INTERNATIONAL STANDARD

ISO 19880-3

First edition
2018-06

Gaseous hydrogen — Fuelling stations —

Part 3: Valves

Carburant d'hydrogène gazeux — Stations-service —

Partie 3: Vannes

Reference number
ISO 19880-3:2018(E)

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 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 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 ISO/TC 197, *Hydrogen technologies*.

A list of all parts in the ISO 19880 series can be found on the ISO website.

Introduction

Over the course of several years, international efforts have been initiated for the development of regulations, codes and standards that are required for the introduction of hydrogen energy systems. Hydrogen has unique properties and therefore presents unique safety concerns.

One of the many hydrogen energy applications is the automobile sector for which commercialization begun recently. For the success of this application, however, hydrogen infrastructure for fuelling vehicles is as essential as the hydrogen vehicles themselves. Thus, the development of safety standards for fuelling stations and components is of paramount importance.

This document provides safety performance requirements and test methods for valves to be used in gaseous hydrogen environment. Valves are critical to the safety of hydrogen fuelling stations, because they control the flow of gaseous hydrogen, shut it down in an emergency and, at the same time, may become a potential source of hydrogen release or leakage.

This document will facilitate the development of hydrogen infrastructure that is needed to pave a way for the widespread deployment of hydrogen-fuelled vehicles. Benefits to be gained by the implementation of this document include: the establishment of a certain level of safety performance for valves, a safety-critical component; the streamlining of the design and construction processes for fuelling stations by providing standardized components; and the promotion of public acceptance of hydrogen stations through the transparency of the international standardization processes.

This document is based on the Canadian Standards Association references CSA HGV3.1-2013, ANSI/CSA HGV 4.4-2013, ANSI/CSA HGV 4.6-2013 and ANSI/CSA HGV 4.7-2013.

This document is not intended to exclude any specific technologies that meet the performance requirements herein.

This document is to be applied in conjunction with other International Standards relevant to hydrogen fuelling stations and components.

Gaseous hydrogen — Fuelling stations —

Part 3:
Valves

1 Scope

This document provides the requirements and test methods for the safety performance of high pressure gas valves that are used in gaseous hydrogen stations of up to the H70 designation.

This document covers the following gas valves:

- check valve;
- excess flow valve;
- flow control valve;
- hose breakaway device;
- manual valve;
- pressure safety valve;
- shut-off valve.

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.

IEC 60079-0, *Explosive atmospheres — Part 0: Equipment — General requirements*

3 Terms and definitions

For the purpose of this document, the following terms and definitions 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
allowable temperature range
minimum and maximum temperatures for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at the specified pressure

3.2
component pressure rating
maximum allowable pressure at which it is permissible to operate a component as specified by the manufacturer at a specified temperature

Note 1 to entry: Further guidance on dispenser pressure terminology is found in ISO 19880-1.

3.3
Cv value
<flow coefficient> coefficient to represent the flow rate of fluid that a valve is capable of handling

Note 1 to entry: Cv is the flow coefficient of a valve with the fluid at 15,56 °C under a pressure difference of 6 894 N/m^2.

Note 2 to entry: There are different types of flow coefficients including Cv, Kv and Av.

3.4
dispenser
system downstream of the hydrogen supply system comprising all equipment necessary to carry out the vehicle fuelling operation, through which the compressed hydrogen is supplied to the vehicle

Note 1 to entry: As an example, the dispenser can include a dispenser cabinet, gas flow meter, a fuelling hose and fuelling nozzle attachments.

3.5
hydrogen service level
HSL
pressure level in MPa used to characterize the hydrogen service of the dispenser based on the NWP rating of the vehicleNote 1 to entry: The numerical value of HSL also matches the number after the "H" in Pressure Class.

Note 1 to entry: Hydrogen service level is expressed in MPa.

3.6
maximum allowable working pressure
MAWP
maximum pressure permissible in a system at the temperature specified for the pressure

Note 1 to entry: The maximum allowable working pressure may also be defined as the design pressure, the maximum allowable operating pressure, the maximum permissible working pressure, or the maximum allowable pressure for the rating of pressure vessels and equipment manufactured in accordance with national pressure vessel codes.

3.7
maximum operating pressure
MOP
highest pressure that is expected for a component or system during normal operation

3.8
valve
device by which the flow of a fluid may be started, stopped or regulated, using a movable part which opens or obstructs passage

3.8.1
check valve
valve which allows gas to flow in only one direction

3.8.2
excess flow valve
valve which automatically shuts off or limits the gas flow when the flow exceeds a set design value

3.8.3
flow control valve
gas flow restricting device, installed downstream of a pressure regulator, which controls gas flow

3.8.4
breakaway device
device on the fuelling hose that disconnects the hose from the dispenser when a tension limit is exceeded and blocks the flow of hydrogen from the dispenser, e.g. if the vehicle moves away with the fuelling hose connected to the vehicle

Note 1 to entry: This device is treated as a type of valve according to 3.8.

3.8.5
manual valve
hand-operated device for controlling the flow of gas

3.8.6
pressure safety valve
PSV
pressure activated valve that opens at a specified set point to protect the system from burst and recloses when the pressure falls below the set point

3.8.7
shut-off valve
on/off valve for controlling the flow of gas, which is pneumatically or electrically actuated

4 General requirements

4.1 General

This document defines proof of design (type) tests for valves, designed and manufactured under existing standards that are intended for use in hydrogen fuelling stations.

