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

Part 6: Automatic valve

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

Partie 6: Valve automatique

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects for gaseous fuels*.

A list of all the parts in the ISO 12619 series can be found on the ISO website.

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

Part 6: Automatic valve

1 Scope

This document specifies tests and requirements for the automatic valve, a compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system component 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:

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 document and tested according to the appropriate functional tests.

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

NOTE 3 This document may not apply to fuel cell vehicles in compliance with international regulations.

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 12619-1, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blend fuel system components — Part 1: General requirements and definitions*

ISO 12619-2, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blend fuel system components — Part 2: Performance and general test methods*

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

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:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
automatic valve
on/off valve for controlling flow of gas that is not manually operated

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the working pressure or working pressure and temperature range;

d) the type of fuel.

The following additional markings are recommended:

e) —H1‖, —H2‖ or —H3‖ depending on the test condition followed in 6.4.1;

f) the direction of flow (when necessary for correct installation);

g) electrical ratings (if applicable);

h) the symbol of the certification agency (if applicable);

i) the type approval number;

j) the serial number or date code;

k) reference to this document, i.e. ISO 12619-6.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The automatic valve shall comply with the applicable provisions of ISO 12619-1 and ISO 12619-2, and with the tests specified in Clause 6. All automatic valves, including solenoid valves, cylinder valves and valves with manual by-pass, shall comply with the tests specified in Clause 6.

An automatic valve shall be closed when de-energized.

An automatic valve with manual by-pass shall meet the minimum requirements of this document.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Applicable tests

Test	Applicable	Test procedure as required by ISO 12619-2	Specific test requirements of this document
Hydrostatic strength	X	—	X (see 6.2)
Leakage	X	—	X (see 6.3)
Excess torque resistance	X	X	—
Bending moment	X	X	—
Continued operation	X	—	X (see 6.4)
Corrosion resistance	X	X	—
Oxygen ageing	X	X	—
Ozone ageing	X	X	—
N-pentane	X	X	—
Heat aging	X	X	—
Electrical over-voltages	X	X	—
Material requirements	X	X	—
Non-metallic material immersion	X	X	—
Non-metallic material compatibility to hydrogen	X	X	—
Ultraviolet resistance of external surfaces	X	X	—
Automotive fluid exposure	X	X	—
Vibration resistance	X	X	—

6.2 Hydrostatic strength

Test the automatic valve according to the procedure for testing hydrostatic strength specified in ISO 12619-2. The test pressure shall be 2,5 times the working pressure.

6.3 Leakage

Test the automatic valve at the temperatures and pressures given in Table 2.

Table 2 — Test temperatures and pressures

Temperature °C	**Pressure** **Factor × working pressure** (WP)	
	First test	Second test
−40 or −20	0,75 × WP	0,025 × WP
20	0,025 × WP	1,5 × WP
85 or 120	0,05 × WP	

6.4 Continued operation

6.4.1 Test the automatic valve in accordance with the procedure for testing continued operation given in ISO 12619-2, for 50 000 cycles but lower the downstream pressure of the test fixture to less than 2 % of working pressure, or, if the automatic valve is closed during commanded stop phases, the valve shall

be submitted to the following numbers of operations during testing according to ISO 12619-2 but lower the downstream pressure of the test fixture to less than 2 % of working pressure:

a) 200 000 cycles (mark “H1”) if the engine shuts off automatically when the vehicle comes to a halt;

b) 500 000 cycles (mark “H2”) if, in addition to a), the engine also shuts off automatically when the vehicle drives with the electric motor only;

c) 1 000 000 cycles (mark “H3”) if, in addition to a), the engine also shuts off automatically when the accelerator pedal is released.

Notwithstanding the above-mentioned provisions, the valve complying with b) shall be deemed to satisfy a), and the valve complying with c) shall be deemed to satisfy a) and b).

Perform the leakage test in accordance with 6.3. The valve shall continue to operate according to the manufacturer’ specifications.

6.4.2 Following cycling and leakage testing, perform the hydrostatic strength test in accordance with 6.2.

6.5 Insulation resistance

The insulation resistance test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the automatic valve casing.

Apply DC 1 000 V between one of the connector pins and the housing of the automatic valve for at least 2 s. The minimum allowable resistance shall be 240 kΩ.

If the automatic valve is electrically operated and is to be used inside a gas-tight housing, it shall be intrinsically safe as defined in IEC 60079-10-1.

6.6 Minimum opening voltage

The minimum opening voltage at room temperature shall be ≤8 V for a 12 V system and ≤16 V for a 24 V system. The component shall be pressurized at minimum 0,75 times working pressure during the test.

6.7 Pressure impulse

The automatic valve that is exposed in service to cylinder pressure, shall withstand 100 pressure pulses, as follows.

a) If the automatic valve is external, connect both inlet and outlet to a pipe or tube of the type specified by the manufacturer and of at least 1 m in length each.

b) If the automatic valve is mounted to or inside the cylinder valve, the cylinder valve containing the automatic valve shall be connected securely by a suitable fitting to a pressurized source of dry air, nitrogen or natural gas. Connect the outlet to a pipe or tube of the type specified by the manufacturer and of at least 1 m in length each.

c) The outlet of the automatic valve shall be vented until the inlet is at atmospheric pressure, and then the outlet of the valve shall be closed.

d) Working pressure shall be instantaneously applied to the inlet.

e) Test the component in the same way with reverse flow direction.

Following the pressure impulse test, the automatic valve should operate according to the manufacturer’s specification.

This test was included in order to evaluate the performance of the components that may suffer from the effects of an instantaneous increase in pressure. In normal service, this may happen, for example, when filling gas in an empty system or when a solenoid valve opens the flow of gas to an empty fuel line.

Previous tests have revealed that certain designs cannot cope with these instantaneous pulses and the components tend to bend or jam.

Bibliography

[1] ISO 3833, *Road vehicles — Types — Terms and definitions*

[2] ISO 13686, *Natural gas — Quality designation*

[3] ISO 14687, *Hydrogen fuel — Product specification*

[4] ISO 11114-2, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*

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

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

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

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

[9] ISO/TS 15869, *Gaseous hydrogen and hydrogen blends — Land vehicle fuel tanks*

[10] ISO/TR 15916, *Basic considerations for the safety of hydrogen systems*

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