
**Road vehicles — Compressed gaseous
hydrogen (CGH₂) and hydrogen/
natural gas blends fuel systems —**

**Part 1:
Safety requirements**

*Véhicules routiers — Systèmes d'alimentation pour hydrogène gazeux
comprimé (CGH₂) et mélanges d'hydrogène et de gaz naturel —*

Partie 1: Exigences de sécurité

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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 TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects for gaseous fuels*.

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.

A list of all the parts in the ISO 21266 series can be found on the ISO website.

Introduction

For the purposes of this document, all fuel system components in contact with natural gas have been considered suitable for compressed gaseous hydrogen (CGH₂), in accordance with ISO 14687-1 or ISO 14687-2, and hydrogen/natural gas blends using natural gas, in accordance with ISO 15403-1 and ISO/TR 15403-2.

When applying this document, it should be understood that a safety device to prevent overfilling the vehicle's fuel system is part of the fuelling station. The pressure gauge has not been considered as a safety component.

When necessary, technical solutions regarding functional requirements are given in this document, as in [Annex A](#).

This document refers to a service pressure of 20 MPa.

NOTE This document is based on a service pressure for compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends as fuels of 20 MPa settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, pressures to be multiplied by 1,25 for a 25 MPa service pressure system.

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Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel systems —

Part 1: Safety requirements

1 Scope

This document specifies the minimum safety requirements applicable for the functionality of compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends on-board fuel systems intended for use on the types of motor vehicles defined in ISO 3833.

It is applicable to vehicles using compressed gaseous hydrogen (CGH2), in accordance with ISO 14687-1 or ISO 14687-2, and hydrogen/natural gas blends using natural gas, in accordance with ISO 15403-1 and ISO/TR 15403-2. It is not applicable to the following:

- 1) liquefied hydrogen (LH2) fuel system components;
- 2) fuel containers;
- 3) stationary gas engines;
- 4) container mounting hardware;
- 5) electronic fuel management;
- 6) refuelling receptacles; and
- 7) fuel cell vehicles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this document and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this document are considered gauge pressures unless otherwise specified.

All matters relating to the skills of installers and converters have been excluded from this document.

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 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 12619 (all parts), *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components*

ISO 16380, *Road vehicles — Blended fuels refuelling connector*

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

ISO 21266-2, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blend fuel system components — Part 2: test methods*

ISO 20653, *Road vehicles — Degrees of protection (IP code) — Protection of electrical equipment against foreign objects, water and access*

ISO 14687-1, *Hydrogen fuel — Product specification — Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles*

ISO 14687-2, *Hydrogen fuel — Product specification — Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles*

ISO 19881¹⁾, *Gaseous hydrogen — Land vehicle fuel containers*

IEC 60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12619-1 and the following 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 General terms

3.1.1 service pressure

settled pressure of 20 MPa at a uniform gas temperature of 15 °C

3.1.2 compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends on-board fuel system

compressed natural gas fuel system comprising cylinder, or cylinders according to ISO 19881 or ISO/TS 15869 as applicable, mounting, one or more refuelling receptacles according to ISO 16380 or ISO 17268 as applicable, and the components described in ISO 12619-3 and following parts

3.1.3 main shut-off valve

automatic valve designed to isolate a high-pressure source

3.1.4 bi-fuel HNGV

vehicle that has two independent fuel systems (one of them for compressed gaseous hydrogen and hydrogen/natural gas blend) and can run alternatively on either fuel, but only on one at a time

Note 1 to entry: The term Bi-fuel also applies to vehicles that run on both fuels simultaneously in limited amount or duration.

3.2 Vehicle mass

3.2.1 kerb mass

complete shipping mass of a vehicle fitted with all equipment necessary for normal operation plus the mass of the following elements for M1, N1 and M2 having a maximum authorized mass not exceeding 3 500 kg:

- lubricants, coolant (if needed), washer fluid;
- fuel (tank filled to at least 90 % of the capacity specified by the manufacturer);

1) Under preparation. Stage at the time of publication: ISO/FDIS 19881.