The requirements contained within this document are intended to provide performance-based tests to verify capability of valves for high pressure hydrogen service but not to prevent alternative methods to demonstrate acceptable capability. Valves that have extensive, successful service at comparable design conditions with similarly proportioned components made of the same or like material are not required to perform verification tests defined in Clauses 5 through 12 of this document if allowed by applicable codes and regulations.

Components shall comply with all construction specifications set forth herein, or their construction shall demonstrate at least equivalent performance.

4.2 Intended use

The quality of hydrogen fuel dispensed to vehicles is defined in ISO 14687. The design, manufacture and operation of valves constructed in accordance with this document shall not introduce contamination to the hydrogen passing through or in contact with them.

4.3 Material requirements

Resistance to chloride stress corrosion cracking shall be taken under consideration if selecting stainless steel materials. Resistance to sustained load cracking shall be taken under consideration if selecting aluminum materials.

Materials normally 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.

Non-metallic materials normally in contact with hydrogen shall be determined to be acceptable in hydrogen service. Consideration shall be given to the fact that hydrogen diffuses through these materials much more easily than through metals; therefore, the suitability of materials shall be verified.

Non-metallic materials shall retain their mechanical stability with respect to strength (fatigue properties, endurance limit, creep strength) when exposed to the full range of service conditions and lifetime as specified by the manufacturer.

Materials shall be sufficiently resistant to the chemical and physical action of the fluids that they contain and to environmental degradation.

The material chemical and physical properties necessary for operational safety shall not be significantly affected within the scheduled lifetime of the equipment unless replacement is foreseen.

When selecting materials and manufacturing methods, due account shall be taken of:

— material's corrosion and wear resistance;

— electrical conductivity;

— impact strength;

— aging resistance;

— effects of temperature variations;

— effects arising when materials are combined (for example, galvanic corrosion);

— effects of ultraviolet radiation;

— degradation effects of hydrogen on the mechanical performance of a material.

Guidance to account for the degradation effects of hydrogen on the mechanical performance of a material can be found in ISO/TR 15916.

4.4 Product quality

The manufacturer shall establish production processes with quality control measures to ensure that production valve(s) meet requirements established in this document. As part of this requirement, a hydraulic proof pressure test at 150 % and a gas leak test at 100 % of the component pressure rating shall be conducted. Alternatively a gas leak test at 125 % of the component pressure rating may be conducted.

5 General test methods

5.1 General

General test requirements for all valves are outlined in 5.2 to 5.11. Where additional test requirements exist for specific types of valves, these are included in Clauses 6 to 12.

Any component to be installed downstream of the precool system shall be subject to a cold gas in warm valve test.

5.2 Test conditions

5.2.1 Test sample

A new valve may be used for each test specified. When a series of valves that differ in size only is to be evaluated, three representative samples shall be chosen. At a minimum the smallest, largest and one intermediate size valves shall be evaluated.

5.2.2 Pressure

Unless otherwise stated, all pressures noted within this document are gauge pressure. For general applications, the component pressure rating of the valve to be tested shall be used as is. Since the component pressure rating is to be greater or equal to the system MAWP, the following is permitted:

a) For dispenser applications, the component pressure rating of the valve may be replaced with the MAWP of the dispenser system in which the valve is to be used.

b) For applications in other pressure systems, the component pressure rating of the valve may be the MAWP of such a pressure system.

5.2.3 Normal test temperature

Unless otherwise stated, any test at room temperature shall be conducted at 20 °C (± 5) °C.

5.2.4 Specified test temperature

The tests in these requirements shall be conducted at −40 °C (+0 °C, −3 °C) and at 85 °C (+3 °C, −0 °C) where the valve is used in a dispenser. If the manufacturer specifies the temperature range for use, the test temperatures are the minimum and the maximum of the range.

5.2.5 Test media

Test media as specified in these requirements shall be:

a) hydrogen for leak tests;

b) hydrogen for permeation;

c) hydrogen for gas pressure cycle test;

d) liquids (e.g., water or oil) for hydrostatic strength tests;

e) hydrogen, helium, nitrogen or dry air for all other tests.

5.2.6 Test sequence

For any valve type, the tests described in 5.3, 5.4, 5.5, 5.6 and 5.7 shall be performed in this sequence using the same test sample.

5.3 Hydrogen gas pressure cycle test

5.3.1 General

For the details of test methods for particular valves, see the applicable part of this document.

The method specified in this clause is general in nature and applicable even to miscellaneous valves.

A valve shall withstand 102 000 hydrogen gas pressure cycles without damage or leakage. The replacement of valve seals shall be acceptable at intervals of 16 000 cycles. Prior to conducting this test the valve shall comply with 5.4 at room temperature only.

5.3.2 Test method

The outlet of the valve shall be plugged and the inlet shall be attached to hydrogen pressure supply. The valve shall be in the open position unless otherwise provided in the clause applicable to a specific valve to be tested. Cycling shall be between less than 5 % of the component pressure rating and the component pressure rating (+3 %, −0 %) within a period of not less than 6 s (10 cycles per minute). 100 000 cycles shall be completed at room temperature, with additional 1 000 cycles at an ambient