be provided to reduce the consequences of an explosion.

5 Hydrogen delivery systems

5.1 General

5.1.1 Access to the hydrogen delivery and storage areas

The installation shall be so designed that authorized personnel shall have easy access to and exit from the operating area of the installation at all times.

The hydrogen delivery and storage area shall be located so that it is readily accessible to mobile supply equipment at ground level and to authorized personnel. Suitable roadways or other means of access for emergency equipment, such as fire department apparatus, shall be provided.

Where fencing is provided to prevent access of unauthorized persons, the minimum clearance between the fence and the installation shall be 0,8 m to allow free access to and escape from the enclosure.

Adequate means of escape in the case of emergency shall be provided. In cases where authorized personnel can be trapped inside compounds, there shall be at least two separate outward opening exits, remote from each other, strategically placed in relation to the degree of hazard considered.

All gates shall be outward opening and wide enough to provide for the easy access and exit of authorized personnel. Gates shall not allow entry without a key during normal operation.

Consideration shall be given to the provision of an additional emergency exit where the size of the fenced area or equipment location necessitates this.

Access to the installation shall be prevented to all unauthorized persons. Warning notices shall support this.

Timber or other readily combustible materials shall not be used for fencing. The height of the fencing should be at least 2 m.

5.1.2 Electrical grounding

All delivery vehicles shall be electrically connected to the ground prior to flexible hose connection.

The effectiveness of the grounding connection shall be checked at least once every three years.

5.2 Gaseous hydrogen supply by tube trailers and multi cylinder packs

5.2.1 Tube trailers

Hydrogen tube trailers shall be stationed in an area that is accessible to hydrogen distribution tractors and fire-fighting services at all times.

Safety distances shall comply with those given in 13.2.2 for gaseous hydrogen systems.

Minimum clearance of 1 m shall be maintained on all sides of each tube trailer.

The tube trailer stationing area shall be level and horizontal. The front and rear ends of the tube trailer bays shall be kept open. A bump stop shall indicate normal tube trailer position.

The location of the pressure reducing station shall be accessible.

Hydrogen tube trailers shall not be stationed outside of the designated trailer unloading bays.

A designated temporary tube trailer parking location shall be provided for carrying out tube trailer exchange without interfering with fuelling operations, unless the fuelling activity is fully suspended during the tube trailer exchange operation.

These temporary tube trailer parking locations shall not be located near buildings where persons are present or near any potentially hazardous processes, sources of fuel, flammable gases or liquids.

5.2.2 Multi cylinder pack

Multi cylinder pack trailers shall be electrically connected to ground prior to flexible hose connection.

The storage area shall be fenced to prevent access of unauthorized persons. Activities other than those directly related to the hydrogen tube trailer operation shall not be permitted in the vicinity of the trailers.

5.3 Liquid hydrogen supply

5.3.1 Liquid hydrogen storage layout and design features

To minimize the consequence of an accidental leakage, liquid hydrogen storage tanks should not be enveloped or constricted by walls or buildings. Liquid hydrogen storage tanks in 2- or 3-sided zone) should also be avoided as much as possible to prevent accidental gas confinement if leakage occurs.

Safety distances shall comply with those given in 13.2.1 for liquid hydrogen systems.

For access and inspection, a minimum clearance of 1 m shall be maintained on all sides of each storage tank.

Any firebreak walls or partitions shall be made of brick, concrete or any other suitable non-combustible material of 90 min rating.

The liquid hydrogen storage tanks shall be protected against vehicular impact by barriers or bollards.

Filling connections and equipment controls shall be accessible.

Connections and equipment controls necessary for filling purposes shall be located in close proximity to each other and in such a way that the storage tank and tanker controls are visible and accessible from the operator's position.

Dykes, diversion kerbs or grading shall be used to ensure that liquid leakage from adjacent combustible liquid or liquid oxygen storages installed at a higher level than the liquid hydrogen storage is prevented from accumulating within 15 m of the liquid hydrogen storage.

The liquid hydrogen storage tanks shall comply with ISO 21009-1.

5.3.2 Liquid hydrogen transfer area

The liquid hydrogen transfer area shall be designated a “NO PARKING” area.

The tanker, when in position for discharging to the installation, shall be in the open and not be in a walled enclosure from which the escape of liquid or cold vapour is restricted. Tankers shall have easy access to, and exit from, the installation at all times.