



International
Standard

ISO 19880-2

**Gaseous hydrogen — Fuelling
stations —**

**Part 2:
Dispensers and dispensing systems**

*Carburant d'hydrogène gazeux — Stations de ravitaillement —
Partie 2: Dispositifs et systèmes de distribution*

**First edition
2025-02**

STANDARDSISO.COM : Click to view the full PDF of ISO 19880-2:2025



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 General	7
5 Requirements	8
5.1 General material requirements	8
5.2 Construction and assembly requirements	9
5.2.1 General construction and assembly	9
5.2.2 Housings and cabinets	10
5.3 Dispenser hydrogen systems	10
5.4 Piping and fittings	11
5.5 Overpressure protection devices	12
5.6 Filters	12
5.7 Valves	13
5.8 Venting	13
5.9 Dispenser fuelling assembly	13
5.10 Breakaway devices	14
5.11 Instruments for gaseous hydrogen systems	14
5.12 Metering	15
5.13 Precoolers and precool control	15
5.14 Electrical equipment and wiring	15
5.14.1 General electrical requirements	15
5.14.2 Bonding and grounding	15
5.14.3 Safety instrumented systems	15
5.14.4 Illumination	16
5.14.5 Payment terminals or fuelling authorizing systems	16
5.14.6 Electromagnetic compatibility and interference (EMC)	16
5.15 Emergency shutdown system (ESS)	16
6 Dispensing requirements	17
6.1 Control of dispensing	17
6.2 Dispensing temperature, pressure and flow rate	17
6.3 Pressure integrity check (leak check)	17
6.4 Fuelling protocol and process limits	18
6.5 Post dispensing	18
7 Dispenser fault management	18
8 Marking	18
8.1 General requirements	18
8.2 Dispenser name plate	19
8.3 Self-serve dispenser instructions	19
9 Qualification tests	19
9.1 General	19
9.2 Standard test conditions	19
9.3 Proof pressure test	20
9.3.1 Acceptance criteria	20
9.3.2 Test method	20
9.4 Leakage test	20
9.4.1 Acceptance criteria	20
9.4.2 Test method	20
9.5 Impact test	20

9.5.1	Acceptance criteria	20
9.5.2	Test method	21
9.6	Dispenser shutdown test	21
9.6.1	Acceptance criteria	21
9.6.2	Test method	21
9.7	Hose rupture	22
9.7.1	General	22
9.7.2	Acceptance criteria	22
9.7.3	Test method	22
9.8	Hose breakaway test	23
9.8.1	Acceptance criteria	23
9.8.2	Test method	23
9.9	Prevention of electrostatic discharge	23
9.9.1	Acceptance criteria	23
9.9.2	Test method	23
9.10	Dispenser ground continuity test	24
9.10.1	Acceptance criteria	24
9.10.2	Test method	24
9.11	Dielectric voltage-withstand test	24
9.11.1	Acceptance criteria	24
9.11.2	Test method	24
9.12	Dispenser cabinet test	25
9.12.1	Acceptance criteria	25
9.12.2	Test method	25
9.13	Marking material adhesion and legibility test	25
9.13.1	Acceptance criteria	25
9.13.2	Test method	25
10	Routine tests	26
11	Product literature	26
11.1	General	26
11.2	Installation	26
11.3	Maintenance and service	26
11.4	Operation	27
Annex A (informative)	Dispenser system types	28
Annex B (informative)	Examples of hazardous area classification	30
Annex C (normative)	Marking class requirements	33
Bibliography		35

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*.

A list of all parts in the ISO 19880 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

The purpose of this document is to promote the implementation of hydrogen-powered land vehicles through the creation of performance-based safety and testing requirements for compressed hydrogen fuel dispensers. The successful commercialization of hydrogen land vehicle technologies requires codes and standards pertaining to fuelling stations, 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.

This document is a part of the ISO 19880 series for hydrogen fuelling stations with its scope limited to compressed hydrogen dispensers for land vehicles that use hydrogen as fuel. Dispensers are a major component of hydrogen fuelling stations, without which hydrogen vehicles will not become a significant element of mobility in the future. This document includes requirements for manufacture, commissioning and routine maintenance of dispensers in order to ensure the safe operation of dispensing hydrogen to vehicles.

Note [Annex A](#) has additional information about the range of options for dispenser systems.

STANDARDSISO.COM : Click to view the full PDF of ISO 19880-2:2025

Gaseous hydrogen — Fuelling stations —

Part 2: Dispensers and dispensing systems

1 Scope

This document specifies safety requirements and test methods for the components and systems that enable the transfer of compressed hydrogen to a hydrogen vehicle, as addressed in ISO 19880-1, by a hydrogen dispenser with dispensing pressures up to the H70 pressure class designation.

