INTERNATIONAL STANDARD

ISO 12619-3

First edition
2014-06-15

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

Part 3: Pressure regulator

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

Partie 3: Regulateur de pression

Reference number
ISO 12619-3:2014(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Marking and labelling **2**
5 Qualifications for construction and assembly **2**
6 Tests **3**
6.1 Applicability 3
6.2 Hydrostatic strength 4
6.3 External leakage 4
6.4 Continued operation 4
6.5 Insulation resistance 5
6.6 Pressure impulse 5
6.7 Water jacket freezing 5
Bibliography **6**

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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is 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 blend fuel system components —

Part 3: Pressure regulator

1 Scope

This part of ISO 12619 specifies tests and requirements for the pressure regulator, 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.

This part of ISO 12619 is applicable to vehicles using 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:

— liquefied hydrogen (LH2) fuel system components;

— fuel containers;

— stationary gas engines;

— container mounting hardware;

— electronic fuel management;

— refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 12619 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 12619 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 12619 may not apply to fuel cell vehicles in compliance with international regulations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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*

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 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*

3 Terms and definitions

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

3.1
lock-up pressure
stabilized outlet pressure of the regulator at 0 (zero) flow

4 Marking and labelling

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 maximum outlet pressure;

e) the type of fuel.

The following additional markings are recommended:

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

— electrical ratings (if applicable);

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

— the type approval number;

— the serial number or date code;

— reference to this part of ISO 12619, i.e. ISO 12619-3:2014.

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 Qualifications for construction and assembly

5.1 The pressure regulator shall comply with the applicable provisions of ISO 12619-1 and ISO 12619-2, and with the tests specified in Clause 6 of this part of ISO 12619.

5.2 A pressure relief valve shall be of a type that resets after relieving; it is intended that downstream components are protected from exposure to cylinder pressure.

5.3 A pressure relief valve may be integral to the pressure regulator, or not.

5.4 The pressure regulator shall have a factory-set maximum outlet pressure. The maximum outlet pressure rating and the inlet pressure rating shall be marked on the regulator.

5.5 A mean shall be provided to allow venting from the safety relief valve of the regulator to the outside of the vehicle.

5.6 All non-metallic components or subcomponents in contact with compressed gaseous hydrogen (CGH2) or hydrogen/natural gas blends shall be used according to ISO 11114-2.

6 Tests

6.1 Applicability

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

Table 1 — Required tests

Test	Applicable	Test procedure as required in ISO 12619-2	Specific test required in this part of ISO 12619
Hydrostatic strength	X	X	§ 6.2
Leakage	X (External)	X	§ 6.3
Excess torque resistance	X	X	—
Bending moment	X	X	—
Continued operation	X	X	§ 6.4
Corrosion resistance	X	X	—
Oxygen ageing	X	X	—
Ozone ageing	X	X	—
Electrical over-voltages	X	X	—
Non-metallic immersion	X	X	—
Metallic material compatibility to hydrogen	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	—
Brass material compatibility	X	X	—
Non-metallic material compatibility to hydrogen	X	X	—
Insulation resistance	X	—	§ 6.5
Pressure impulse	X	—	§ 6.6
Water jacket freezing	X*	—	§ 6.7
Pre-Cooled Hydrogen Exposure Test	—	—	—
Insulation Resistance	X**	X	—
*Only if the water jacket is present.			
**Only if electronic components are present.			

6.2 Hydrostatic strength

6.2.1 Test the pressure regulator according to the procedure for testing hydrostatic strength specified in ISO 12619-2.

6.2.2 Test the inlet of the first stage at a pressure of two times the working pressure.

6.2.3 The chambers downstream of the inlet valve to the pressure regulator shall be tested according to the following procedure.

With the inlet to the chamber in an open position and all the outlets plugged, test the chamber at two times the working pressure of the chamber. If the chamber has a pressure relief valve, the chamber shall be tested at two times the relief valve's set pressure. If there is no relief valve, test the chamber to upstream working pressure.

6.2.4 Test the outlet chamber, port and all outlet fittings at two times the working pressure, or 0,4 MPa (4 bar), whichever is the greater.

