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

Part 7: Gas injector

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

Partie 7: Injecteur de gaz

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Foreword

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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 Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects for gaseous fuels*.

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

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

Part 7: Gas injector

1 Scope

This document specifies tests and requirements for the gas injector and/or fuel rail, 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;

g) 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 to be considered gauge pressures unless otherwise specified.

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 12619-2:2014, *Road vehicles — Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blend fuel system components — Part 2: Performance and general test methods*

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
duty cycle
percentage of time that the gas injector is operating in the *period* (3.2)

3.2
period
P
time elapsed between the beginning of one injection pulse and the beginning of the next injection pulse

Note 1 to entry: It is expressed in milliseconds.

3.3
fuel rail assembly
component consisting of gas injector(s) and fuel rail integrated into one component

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:

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

b) electrical ratings (if applicable);

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

d) the type approval number;

e) the serial number or date code;

f) a reference to this document, i.e. ISO 12619-7.

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

5.1 The gas injector shall be in the closed position when de-energized.

5.2 The gas injector shall comply with the applicable provisions of ISO 12619-1 and ISO 12619-2, and with the tests specified in Clause 6. Tolerances should follow the specifications of ISO 12619-2.

6 Tests

6.1 Applicability

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

Table 1 — Test applicable

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

6.2 Pneumatic strength

This test has two parts, with the procedures to be carried out in the sequence as given below.

a) Apply two times the working pressure to the inlet and outlet of the gas injector and/or fuel rail for a period of at least 3 min. On completion of this procedure, the gas injector and/or fuel rail shall remain gas-tight.

b) Increase the gas pressure from two times the working pressure up to a maximum of four times the working pressure until such time as the gas injector and/or fuel rail leaks or bursts.

On completion of this procedure, the gas injector and/or fuel rail shall not have burst before leaking.

NOTE If the gas injector fails in the closed position due to its construction, then it is considered to have passed both parts of this test.

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

6.3 Continued operation

6.3.1 Bench durability

Prior to this test, the gas injector or fuel rail assembly shall pass the leakage test in accordance with ISO 12619-2:2014, Clause 6 and the insulation resistance test given in 6.4.

Subject the gas injector or fuel rail assembly to 600 × 10^6 pulses at working pressure and room temperature. This procedure may be interrupted at 20 % intervals in order to check test criteria.

The minimum frequency for the pulses shall be 50 Hz.

Upon completion of this test, the gas injector or fuel rail assembly shall pass the leakage test in accordance with ISO 12619-2:2014, Clause 6 and the insulation resistance test given in 6.4.

6.3.2 Temperature

6.3.2.1 Hot static

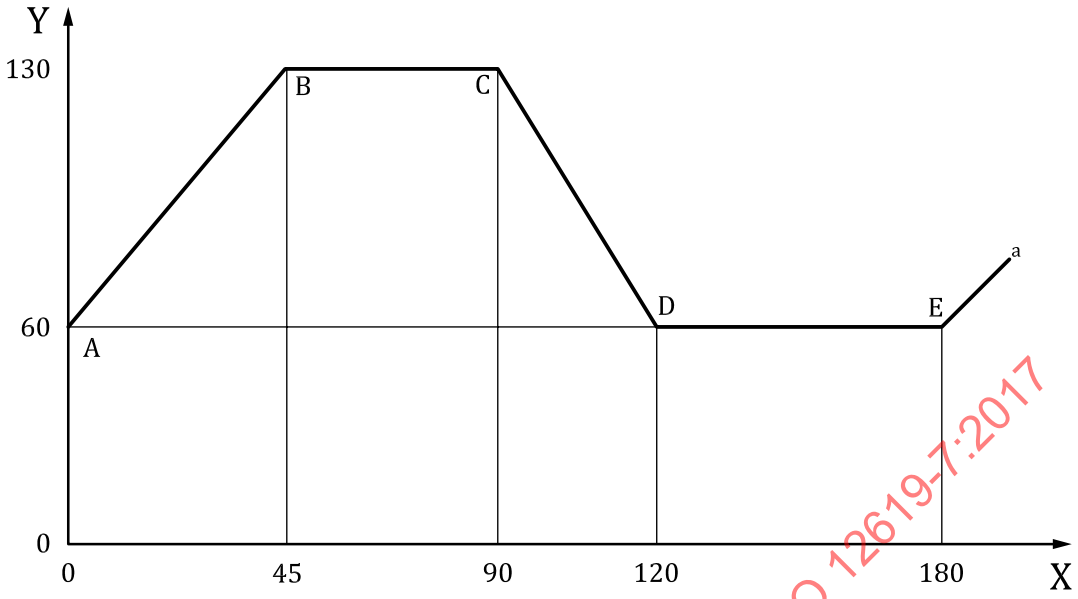
Connect the injector or fuel rail assembly to an appropriate source of pressurized test gas at its working pressure, then expose the pressurized gas injector or fuel rail assembly to an environment with a stabilized temperature of 140 °C ± 2 °C for 16 h. The gas injector or fuel rail assembly shall not be operated during this test.

6.3.2.2 Cold static

Connect the injector or fuel rail assembly to an appropriate source of pressurized test gas at its working pressure, then expose the pressurized gas injector or fuel rail assembly to an environment with a stabilized temperature of –40 °C ± 2 °C or –20 °C ± 2 °C, as applicable, for 16 h. The gas injector shall not be operated during this test.

6.3.2.3 Thermocycle

Connect the injector or fuel rail assembly to an appropriate source of pressurized test gas at its working pressure, then expose the pressurized gas injector or fuel rail assembly to the thermocycle in accordance with Figure 1 for a total of 140 cycles. The gas injector or fuel rail assembly shall be operated only during segment D to E as shown in Figure 1 with a 50 % duty cycle and a period of 10 ms.



Key

X time, min

Y temperature, °C

[a] Repeat cycle.

NOTE Specified temperatures have a tolerance of ±2 °C.

Figure 1 — Thermocycle

6.3.2.4 Requirements

Upon completion of the procedures given in 6.3.2.1, 6.3.2.2 and 6.3.2.3, the test samples shall pass the leakage test in accordance with ISO 12619-2:2014, Clause 6 and the insulation resistance test given in 6.4.

6.4 Insulation resistance

This test is designed for checking the insulation resistance between the connector pin and the housing.

Apply a test voltage of 500 V d.c. for a duration of 60 s; for injectors with circuitry of 3,8 mm pitch or below, 100 V d.c. shall be used.

The minimum allowable resistance shall be >10 MΩ.