This document applies to a hydrogen dispensing system, referred to as a “dispenser”; the configuration of the dispenser can range from:

- a) a dispenser cabinet, located in the fuelling area, that can perform all of the functionality needed to deliver hydrogen to a vehicle, to
- b) a minimum set of components mounted in or on (as applicable) a dispenser cabinet or other supporting structure as appropriate, with the remaining functionality provided elsewhere in the hydrogen fuelling station.

A dispensing system includes the user and vehicle interface and can include components starting from the hydrogen supply, such as a connection to the banking system, a cooling unit, a dispenser control system, a flow meter, a pressure sensor, a fuel temperature sensor, an ambient temperature sensor, user interface and a fuelling hose assembly. Not all dispensing system equipment has to be physically housed within the enclosure at the dispensing area, as long as the specification of component design or type and location are adequate to ensure that the overall process meets the requirements in this document.

This document specifies the requirements for hydrogen dispensers and can provide specific references to other standards for individual components included in the hydrogen dispenser, such as valves (ISO 19880-3) and hoses (ISO 19880-5).

This document specifies general requirements for supporting the fuelling protocol and directs the user to ISO 19880-1 for additional requirements and the test methods required to verify proper fuelling protocol implementation.

This document does not specify the accuracy of flow meters that can be used to meter dispensed fuel.

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 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and designation codes*

ISO 3601-2, *Fluid power systems — O-rings — Part 2: Housing dimensions for general applications*

ISO 3601-3, *Fluid power systems — O-rings — Part 3: Quality acceptance criteria*

ISO 3864-2, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 4126 (all parts), *Safety devices for protection against excessive pressure*

ISO 80079-36, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

ISO 80079-37, *Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres — Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*

ISO 14687, *Hydrogen fuel quality – Product specification*

ISO 15649, *Petroleum and natural gas industries — Piping*

ISO 17268, *Gaseous hydrogen land vehicle refuelling connection devices*

ISO 19880-1:2020, *Gaseous hydrogen — Fuelling stations — Part 1: General requirements*

ISO 19880-3, *Gaseous hydrogen — Fuelling stations — Part 3: Valves*

ISO 19880-5, *Gaseous hydrogen – Fuelling stations – Part 5: Dispenser hoses and hose assemblies*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60364, *Low-voltage electrical installations*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

SAE J2600, *Compressed Hydrogen Surface Vehicle Fuelling Connection Devices*

SAE J2601, *Fuelling Protocols for Light Duty Gaseous Hydrogen Surface 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

breakaway device

device on the *fuelling hose* (3.11) that disconnects the hose from the *dispenser* (3.5) when a tension limit is exceeded and blocks the flow of hydrogen from the *dispenser* (3.5), e.g. if the vehicle moves away with the *fuelling hose* (3.11) connected to the vehicle

[SOURCE: ISO 19880-1:2020, 3.50]

3.2

component pressure rating

maximum pressure at which it is permissible to operate a component as specified by the *manufacturer* (3.15) at a specified temperature

Note 1 to entry: Components designed with a maximum allowable pressure per the European PED represent the component pressure rating by the *manufacturer* (3.15) as indicated by the value of “PS”.

Note 2 to entry: See Annex E of ISO 19880-1 for discussion of pressure terminology and its application to *dispensing systems* (3.6).

Note 3 to entry: Unless otherwise specified, the pressure in this document is expressed in gauge pressure.

[SOURCE: ISO 19880-1:2020, 3.10 modified – Notes 2 to 4 to entry deleted with Note 5 to entry of the source definition renumbered as Note 2 to entry.]

3.3

control system

system which responds to input signals from the process and/or from an operator and generates output signals causing the process to operate in the desired manner

[SOURCE: ISO 19880-1:2020, 3.11 modified – Note 1 to entry deleted.]

3.4

flow coefficient

C_v

coefficient to represent the flow rate of fluid that a *valve* (3.28) is capable of handling

Note 1 to entry: C_v is the flow coefficient of a *valve* (3.28) with the fluid at 15,56 °C under a pressure difference of 6 894 N/m² (= Pa)

3.5

dispenser

equipment in the *dispensing system* (3.6), including the dispenser cabinet(s) and supporting structure, that is physically located in the fuelling area

Note 1 to entry: The hydrogen dispenser typically includes, as a minimum, the *fuelling assembly* (3.10), required temperature and pressure instrumentation, filters and the user interface to conduct vehicle fuelling.

Note 2 to entry: The *manufacturer* (3.15) of the hydrogen dispenser can elect to include additional equipment in the dispenser, including the possibility of all equipment in the *dispensing system* (3.6).