6.3 External leakage

Test the pressure regulator at the temperatures and pressures given in Table 2.

Table 2 — Test temperatures and pressures

Temperature °C	Stage	Test pressure (Factor x working pressure)	
		First test	Second test
−40 or −20	Inlet to 1	0,80	0,05
+20	Inlet to 1	0,05	1,5
+120 or +85*	Inlet to 1	0,05	
−40 or −20	Chambers downstream of inlet to 1	0,80	0,05
+20		0,05	1,5
+120 or +85*		0,05	

* According to ISO 12619-1, 4.3.

6.4 Continued operation

The regulator shall be able to withstand 50 000 cycles without any failure when tested according to the following procedure. Where the stages of pressure regulation are separate, the working pressure in a) to f) is considered to be the working pressure of the upstream stage.

a) Recycle the regulator for 95 % of the total number of cycles at room temperature and at the service pressure. Each cycle shall consist of flow until stable outlet pressure has been obtained, after which the gas flow shall be shut off by a downstream valve within 1 s, until the downstream lock-up pressure has stabilized. Stabilized outlet pressures are defined as set pressure ± 15 % for at least 5 s. The regulator shall comply with 6.3 at room temperature at intervals of 20 %, 40 %, 60 %, 80 % and 100 % of room temperature cycles.

b) Cycle the inlet pressure of the regulator for 1 % of the total number of cycles at room temperature from 100 % to 50 % of the service pressure. The duration of each cycle shall be no less than 10 s. The regulator shall comply with 6.3 at room temperature at the completion of this test.

c) Repeat the cycling procedure of a) at the maximum temperature in accordingly to 4.3 of ISO 12619-1 at the service pressure for 1 % of the total number of cycles.

d) Repeat the cycling procedure of b) at the maximum temperature in accordingly to 4.3 of ISO 12619-1 at the service pressure for 1 % of the total number of cycles. The regulator shall comply with 6.3 at the maximum temperature according to 4.3 of ISO 12619-1 at the completion of this test.

e) Repeat the cycling procedure of a) at –40 °C or –20 °C, as applicable, and 50 % of service pressure for 1 % of the total number of cycles.

f) Repeat the cycling procedure of b) at –40 °C or –20 °C, as applicable, and 50 % of service pressure for 1 % of the total number of cycles. The regulator shall comply with 6.3 at –40 °C at the completion of this test.

At the completion of the cycles, the lock-up pressure downstream of the regulator shall not exceed the lock-up pressure specified by the manufacturer.

6.5 Insulation resistance

This test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the pressure regulator casing.

Apply 1 000 V d.c. between one of the connector pins and the housing of the pressure regulator for at least 2 s. The minimum allowable resistance shall be 240 kΩ.

6.6 Pressure impulse

6.6.1 Internal impulse

a) Subject the pressure regulator with its first stage valve rendered fully open to a sudden application of its working pressure at its inlet. The pressure regulator shall retain or release the pressure without any permanent deformation.

b) The lock-up pressure downstream of the regulator shall not exceed the lock-up pressure specified by the manufacturer.

6.6.2 External impulse

The pressure regulator shall withstand 100 inlet pressure pulses, as follows.

a) If the regulator has an integrated solenoid valve, it shall be opened by application of the rated voltage.

b) The outlet of the regulator shall be vented until the inlet chamber is at atmospheric pressure and then closed.

c) Working pressure shall be instantaneously applied to the regulator inlet.

The pressure regulator shall contain or vent the pressure without any permanent deformation. The pressure regulator shall meet the requirements of the external leakage in accordance with 6.3, and the lock up pressure shall not exceed the manufacturer's rated lockup pressure.

6.7 Water jacket freezing

a) Attach 1 m sections of coolant hose to the coolant inlet and outlet of the regulator or water jacket. Fill the regulator or water jacket, which normally contains an antifreeze solution, with water to normal capacity and expose it at –40 °C or –20 °C, as applicable, for 24 h.

b) Following the freezing conditioning, and after exposing the assembly to 20 °C ± 5 °C for 24 h, conduct an external leakage test at room temperature according to 6.3.

A separate sample may be used for this test.