FINAL DRAFT
International
Standard

ISO/FDIS 19882

ISO/TC **197**

Secretariat: **SCC**

Voting begins on:
2024-11-14

Voting terminates on:
2025-01-09

Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers

Hydrogène gazeux — Dispositifs limiteurs de pression thermiquement activés pour les conteneurs de carburant de véhicules à hydrogène comprimé

Reference number
ISO/FDIS 19882:2024(en)

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 197, *Hydrogen technologies*.

This second edition cancels and replaces the first edition (ISO 19882:2018), which has been technically revised.

The main changes are as follows:

— Addition of pilot TPRDs and PRD valve coverage;

— Updates to design qualification test procedures;

— Additional test requirements for excess torque resistance, hydrostatic strength and waterjet protection.

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

The purpose of this document is to promote the implementation of hydrogen powered land vehicles through the creation of performance-based testing requirements for thermally activated pressure relief devices for compressed hydrogen fuel containers. The successful commercialization of hydrogen land vehicle technologies requires standards pertaining vehicle fuel system components and the global homologation of standards requirements for technologies with the same end use. This will allow manufacturers to achieve economies of scale in production through the ability to manufacture one product for global use.

Documents which apply to hydrogen fuel vehicles and hydrogen fuel subsystems include IEC 62282- 4-101, SAE J2578, SAE J2579, UN ECE R134, or UN GTR No. 13.

Annex A presents an informative record of recommended fuel container, fuel storage subsystem and vehicle level requirements. The statements in Annex A are intended as recommendations for consideration of inclusion by the organizations and committees developing standards on these sub-system and vehicle level standards.

Annex B presents a rationale for the design qualification tests in this document.

This document is based on the CSA Standard CSA/ANSI HPRD 1:21.

Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers

1 Scope

This document specifies minimum requirements for pressure relief devices intended for use on hydrogen fuelled vehicle fuel containers that comply with ISO 19881, IEC 62282-4-101, CSA/ANSI HGV 2, EC79/EU406, SAE J2579, UN ECE R134, or the UN GTR No. 13.

The applicability of this document is limited to thermally activated pressure relief devices installed on fuel containers containing gaseous hydrogen according to ISO 14687 for fuel cell and internal combustion land vehicles. This document specifies requirements for thermally activated pressure relief devices acceptable for use on-board the following types of land vehicles:

— light-duty vehicles;

— heavy-duty vehicles;

— industrial powered trucks, such as forklifts and other material handling vehicles.

Requirements for other types of land vehicles such as rail, off-road, etc., can be derived with due consideration of appropriate service conditions.

This document does not apply to reseating, resealing, or pressure-activated devices.

Pressure relief devices can be of any design or manufacturing method that meets the requirements of this document.

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 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 6270-2, *Paints and varnishes — Determination of resistance to humidity — Part 2: Condensation (in-cabinet exposure with heated water reservoir)*

ISO 14687, *Hydrogen fuel quality — Product specification*

ISO 19881, *Gaseous hydrogen — Land vehicle fuel containers*

ASTM D572, *Standard Test Method for Rubber — Deterioration by Heat and Oxygen*

ASTM D1149, *Standard Test Methods for Rubber Deterioration — Cracking in an Ozone Controlled Environment*

ASTM D1193, *Standard Specification for Reagent Water*

CSA/ANSI HGV 2, *Compressed hydrogen gas vehicle fuel containers*

UN GTR No. 13, *UN Global Technical Regulation on Hydrogen and Fuel Cell Vehicles*

SAE J2579, *Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles*

SAE J2719, *Hydrogen Fuel Quality for Fuel Cell Vehicles*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
flow capacity
<pressure relief device> capacity in volume per unit time at specified conditions

3.2
fusible material
metal, alloy, or other material capable of being melted by heat where the melting is integral to the function of the *pressure relief device* (3.7)

3.3
manufacturer's specified activation temperature
temperature, as specified by the pressure relief device manufacturer, at which the *pressure relief device* (3.7) is designed to release pressure

3.4
manufacturer's specified nominal working pressure
highest settled pressure at a uniform gas temperature of 15 °C of the container or container assembly with which the *pressure relief device* (3.7) may be used, as specified by the pressure relief device manufacturer

3.5
normal cubic centimetre
Ncm^3
dry gas that occupies a volume of 1 cm^3 at a temperature of 293,15 K (20 °C) and an absolute pressure of 101,325 kPa

3.6
pilot-activating device
valve or device designed to be used as a trigger for pilot-activated *pressure relief device* (3.7) valves, other than pilot TPRDs

3.7
pressure relief device
PRD
device that, when activated under specified performance conditions, is used to vent the container contents

Note 1 to entry: Reseating and resealing devices are not addressed by this document.