[SOURCE: ISO 19880-1:2020, 3.13]

3.6

dispensing system

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

[SOURCE: ISO 19880-1:2020, 3.17]

3.7

emergency shutdown system

ESS

system which responds to automatic and/or manually activated emergency shutdown devices to stop hazardous movements and operations such as the flow of hydrogen gas to the *dispenser* (3.5) and vehicle

3.8

enclosure

structure, *protective housing* (3.13), container, machine cabinet, etc., which encloses or partially encloses equipment of a station that may have access for maintenance but is not intended to be occupied

Note 1 to entry: In this document the enclosure of the *dispenser* (3.5) is defined as a “dispenser cabinet”.

Note 2 to entry: Some hydrogen station *manufacturers* (3.15) may build an all-in-one *fuelling station* (3.12) where the dispenser components are built into one side or end of the equipment enclosure without using a separate dispenser cabinet.

Note 3 to entry: The use of an enclosure could be to protect equipment from the environment, provide noise attenuation or provide safety to the areas surrounding the equipment.

[SOURCE: ISO 19880-1:2020, 3.18 modified – Notes 1 and 2 to entry are newly inserted, the original Note 1 to entry is renumbered as Note 3 to entry and the original Note 2 to entry deleted.]

3.9 fitting

part or design feature on a component used to join (i.e., connect) any pressure-retaining components in the system

[SOURCE: ISO 19880-1:2020, 3.24]

3.10 fuelling assembly

part of the *dispenser* (3.5) providing the interface between the hydrogen *fuelling station* (3.12) and the vehicle — an assembly consisting of a *breakaway device* (3.1), a hose(s), a *nozzle* (3.19) and connections between these components

Note 1 to entry: The fuelling assembly can include, or not include, a nozzle vent line (with hose *breakaway device* (3.1) and hose) depending on the type of *nozzle* (3.19), and communications, if used.

[SOURCE: ISO 19880-1:2020, 3.26]

3.11 fuelling hose

flexible conduit used for dispensing gaseous hydrogen to vehicles through a fuelling *nozzle* (3.19)

[SOURCE: ISO 19880-1:2020, 3.27]

3.12 fuelling station

facility for the dispensing of compressed hydrogen vehicle fuel, often referred to as a hydrogen refuelling station (HRS) or hydrogen filling station, including the supply of hydrogen, and hydrogen compression, storage and *dispensing systems* (3.6)

[SOURCE: ISO 19880-1:2020, 3.29]

3.13 housing

guard or *enclosure* (3.8) for operating parts, control mechanisms, or other components that do not need to be accessible during normal operation

Note 1 to entry: Housing may be synonymous with: *enclosure* (3.8), cabinet or frame.

[SOURCE: ISO 19880-1:2020, 3.40]

3.14 hydrogen service level HSL

pressure level in MPa used to characterize the hydrogen service of the *dispensing system* (3.6) based on the NWP rating of the vehicle

Note 1 to entry: The numerical value of HSL also matches the number after the “H” in *pressure class* (3.20) (see Table 1 in ISO 19880-1).

Note 2 to entry: See Annex E of ISO 19880-1 for application of pressure terminology to hydrogen-dispensing systems and vehicles.

[SOURCE: ISO 19880-1:2020, 3.42]

3.15 manufacturer

person or organization responsible for the design and manufacturer of the equipment and components

3.16

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 can 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.

Note 2 to entry: See Annex E of ISO 19880-1 for a discussion of pressure terminology and the application to *dispensing systems* (3.6) and *fuelling stations* (3.12) in general.

[SOURCE: ISO 19880-1:2020, 3.45]

3.17

maximum operating pressure

MOP

highest pressure that is expected for a component or system during normal operation, including anticipated transients

Note 1 to entry: In the case of the *dispensing system* (3.6), the MOP is equivalent to the maximum fuelling pressure of the vehicle.

Note 2 to entry: See Annex E of ISO 19880-1 for a discussion of pressure terminology and the application to *dispensing systems* (3.6) and *fuelling stations* (3.12) in general.

[SOURCE: ISO 19880-1:2020, 3.47]

3.18

nominal working pressure

NWP

pressure of a vehicle compressed hydrogen storage system (CHSS) at 100 % SOC (3.27) at a gas temperature of 15 °C

Note 1 to entry: For further guidance on pressure terminology and associated equipment ratings, see Annex E of ISO 19880-1.

[SOURCE: ISO 19880-1:2020, 3.51 modified – Notes 1 to 4 to entry deleted and new Note 1 to entry inserted.]

