DRAFT AMENDMENT

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Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blend fuel system components —

Part 2:
Performance and general test methods

AMENDMENT 1

Véhicules routiers — Composants des circuits d'alimentation pour hydrogène gazeux comprimé (CGH2) et mélanges de gaz naturel et hydrogène —

Partie 2: Performance méthodes d'essai en général

AMENDEMENT 1

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

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.

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 12619-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Vehicles using gaseous fuels*.

ISO 12619 consists of the following parts, under the general title *Road vehicles — Compressed Gaseous Hydrogen (CGH2) and Hydrogen/Natural Gas blends fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Pressure regulator*

Road vehicles — Compressed Gaseous Hydrogen (CGH2) and Hydrogen/Natural Gas blends fuel system components — Part 2: Perfromance and general test methods

1 Scope

This Standard specifies performance and general test methods for Compressed Gaseous Hydrogen (CGH2) and Hydrogen/Natural Gas blends fuel system components, 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/TS 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:

a) liquefied hydrogen (LH2) fuel system components;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

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

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

NOTE 3 This Standard may not apply to fuel cell vehicles in compliance with international Regulations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative referenced document (including any amendments) applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

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

ISO/TS 14687-2, Hydrogen Fuel — Product Specification — Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles.

ISO 12619-1: —[1)] , *Road vehicles* - Compressed Gaseous Hydrogen (CGH2) and Hydrogen/Natural Gas blends *fuel system components - Part 1: General requirements and definitions*

ISO 12619-3: —[2)] , *Road vehicles* - Compressed Gaseous Hydrogen (CGH2) and Hydrogen/Natural Gas blends *fuel system components – Part 3: Pressure regulator*

ISO 11114-2: Transportable gas cylinders – Compatibility of cylinders and valve material with gas contents – Part-2 – Non-metallic materials

ISO 11114-4: Transportable gas cylinders – Compatibility of cylinders and valve material with gas contents – Part-4 – Tests methods for selecting metallic materials resistant to hydrogen embritlement

ISO 15500-2 : Road vehicles — Compressed Natural Gas (CNG) fuel system components – Part 2: Performance and general test methods

ISO 1431-1: Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static and dynamic strain testing

ISO 15403-1, Natural gas — Natural gas for use as a compressed fuel for vehicles — Part 1: Designation of the quality

ISO/TR 15403-2, Natural gas — Natural gas for use as a compressed fuel for vehicles — Part 2: Specification of the quality

ASTM G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

ASTM D4814 -11b, Standard Specification for Automotive Spark-Ignition Engine Fuel

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in ISO 12619-1 apply.

4 General

4.1 Unless otherwise stated, the tests shall be conducted at room temperature: i.e. 20 °C ± 5 °C.

4.2 Components shall comply with the tests specified in ISO 12619-3 and subsequent parts, as well as the applicable tests specified in this Standard. Because of the peculiarities of some components, the list of tests given in this Standard (clauses 5 to 17) is not exhaustive. Where additional tests are required, their provisions are given in another relevant part.

4.3 Unless otherwise specified, all tests shall be conducted using dry hydrogen, helium or blends of nitrogen with a minimum 5% of hydrogen. Test shall be performed by qualified personnel and appropriate safety measures shall be taken. The dew point of the test gas at the test pressure shall

1) To be published

2) To be published

be at the temperature at which there is no icing, or hydrate or liquid formation. The dew point of the test gas at the test pressure shall be at the temperature at which there is no icing, or hydrate or liquid formation.

4.4 It is recognized that new technology may not be covered in ISO 12619-3 or subsequent parts of ISO 12619.

4.5 Hydrogen used for testing shall comply with either ISO 14687-1, *Hydrogen fuel - Product specification - Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles or ISO/TS 14687-2, Hydrogen Fuel — Product Specification — Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles.*

5 Hydrostatic strength

A component shall not show any visible evidence of rupture when subjected to the following test procedure.

