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Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 13: Pressure relief device (PRD)

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —
Partie 13: Dispositifs de limitation de pression

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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 of 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 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*.

This third edition cancels and replaces the second edition (ISO 15500-13:2012), which has been technically revised. It also incorporates the Amendment ISO 15500-13:2012/Amd.1:2016.

The main changes are as follows:

— Clause 4, the type of gas and service pressure value have been added;

— Clause 6, new tests for "high-pressure activation and flow rate", "water jet protection" and "impact due to drop" have been added.

A list of all parts in the ISO 15500 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.

Introduction

For the purposes of this document, all fuel system components in contact with natural gas have been considered suitable for natural gas as defined in ISO 15403-1. However, 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.

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

This document is based on a service pressure for natural gas used as fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system requires that pressures be multiplied by 1,25.

1) 1 bar = 0,1 MPa = 10^5 Pa 1 MPa = 1 N/mm^2.

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 13: Pressure relief device (PRD)

1 Scope

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

This document is applicable to vehicles (mono-fuel, bi-fuel or dual-fuel applications) using natural gas in accordance with ISO 15403-1.

It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container-mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

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

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*

ISO 20653, *Road vehicles — Degrees of protection (IP code) — Protection of electrical equipment against foreign objects, water and access*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15500-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

3.1
activation pressure
rupture disc pressure rating
pressure, as specified by the pressure relief device (PRD) manufacturer, at which a PRD is designed to activate in order to allow 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 in order to allow 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.

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 relief device* (3.5) which, when installed in the device, is designed to burst at a predetermined pressure to permit discharge of the cylinder

3.7
series-combination relief device
pressure relief device (PRD) activated by a combination of high temperature and pressure acting together

3.8
thermally-activated relief device
pressure relief device (PRD) activated by high temperature

3.9
yield temperature
temperature at which the *fusible material* (3.3) becomes sufficiently soft to activate the device and to permit discharge of the cylinder

Note 1 to entry: There are several possible scenarios for a vehicle involved in a fire. The pressure relief device (PRD) is intended to reduce the risk of cylinder rupture under most of these scenarios while keeping a low risk of accidental activation. Experience shows that the best solution depends on the type of cylinder the PRD is mounted on.

3.10
flow capacity
capacity in volume per unit time at specified conditions, for a pressure relief device (PRD)

3.11
long trigger PRD
pressure relief device (PRD) having a heat reactive element (portion of a PRD that reacts to heat to activate the PRD) that is more than 10 times longer than the longest dimension of the PRD body

3.12
remote trigger PRD
pressure relief device (PRD) having the heat reactive element (portion of a PRD that reacts to heat to activate the PRD) that is separate from the gas handling portion of the PRD, such that it is possible for the heat reactive element to be heated separately from the main body or gas control portion of the PRD

3.13
K_v
valve flow coefficient
number equal to the flow rate in cubic meters per hour [m^3/h] of water at a temperature of 16 °C with a pressure drop across the valve of 0,1 MPa

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 type of gas (CNG);

c) the service pressure;

d) the fusible material yield temperature or PRD activation temperature (as per Annex A), and the rupture disc pressure rating or activation pressure, as appropriate;

e) the type of relief device (e.g. thermally-activated, series-combination, parallel-combination).

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.

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 conform to the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in Clause 6. Tolerances should follow the specifications of ISO 15500-2.

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.

The suggested configuration for PRDs is a parallel-combination or thermally-activated relief device for every type of cylinder. Series PRDs may only be used in type 1 steel cylinders and shall not be used in type 2, type 3 and type 4 cylinders.

PRDs designed to conform to this document shall be used with natural gas that conforms to the natural gas specifications from ISO 15403-1.

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 15500-2	Specific test requirements of this document
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X[a]	X	X (see 6.4)
Continued operation	X	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	
Electrical over-voltages	X	X	
Non-metallic material immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Accelerated life	X	X	X (see 6.6)
Benchtop activation	X	X	X (see 6.7)
Thermal cycling	X	X	X (see 6.8)
Condensate-corrosion resistance	X	X	X (see 6.9)
Flow capacity	X	X	X (see 6.10)
High-pressure activation and flow rate	X		X (see 6.11)
Water jet protection	X		X (see 6.12)
Impact due to drop	X		X (see 6.13)

[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.

Unless otherwise noted, while testing long trigger PRDs, or remote trigger PRDs, the tests performed shall use lengths or configurations that represent the worst conditions for that test, or shall use samples at each limit of the lengths to be approved.

6.2 Hydrostatic strength

6.2.1 Housing

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

6.2.1.1 Test procedure

6.2.1.1.1 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 15500-2 using a pressure of 2,5 times the working pressure at 20 °C ± 5 °C.

6.2.1.1.2 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 15500-2 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) hydraulically at 20 °C ± 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 series-combination relief devices, the burst disc shall not be removed. 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 less than or equal to 0,5 MPa/s to 2,3 times the working pressure 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 1,7 times the working pressure, the device is considered to have failed the test.

6.3 Leakage

Follow the procedure for testing leakage given in ISO 15500-2, 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	75 % and 2,5 % of the working pressure
room temperature	2,5 % and 100 % of the working pressure
85 or higher	5 % and 100 % of the working pressure

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 15500-2.