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

Part 10:
Pressure relief device (PRD)

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

Partie 10: Dispositif de surpression

Reference number
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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).

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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 10: Pressure relief device (PRD)

1 Scope

This document specifies tests and requirements for the pressure relief device (PRD), a compressed gaseous hydrogen (CGH_2) and hydrogen/natural gas blend fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

It is applicable to vehicles using CGH_2 in accordance with ISO 14687-1 or ISO 14687-2 and hydrogen/natural gas blend using natural gas in accordance with ISO 15403-1 and ISO/TR 15403-2. It is not applicable to the following:

a) liquefied hydrogen (LH_2) 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 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 (CGH_2) and hydrogen/natural gas blend fuel system components — Part 1: General requirements and definitions*

ISO 12619-2, *Road vehicles — Compressed gaseous hydrogen (CGH_2) 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
activation pressure
rupture pressure, as specified by the pressure relief device (PRD) manufacturer, at which a PRD is designed to activate to permit the discharge of the cylinder

3.2
activation temperature
temperature, as specified by the pressure relief device (PRD) manufacturer, at which a PRD is designed to activate to permit the discharge of the cylinder

3.3
fusible material
metal, alloy, or other material capable of being melted where the melting is integral to the function of the pressure relief device (PRD)

3.4
parallel-combination relief device
pressure relief device (PRD) activated by high temperature or pressure acting separately

Note 1 to entry: This device may be integrated into one device that has independent pressure-activated and thermally activated parts. It may also be formed by two independent devices (one pressure-activated and one thermally activated) that act independently. Each part of the device shall not interfere with the operation/activation of the other part. The device shall be able to vent the content of the cylinder through any one of the parts of the PRD independently. The device shall be able to vent the content of the cylinder if the pressure- and thermally activated parts open simultaneously.

3.5
pressure-activated relief device
pressure relief device (PRD) activated by pressure

3.6
burst disc
rupture disc
operating part of a pressure-activated pressure relief device (PRD) which, when installed in the device, is designed to burst at a predetermined pressure to permit discharge of the cylinder

3.7
thermally activated relief device
pressure relief device (PRD) activated by high temperature

3.8
yield temperature
temperature at which the *fusible material* (3.3) becomes sufficiently soft to activate the device and to permit discharge of the cylinder

4 Marking

If the PRD is a stand-alone component, marking shall provide sufficient information to allow the following to be traced:

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

b) the fusible material yield temperature or PRD activation temperature in accordance with Annex A and the rupture disc pressure rating or activation pressure, as appropriate;

c) the type of relief device (thermally activated, parallel-combination, etc.).

If there is a possibility that the PRD could be installed with the flow in the wrong direction, the PRD shall be marked with an arrow to show the direction of flow.

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 PRD 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.

The PRD may be integrated with other components. The other components shall not interfere with the operation/activation of the PRD.

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[a]	—	X (see 6.4)
Continued operation	X	—	X (see 6.5)
Corrosion resistance	X	X	—
Oxygen ageing	X	X	—
Ozone ageing	X	X	—
Heat ageing	X	X	—
Automotive fluids	X	X	—
Non-metallic material immersion	X	X	—
Vibration resistance	X	X	—
Brass material compatibility	X	X	—
Accelerated life	X	—	X (see 6.6)
Benchtop activation	X	—	X (see 6.7)
Thermal cycling	X	—	X (see 6.8)
Condensate-corrosion resistance	X	—	X (see 6.9)
Flow capacity	X	—	X (see 6.10)
Impact due to drop and vibration	X	—	X (see 6.11)

[a] This test is to confirm proper design and construction of stand-alone, externally threaded PRD designs and is not required if the PRD is internally imbedded in the valve body.

6.2 Hydrostatic strength

6.2.1 Housing

6.2.1.1 General

The manufacturer shall either physically test the housing or prove its strength by calculation.

6.2.1.2 Test procedure

6.2.1.2.1 Inlet passage strength

One piece shall be tested with pressure applied to the inlet with the internal releasing components in the normally closed position. Pressure-activated elements such as burst discs may be modified, replaced with a plug or removed for the purpose of this test. The test shall be performed according to the procedure given in ISO 12619-2 using a pressure of 2,5 times the working pressure at (20 ± 5) °C.

6.2.1.2.2 Outlet passage strength

The outlets or venting orifices shall be plugged in a suitable way, without affecting the housing resistance. The internal triggering components such as fusible material or rupture discs shall be removed or otherwise opened or activated. Pressure shall be applied to the inlet of the device. The test shall be performed according to the procedure given in ISO 12619-2 using a pressure of 1,25 times the working pressure or the working pressure upstream of the outlet passage, whichever is greatest.

6.2.2 Fusible material

6.2.2.1 Test procedure

Test the fusible material in the PRD (thermally activated or combination) with water at (20 ± 5) °C using the following procedure.

a) Subject three randomly selected test specimens to a constant pressure of 1,2 times the working pressure for 30 min. For parallel-combination relief devices, only the thermally activated part of the device shall be tested.

   During the test, the fusible material shall not begin to extrude out of the PRD.

b) Increase the pressure at a rate of 0,5 MPa/s to 60 MPa or to the pressure at which the fusible material starts to extrude.

6.2.2.2 Requirement

If the extrusion of the fusible material begins at less than 45 MPa, the device is considered to have failed the test.

6.3 Leakage

Follow the procedure for testing leakage given in ISO 12619-2 using the test temperatures and pressures given in Table 2. The PRD shall be either bubble-free or have a leakage rate <2 Ncm^3/h.

Table 2 — Test temperatures and pressures

Temperature °C	**Pressure** MPa
−40 or −20	15
82 or higher	26

6.4 Bending moment

The purpose of this test is to confirm proper design and construction of stand-alone, externally threaded PRD designs. Test the PRD according to the corresponding procedure given in ISO 12619-2.

6.5 Continued operation

6.5.1 Test procedure

a) Randomly select five test specimens.

b) Cycle the PRD according to Table 3, with water at between 10 % and 100 % of the working pressure, at a maximum cyclic rate of 10 cycles per minute.

Table 3 — Test temperatures and cycles

Temperature °C	Cycles
82 or higher	2 000
57 ± 2	18 000

6.5.2 Requirements

Following the test, there shall be no extrusion of the fusible material from the PRD.

At the completion of the test, the PRD shall comply with the requirements of 6.3 and 6.7. The rupture pressure will be >75 % and <105 % of the activation pressure of a PRD not subjected to any previous testing.

6.6 Accelerated life

6.6.1 General

Fusible materials can creep and flow within the operating temperature range of PRDs.

Accelerated-life testing is performed to verify that the rate of creep is sufficiently low in order that the device can perform reliably for at least 1 year at 82 °C and for at least 20 years at 57 °C. Accelerated-life testing shall be performed on new PRD designs or designs in which the fusible material melt temperature or device activation mechanism is modified. For devices not using activation materials that can creep, testing and analysis shall be performed to verify that the device will perform reliably for at least 1 year at 82 °C and at least 20 years at 57 °C.

6.6.2 Test procedure

a) Place the test specimens in an oven or liquid bath, holding the specimens’ temperature to within ±1 °C throughout the test.

b) Elevate the pressure on the PRD inlet to 100 % of the working pressure and hold this constant to within ±0,7 MPa until activation. The pressure supply may be located outside the controlled temperature oven or bath. Limit the volume of liquid or gas to prevent damage to the test apparatus upon activation and venting.

Each device may be pressurized individually or through a manifold system. If a manifold system is used, each pressure connection shall include a check valve to prevent pressure depletion of the system if one specimen fails.

