INTERNATIONAL STANDARD

ISO 21266-2

First edition
2018-10

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

Part 2: Test methods

Véhicules routiers — Systèmes d'alimentation pour hydrogène gazeux comprimé (CGH2) et mélanges d'hydrogène et de gaz naturel — Partie 2: Méthodes d'essai

Reference number
ISO 21266-2:2018(E)

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

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.

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 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.

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

Part 2: Test methods

1 Scope

This document specifies the test methods for checking the minimum safety requirements specified in ISO 21266-1. It is applicable to the functionality of the fuel systems designed to operate on compressed gaseous hydrogen and hydrogen/natural gas blends of motor vehicles as defined in ISO 3833.

For tests of individual components, refer to the parts of ISO 12619, ISO 16380, ISO 17268, ISO 19881[1)] and ISO/TS 15869 as applicable

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 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

ISO 12619-1, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components*

ISO 21266-1:2018, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel systems — Part 1: Safety requirements*

3 Terms and definition

For the purposes of this document, the terms and definitions given in ISO 12619-1, ISO 21266-1 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
notified body
government-appointed body mandated to approve or disapprove

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

4 Test methods

4.1 Cylinder mounting strength tests

4.1.1 General

When a vehicle is equipped with several cylinders, they should preferably be tested as a unit.

When groups of cylinders are installed on a vehicle such that they are separately anchored to the original structure of the vehicle, then each separate group of cylinders may be tested individually.

When performing these tests, accessories and piping shall not contribute to reinforcing the cylinder mounting.

The requirements of ISO 21266-1:2018, 4.4.3, shall be verified by the test specified in 4.1.2, 4.1.3, 4.1.4 or 4.1.5 of this document.

4.1.2 Inertia test

The cylinder or cylinders to be tested shall be mounted on the vehicle body or a part of the vehicle body, according to the specifications of the original equipment manufacturer (OEM) or after-market converter.

The vehicle body or part of the vehicle body shall be firmly anchored to the test trolley. The method used for anchoring the vehicle body to the test trolley shall not result in reinforcement of the cylinder anchorages or the part of the vehicle structure participating in anchoring the cylinder or cylinders. Testing performed with a trolley shall geometrically match original vehicle conditions.

The test shall be carried out using the following procedure.

a) Fill the cylinder or cylinders with a mass corresponding to at least 90 % of the mass of compressed gaseous hydrogen and hydrogen/natural gas blends capacity at service pressure. The gas density for these conditions shall be considered to be equal to 0,2 kg/l.

b) Measure the trolley deceleration with data channels of channel frequency class (CFC) 60 corresponding to the characteristics given in ISO 6487.

c) Maintain the value of the deceleration as defined in ISO 21266-1, for the vehicle category, for at least 30 ms.

4.1.3 Static test

This test may be carried out on a vehicle body or on a part of a vehicle body.

The cylinder or cylinders to be tested shall be mounted on the vehicle body or on part of the vehicle body, according to OEM or after-market converter specifications.

The method used for anchoring the vehicle body or the part of the vehicle body in this test shall not:

— submit the anchorages and anchorage area (300 mm diameter circle) to abnormal stresses and/or deformation;

— result in reinforcement of the cylinder or cylinders or cylinder anchorages, or the part of the vehicle structure participating in anchoring the cylinder or cylinders.

The traction force is defined by the following formula:

$$F = (M_c + 0{,}9\,\rho V)\,a$$

where

F is the traction force, in newtons;

M_c is the mass of empty cylinder(s), in kilograms;

a is the acceleration as defined in ISO 21266-1:2018, 4.4.3;

V is the volume of the cylinder(s) in litres;

ρ is the density of CNG at 20 MPa 0,2 kg/l.

The test shall be carried out using the following procedure.

a) Apply the traction force to the cylinder or cylinders' centre of gravity in the specified directions within 0,2 s.

b) Hold the specified traction force for at least 0,2 s.

c) Release the traction force.

4.1.4 Alternative method

If a vehicle crash test is performed according to international or equivalent regulations, the requirements of ISO 21266-1, are considered to have been met.

A calculation method can be used instead of practical testing if its equivalence can be demonstrated by the applicant for approval.

4.1.5 Acceptance criteria

4.1.5.1 By testing

At the conclusion of either of these tests, the cylinder or cylinders shall:

— remain attached to the vehicle body or part of the vehicle body; and

— not interfere with the seat structure.

4.1.5.2 By calculation

Appropriate calculations shall be carried out, depending on the individual technical parameters. The method of calculation shall be approved by an authority having jurisdiction.