Plug the outlet opening of the component and have the valve seats or internal blocks assume the open position. Apply, with a test fluid, the hydrostatic pressure specified in the applicable part of ISO 12619 to the inlet of the component for a period of at least 3 min.

The hydrostatic pressure shall be increased at a rate of less than or equal to 1.4 MPa/sec until component failure. The hydrostatic pressure at failure shall be recorded. The failure pressure of components which have been subjected to previous durability and corrosion tests shall be no less than 80 per cent of the failure pressure of the virgin component.

The samples used in this test shall not be used for any other testing.

6 Leakage

6.1 General

6.1.1 Prior to conditioning, purge the component or device with nitrogen and then seal it at 30 % of working pressure using test gases as defined in 4.3. In case of components subjected to more than one working pressures, the test may be conducted in subsequent steps.

6.1.2 Conduct all tests while the device is continuously exposed to the specified test temperatures. The device passes the test if it shall have a leakage rate of less than 10 Ncm^3/h (normal referred to hydrogen) of hydrogen gas using the test method specified in 6.2, 6.3 and 6.4. If test gas other than pure hydrogen is used, the leak rate shall be converted to a 100 percent hydrogen gas leak rate equivalent.

6.2 External leakage

6.2.1 Plug each device outlet with the appropriate mating connection and apply the test pressure to the inlet

6.2.2 Apply test gases as defined in 4.3 to the test device.

6.2.3 At all test temperatures, immerse the components in a suitable test medium for at least 2 min or use a helium vacuum test (global accumulation method) or other equivalent method.

6.2.4 Measure the leak rate by an appropriate method and it should not be more than as specified in 6.1.2.

6.3 Internal leakage

6.3.1 The internal leakage test is applicable only to devices having a closed position. The aim of this test is to check the pressure tightness of the closed system.

6.3.2 Connect the inlet or outlet, as applicable, of the device, with the appropriate mating connection, while leaving the opposite connection or connections open.

6.3.3 Apply the test pressure to the inlet or outlet, as applicable, of the device using test gas.

6.3.4 At all applicable temperatures mentioned in clause 6.4, immerse the component in a suitable test medium for at least 2 min or other equivalent method.

6.3.5 Measure the leak rate at any applicable test pressure mentioned in clause 6.4, or otherwise specified in the other parts of the Standard, by an appropriate method and it should not be more than as specified in 6.1.2.

6.4 Test conditions

6.4.1 The device shall be pressurized at 100% of service pressure and then conditioned until temperature equilibrium is achieved at low temperature of - 40 °C or - 20 °C, as applicable, and maintained at that temperature for at least 30 minutes. Then the device shall be pressurized at 5% of service pressure and maintained at that temperature for at least 30 minutes.

6.4.2 The device shall be pressurized at 5% of service pressure and then conditioned until temperature equilibrium is achieved at the room temperature of 20 °C ±5 °C and maintained at that temperature for at least 30 minutes. Then the device shall be pressurized at 150% of service pressure and maintained at that temperature for at least 30 minutes.

6.4.3 The device shall be pressurized at 5% of service pressure and then conditioned until temperature equilibrium is achieved at high temperature of 85 °C or 120 °C, as applicable, and maintained at that temperature for at least 30 minutes. Then the device shall be pressurized at 150% of service pressure and maintained at that temperature for at least 30 minutes.

7 Excess torque resistance

A component designed to be connected directly to threaded fittings shall be capable of withstanding, without deformation, breakage or leakage, a torque effort of 150 % of the rated installation value, according to the following test procedure.

a) Test an unused component, applying the torque adjacent to the fitting.

b) For a component having a threaded connection or threaded connections, apply the turning effort for 15 min, release it, then remove the component and examine it for deformation and breakage.

c) Subject the component to the leakage test specified in clause 6.

d) Subject the component to the hydrostatic strength test specified in clause 5.

