INTERNATIONAL STANDARD

ISO 20766-9

First edition
2019-05

Road vehicles — Liquefied petroleum gas (LPG) fuel systems components —

Part 9: Pressure relieve device (PRD)

Véhicules routiers — Équipements pour véhicules utilisant le gaz de pétrole liquéfié (GPL) comme combustible —
Partie 9: Dispositif de limitation de pression

Reference number
ISO 20766-9:2019(E)

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Published in Switzerland

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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 20766 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Road vehicles — Liquefied petroleum gas (LPG) fuel systems components —

Part 9: Pressure relieve device (PRD)

1 Scope

This document specifies general requirements and definitions of liquefied petroleum gas fuel components, intended for use on the types of motor vehicles as defined in ISO 3833. It also provides general design principles, and specifies requirements for instructions and marking.

This document is applicable to vehicles (mono-fuel, bi-fuel or dual-fuel applications) using gaseous fuels in accordance with ISO 9162. It is not applicable to the following:

a) fuel containers;

b) stationary gas engines;

c) container mounting hardware;

d) electronic fuel management; and

e) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically addressed herein can be examined for compliance with the criteria of any applicable part of ISO 20766, including testing to the appropriate functional tests.

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

NOTE 3 This document applies to devices which have a service pressure in the range of 110 kPa (Butane rich at 20 °C) and 840 kPa (Propane at 20 °C), hereinafter referred to in this document.

Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio).

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 20766-1, *Road vehicles — Liquefied petroleum gas (LPG) fuel systems components — Part 1: General requirements and definitions*

ISO 20766-2, *Road vehicles — Liquefied petroleum gas (LPG) fuel systems 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 20766-1 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 https://www.iso.org/obp

3.1
activation pressure
rupture pressure
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

4 Markings

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); and

c) the working pressure or working pressure and temperature range in accordance with Annex A.

The following additional markings are recommended:

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

— the type of fuel;

— electrical ratings (if applicable);

— the symbol of the certification agency;

— the type approval number;

— the serial number or date code; and

— reference to this document.

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 PRD shall comply with the applicable provisions of ISO 20766-1 and ISO 20766-2, and with the tests specified in Clause 6 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 20766-2	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	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Oxygen ageing	X	X	
Non-metallic material immersion	X	X	
Ozone ageing	X	X	
Creep	X	X	
Resistance to dry-heat	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)
X[a] Only if applicable.			

6.2 Hydrostatic strength

Test the PRD according to the procedure for testing hydrostatic strength specified in ISO 20766-2. The test pressure shall be 2,5 times the working pressure.

6.3 Leakage

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

Table 2 — Test temperatures and pressures

Temperature °C (±5 °C)	Pressure Factor × working pressure (WP)	
	First test	Second test
−40 or −20	0,75 × WP	0,025 × WP
20	0,025 × WP	2,25 × WP
85	0,05 × WP	

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 20766-2.

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 LPG vehicle 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 one 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 one 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 (7 bar) 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.

6.6.3 Accelerated-life test temperature

The accelerated-life test temperature, TL, is given in °C by the expression:

$$T\text{L} = 12{,}88 * Tf^{0{,}420}$$

where Tf is the manufacturer's specified activation temperature, in °C.

6.6.4 Requirements

6.6.4.1 Three PRDs shall be tested at the manufacturer's specified activation temperature to verify that they activate in less than 10 h.

6.6.4.2 Five PRDs shall be tested at their accelerated-life test temperature. The time-to-activation for accelerated-life test devices shall exceed 500 h.

6.7 Benchtop activation

6.7.1 General

6.7.1.1 The purpose of the benchtop-activation test is to demonstrate that a PRD will activate consistently throughout its life.

6.7.1.2 Test two PRDs without subjecting them to other tests in order to establish a baseline time for activation. The PRDs that have undergone the tests of 6.5 and 6.9 shall be tested according to 6.7 and meet the requirements of 6.7.2, as applicable.

6.7.1.3 Test thermally-activated relief devices in accordance with 6.7.2.

6.7.2 Thermally-activated relief devices

6.7.2.1 Test setup

The test setup shall consist of either an oven or chimney capable of maintaining a gas temperature at 600 °C ± 10 °C in the area of the oven or chimney into which the PRD is inserted for testing. The PRD shall not be exposed directly to flame.

6.7.2.2 Test procedure

a) Pressurize the PRD to 25 % of working pressure or 2 MPa, whichever is less. The temperature shall remain within the acceptable range for 2 min prior to running the test.

b) Insert the PRD in the oven or chimney and record the time-to-activation, t.

6.7.2.3 Requirements

The PRDs subjected to the tests of 6.5, 6.8, 6.9, and the corrosion-resistance and vibration-resistance tests of ISO 20766-2, shall activate to meet the following requirements where t, in minutes, is the time-to-activation of the PRDs not subjected to those tests:

$\leq \quad 5 \cdot t$

$\leq \quad t + 4$ min

6.8 Thermal cycling

6.8.1 Test procedure

Thermally cycle the PRD between −40 °C or −20 °C as applicable and 82 °C or higher, as follows:

a) Place a depressurized PRD in a fluid bath maintained at −40 °C or −20 °C as applicable or lower for a period of 2 h or more. Then transfer the device to a fluid bath maintained at 82 °C or higher within 5 min of having removed it from the cold bath.