3.8
thermally activated pressure relief device
TPRD
pressure relief device (3.7) activated by temperature

3.8.1
direct-acting TPRD
TPRD (3.8) having a heat-reactive element that acts directly with the gas control portion of the *PRD* (3.7)

3.8.2
long-trigger TPRD
TPRD (3.8) having a heat-reactive element that is more than 10 times longer than the longest dimension of the *PRD* (3.7) body

3.8.3
pilot TPRD
TPRD (3.8) designed to be used as the trigger for the *pilot-activated PRD valve* (3.9.2)

3.8.4
remote-sensing TPRD
TPRD (3.8) having one or more remote heat-reactive element(s) such that it can be heated separately from, and acts indirectly with, the gas control portion of the PRD

3.9
pressure relief device valve
PRD valve
single-use valve that is intended to be opened to empty a hydrogen container

3.9.1
negative-acting pilot-activated PRD valve
PRD (3.7) that is designed to be triggered by a remote heat-sensing element or device and that will react to a decrease in pressure being applied to the *pilot-activated PRD valve* (3.9.2) activation port

3.9.2
pilot-activated PRD valve
single-use valve that is intended to be opened to empty a hydrogen container by the action of an attached *PRD* (3.7)

3.9.3
positive-acting pilot-activated PRD valve
PRD (3.7) that is designed to be triggered by a remote heat-sensing element or device and that will react to a positive pressure applied to the *pilot-activated PRD valve* (3.9.2) activation port

4 Service conditions

4.1 General

Fuel containers can accidentally be exposed to fire or elevated temperature. These conditions can act to increase the contained-pressure or to degrade the structural materials, depending on the container type and materials of construction. A pressure relief device provides a means to vent the fuel container under these conditions.

A pressure relief device may not be suitable for all container types, sizes or installations. Fuel container or installation standards may require that a pressure relief device be tested in conjunction with other components.

The service conditions in 4.2 through 4.5 are representative of what can be seen in an automotive service. These service conditions are provided as a basis for the design, manufacture, inspection and testing of pressure relief devices used in compressed hydrogen vehicle fuel containers.

4.2 Design service life

The design service life of the pressure relief device shall be specified by the manufacturer.

NOTE The testing described in this document is based on an expected service life of 20 years. Service life values can be extended by adjusting the filling or duty cycles, as applicable, by the appropriate factor (ratio). For example, a service life of 25 years will require cycling to be multiplied by 1,25.

4.3 Nominal working pressure

This document applies to pressure relief devices that have a nominal working pressure, as specified by the manufacturer, of 35 MPa or 70 MPa at 15 °C, hereinafter referred to in this document as the following:

b) “H35” — 35 MPa;

d) “H70” — 70 MPa.

Other nominal working pressures for hydrogen gas besides those defined are allowed if the required qualification test requirements of this document are met.

4.4 Durability test cycles

Pressure relief devices shall be designed to withstand 15 000 pressure cycles per the cycling requirements in 7.2. Pressure cycling includes 10 cycles between ≤ 2 MPa and ≥ 150 % of the manufacturer’s specified nominal working pressure.

NOTE The maximum pressure under the condition of fuelling station dispenser fault management is 150 % of the vehicle nominal working pressure, as defined in ISO 19880-1, SAE J2760, SAE J2579-2023, Appendix A and CSA/ANSI HGV 4.1.

4.5 Temperature range

The pressure relief device shall be designed to maintain pressure integrity from −40 °C to 85 °C.

It is possible that operational gas temperatures are outside of this range. The manufacturer may choose to test beyond these temperatures.

5 Quality assurance

Quality system programs shall be established and operated to demonstrate that pressure relief devices are produced in accordance with the qualified design.

6 General requirements

6.1 Material requirements

6.1.1 General

Pressure-containing materials in contact with hydrogen shall be determined to be acceptable in hydrogen service, with particular attention to hydrogen embrittlement and hydrogen-accelerated fatigue. Materials and design shall be such that there will be no significant change in the functioning of the device, deformation or mechanical change in the device, and no harmful corrosion, deformation, or deterioration of the materials.

6.1.2 Metallic materials

Material acceptability for metallic materials shall be demonstrated by testing or by referencing published data for the same material, representative form (e.g. bar or plate, forging or casting), similar strength and equivalent service conditions.

NOTE 1 Information regarding material performance in hydrogen environments can be found in ISO/TR 15916, ANSI/CSA CHMC 1, ASME B31.12 and SAE J2579:2023 Appendix B. Hydrogen compatibility can also be demonstrated by testing in hydrogen environments as anticipated in service, such as the pressure cycling test specified in 7.2.

NOTE 2 Some fusible alloys can contain heavy metals that can be considered environmentally unacceptable by some customers and can be prohibited by some jurisdictions.