8 Bending moment

A component shall be capable of operation without cracking, breaking, or leaking when tested according to the following procedure.

a) Assemble the connections of the component, leak-tight, to an appropriate mating connection or connections, representative of design intent. After assembly, the length of the inlet tubing shall be greater than 300 mm (see Figure 1).

b) The outlet connection shall be rigidly supported, 25 mm from the component outlet, except in the following cases:

— if the component has an integral mounting means independent of the inlet and outlet connections, the component shall be mounted using the integral mounting means specified by the manufacturer;

— if the component is intended to be mounted by either the integral mounting means or the component outlet, the mounting means that produces the most severe test condition shall be used.

c) Check this assembly for leaks prior to subjecting it to d).

d) With the component in the closed position, pressurize the system to 0,25 times the working pressure and apply a force according to Table 1, 300 mm from the inlet, maintaining it for 15 min. Without removing the force, check the component for leakage, in accordance with the test method given in clause 6, at room temperature.

NOTE Depending on how this test is performed, increasing the load to compensate buoyancy could be necessary.

e) Conduct procedure d) four times, rotating the component 90° around the horizontal axis between each test. Between tests, open and close (if applicable) the component three times with the bending moment removed.

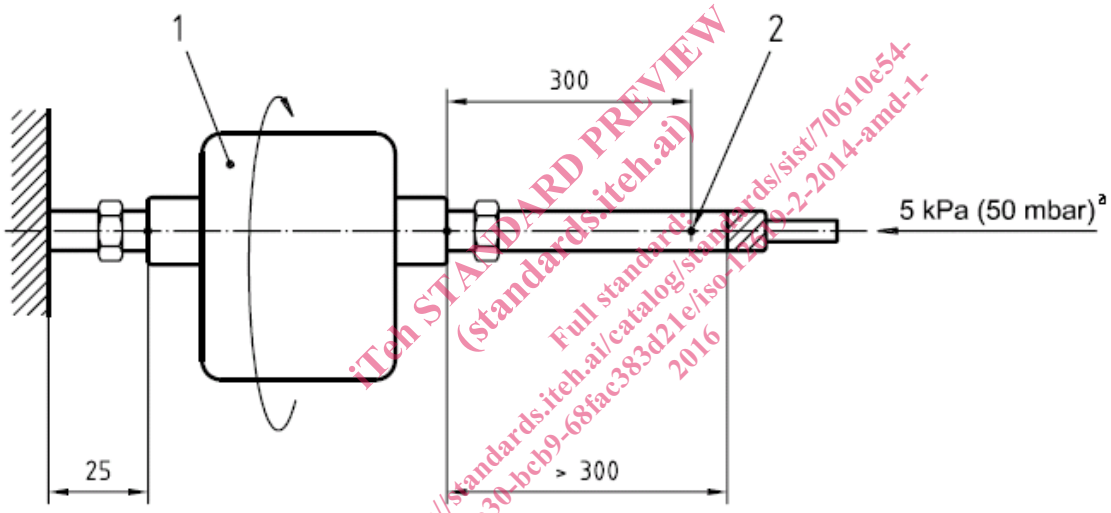
f) At the completion of the above tests, remove the component and examine it for deformation; then subject it to the leakage test according to clause 6 and to the hydrostatic test according to clause 5

Table 1 — Bending moment test force

Outside diameter of tubing mm	Force N
6	3,4
8	9,0
≥ 12	17,0

Figure 1 — Bending moment

Dimensions in millimetres



Key
1 Component
2 Force point
[a] 4 x 90° rotation.

9 Continued operations

9.1 General

For the details of test methods for particular components, see the other parts of ISO 12619. The method specified in this clause is general in nature and also applies to miscellaneous components.

Other components (those for which specific requirements are not specified) shall be subjected to the following continuous operation test for a total number of cycles to be determined by the testing agency. The determination of the total number of cycles shall be generally based on 15,000 fill cycles and/or 50,000 duty cycles.