4.1.5.3 By engineering experience (steel cylinders)

For details of a practical means of compliance for steel cylinders (type 1 in accordance with ISO 19881[2]), determined as a result of calculations and substantiated by experience over time (see Annex A).

4.2 Leak test

This test may be conducted at ambient temperature. It shall be performed on each vehicle after installation.

a) Fill the vehicle fuelling system upstream of the first-stage regulator with an appropriate gas at 1 MPa ± 0,1 MPa.

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

b) Check all connections with a gas detector, foam-producing liquid or any other equivalent method. No bubbles shall be detected during three minutes or the leak rate for each connection shall be less than 20 cm^3 (normal)/h.

Perform this test again with the system upstream of the first regulator at service pressure ±1 MPa.

If the cylinder and its valve have already been leak tested, the leak test shall be performed with the cylinder valve closed.

Stop the test if any leakage occurs during the filling from 1 MPa to service pressure. Where a leak is detected, it shall be rectified by first relieving any pressure, then resealing. The system shall then be re-tested.

4.3 Functional test

4.3.1 Main shut-off valve test

The purpose of this test is to ensure that the main shut-off valve is in the closed position when:

— the ignition key is off;

— the engine stalls;

— cranking on fuel other than compressed gaseous hydrogen and hydrogen/natural gas blends; or

— the engine is not running on compressed gaseous hydrogen and hydrogen/natural gas blends.

Any appropriate method may be used to ensure test results.

4.3.2 Receptacle clearance test

Ensure that free space around the receptacle conforms to ISO 21266-1.

4.4 Receptacle mounting tests

This test can be performed at ambient temperature either on a vehicle, or as a bench test using a compressed gaseous hydrogen and hydrogen/natural gas blends fuel system equivalent in geometry and anchoring to the vehicle. In either case, connect the nozzle to the receptacle and pressurize the compressed gaseous hydrogen and hydrogen/natural gas blends fuel system to service pressure.

The gas tightness of the compressed gaseous hydrogen and hydrogen/natural gas blends fuel system shall not be affected after:

a) a 670 N pull is applied along the longitudinal axis of the receptacle; and

b) a moment of 200 N · m is applied in a worst-case manner.

Following the above test, the gas tightness of compressed gaseous hydrogen and hydrogen/natural gas blends fuelling system shall be checked with an appropriate leak testing method.

Annex A
(informative)

Engineering experience for the mounting of steel cylinders

A.1 Single cylinder

a) There should be at least four points of attachment to the vehicle structure, the distance between which should be sufficient to ensure the stability of the cylinder.

b) Where the cylinder is anchored to sheet metal, the sheet metal should be reinforced at each attachment point with metal plates of areas of no less than 3 600 mm^2 and a thickness of no less than 2,5 mm. Any such reinforcement plates should be contoured to the shape of the sheet metal or chassis rail. It is preferred that a round washer be used but, where a square plate is fitted, should be provided a radius of at least 0,5 mm and the bolt hole should be positioned in the centre of the plate/washer. Where the bolt hole is not central in the plate, the nearest edge should be bent to form an L-section for stiffening. Flat areas, even if ribbed, can be unsuitable for mountings without substantial reinforcement, because of flexing and fatigue. Anchoring should be to structural members where possible.

c) The mounting method should not significantly weaken the vehicle structure.

d) Where anchorage bolts pass through a hollow section, a spacer tube should be provided to prevent collapse of that section under load.

e) All fasteners should have a diameter of no less than that shown in Table A.1 and should comply with property class 8.8 in accordance with ISO 898-1.

f) Where clamping bands are used, at least two steel bands should be provided, the dimensions of which should be no less than those shown in Table A.1. However, in the case of multiple cylinders mounted together, Table A.1 does not apply.

g) Where parts are joined (e.g. by welding a stud to a band), the strength of the joint should be not less than the strength of either component.

h) Where the attachment is by means of clamping bands, there should be a positive means of resisting longitudinal end loads on the cylinder due to the vehicle impact. The friction grip of the clamping bands is not normally an acceptable means of endwise retention unless the clamping bands can be demonstrated to meet the requirement of ISO 21266-1. An acceptable form of retention is to secure a 200 mm length of 50 × 50 structural steel angle to the vehicle at each end of the cylinder. Each length of steel angle should be at right angles to the longitudinal axis of the cylinder with one leg vertical and fitted so as to provide a gap of 7 mm ± 3 mm to the end of the cylinder. The other leg of each angle should be secured to the vehicle by at least two 10 mm diameter bolts. Where suitable, body or structural members of the vehicle construction are available and these components are capable of withstanding the required loading, they may be used, provided the 7 mm ± 3 mm gap is maintained.

A.2 Multiple cylinders

For installations with more than one cylinder, a specific design may be required for the mounting attachment.