- other equipment if included as basic parts for the vehicle, such as spare wheel(s), wheel chocks, fire extinguisher(s), spare parts and tool kit

Note 1 to entry: The definition of kerb mass may vary from country to country, but in this document it refers to the definition contained in ISO 1176.

3.2.2

maximum authorized mass

kerb mass plus the maximum allowable payload

3.3 Vehicle categories

3.3.1

category M

power-driven vehicles having at least four wheels and used for the carriage of passengers

3.3.1.1

category M1

vehicles used for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat

3.3.1.2

category M2

vehicles used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat and having a maximum authorized mass not exceeding 5 000 kg

3.3.1.3

category M3

vehicles used for the carriage of passengers and comprising more than eight seats in addition to the driver's seat and having a maximum authorized mass exceeding 5 000 kg

3.4.2

category N

power-driven vehicles having at least four wheels and used for the carriage of goods

3.4.2.1

category N1

vehicles used for the carriage of goods and having a maximum authorized mass not exceeding 3 500 kg

3.4.2.2

category N2

vehicles used for the carriage of goods and having a maximum authorized mass exceeding 3 500 kg but not exceeding 12 000 kg

3.4.2.3

category N3

vehicles used for the carriage of goods and having a maximum authorized mass exceeding 12 000 kg

3.5

electronic control unit

device which controls the compressed gaseous hydrogen (CGH₂) or hydrogen/natural gas blends demand of the engine and establishes the cut-off of the automatic valve in case of a broken fuel supply pipe or in case of stalling of the engine, or during a crash

4 Requirements

4.1 Design

4.1.1 General

The compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends on-board fuel system components shall comply with ISO 19881²⁾ ISO/TS 15869, ISO 16380, ISO 17268 and ISO 12619, as applicable.

For bi-fuel HNGV, provision shall be made to avoid accelerated deterioration of the non-compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends fuel system as a result of sustained operation on compressed gaseous hydrogen and hydrogen/natural gas blends. Such measures shall be as recommended by the original vehicle manufacturer (e.g. fuel hoses).

All fuel system components shall fulfil the following conditions.

- a) They shall withstand the environmental temperatures and other environmental conditions safely during their operational life.
- b) They shall be located with full regard for anticipated damage while the vehicle is being used safely. Such damage can be caused by the vehicle itself, by extraneous factors such as heat, road debris, automotive fluids (brake liquid, oil, petrol, cooling liquid, etc.), or by rust, etc.
- c) They shall be fitted so that they are not the outermost, highest or lowest parts of the vehicles; otherwise they shall be protected.
- d) They shall be fitted so as not to affect ground clearance, approach angle, ramp (break-over) angle or departure angles as defined by the vehicle manufacturer.
- e) They shall be located so that they do not suffer corrosion damage by accumulation of water or cargo chemicals.
- f) They shall assure the proper electrical conductivity throughout the fuel system in order to avoid the electrostatic charges. This provision does not apply to gas-tight housing and ventilation hoses.
- g) All connections shall be made in locations where access is possible for inspection.

The compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends system shall be installed in such a way that it has suitable protection against damage, such as damage due to moving vehicle components, collision, grit or due to the loading or unloading of the vehicle or the shifting of those loads.

The compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends system shall include automatic valves designed to close when the engine is not running on compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends, and shall be able to be manually opened or closed in case of failure of the automatism (see [Annex B](#)).

The compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends on-board fuel system shall include:

- an automatic valve installed directly on every compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends cylinder, with a manual valve rigidly fixed to the compressed gaseous hydrogen (CGH₂) and hydrogen/natural gas blends cylinder, which may be integrated into the automatic valve. The manual valve shall be able to isolate the cylinder content from the automatic valve;
- a PRD installed on each cylinder, functionally independent from any other component;

2) Under preparation. Stage at the time of publication: ISO/FDIS 19881.