3.19

nozzle

device connected to a fuel *dispensing system* (3.6) which permits the quick connect and disconnect of fuel supply to the *receptacle* (3.22) of the vehicle or storage system

[SOURCE: ISO 17268: 2012, 3.11]

3.20

pressure class

non-dimensional rating of components designed to dispense hydrogen to road vehicles at the required pressure

Note 1 to entry: The numbers following “H” in the pressure class are numerically the same as HSL, but the HSL identifies only the level of the dispensing service whereas the pressure class designation shows that the component is fully capable of meeting the pressure and temperature requirements for dispensing hydrogen at the indicated service level.

Note 2 to entry: See Annex E of ISO 19880-1 for a discussion of pressure terminology and its application to *dispensing systems* (3.6) and *fuelling stations* (3.13) in general.

[SOURCE: ISO 19880-1:2020, 3.58 modified – Note 3 to entry deleted]

3.21

pressure relief device

PRD

safety device that releases gases or liquids above a specified pressure value in cases of emergency or abnormal conditions

Note 1 to entry: PRDs can be activated by pressure or another parameter, such as temperature, and can be either re-closing devices (such as *valves* (3.28)) or non-re-closing devices (such as rupture disks and fusible plugs). Common designations for these specific types of PRDs are as follows:

- Pressure Safety Valve (PSV) – pressure-activated *valve* (3.28) that opens at a specified set point to protect a system from overpressure and re-closes when the pressure falls below the set point requirements for PRVs used in *dispensing systems* (3.6) can be found in 8.2.2.3 of ISO 19880-1. PSVs protecting the *dispensing system* (3.6) can re-close above the *MOP* (3.17).
- Thermally-activated Pressure Relief Device (TPRD) – a PRD that opens at a specified temperature to protect a system from rupture and remains open.

Note 2 to entry: See Annex E of ISO 19880-1 for discussion of pressure terminology and its application to pressure protection of the dispensing system and *fuelling stations* (3.12) in general.

[SOURCE: ISO 19880-1:2020, 3.59]

3.22

receptacle

device connected to a vehicle storage system which receives the *nozzle* (3.19)

Note 1 to entry: This can also be referred to as a fuelling inlet or gas filling port in other documents.

[SOURCE: ISO 17268: 2020, 3.15]

3.23

risk assessment

determination of quantitative or qualitative value of risk related to a specific situation and a recognized threat (also called hazard)

Note 1 to entry: Based on national requirements, a review of a risk analysis or a safety concept by third party is sometimes required.

[SOURCE: ISO 19880-1:2020, 3.66]

3.24

safety function

function to be implemented by a safety-instrumented system, which is intended to achieve or maintain a safe state for the process, with respect to a specific hazardous situation

Note 1 to entry: Other technologies or risk reduction measures have a safety function not achieved through a safety-instrumented system, however validation of these measures is equally important.

[SOURCE: ISO 19880-1:2020, 3.71]

3.25

safety instrumented system

SIS

instrumented system used to implement one or more safety instrumented functions

Note 1 to entry: A safety instrumented system (SIS) is composed of any combination of sensors, logic solvers, and final elements.

Note 2 to entry: A separate safety-instrumented system (SIS), typically with a greater reliability than the more basic process control system, can be required, according to the *manufacturer's* (3.15) *risk assessment* (3.23), to respond solely to safety critical alarms. Further information is provided by IEC 61508 and IEC 61511.

[SOURCE: ISO 19880-1:2020, 3.72]

3.26

shutoff valve

on/off valve (3.28) for controlling the flow of gas, which is pneumatically or electrically actuated

3.27

state of charge

SOC

density (or mass) ratio of hydrogen in the compressed hydrogen storage system (CHSS) between the actual CHSS condition and the capacity at *nominal working pressure* (3.18) when the system is equilibrated at 15 °C

Note 1 to entry: SOC is expressed as a percentage and is computed based on the gas density according to [Formula \(1\)](#).

Note 2 to entry: The accuracy of the NIST formula has been quantified to be within 0,01 % from 255 K to 1 000 K with pressures to 120 MPa at the publishing of this document.

SOC (%) can be calculated as follows:

$$\frac{\rho_1}{\rho_2} \times 100 \quad (1)$$

where

ρ_1 is the density of hydrogen under the specific gas conditions;

ρ_2 is the density of hydrogen at the *nominal working pressure* (3.18) at a gas temperature of 15 °C.

The hydrogen densities at the two major *nominal working pressures* (3.18) are:

- density of H₂ at 35 MPa and 15 °C and = 24,0 g/l
- density of H₂ at 70 MPa and 15 °C and = 40,2 g/l

Note 3 to entry: The ρ_1 function for hydrogen is available from the National Institute of Standards and Technology (NIST) at <https://nvlpubs.nist.gov/nistpubs/jres/113/6/V113.N06.A05.pdf>.

3.28

valve

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

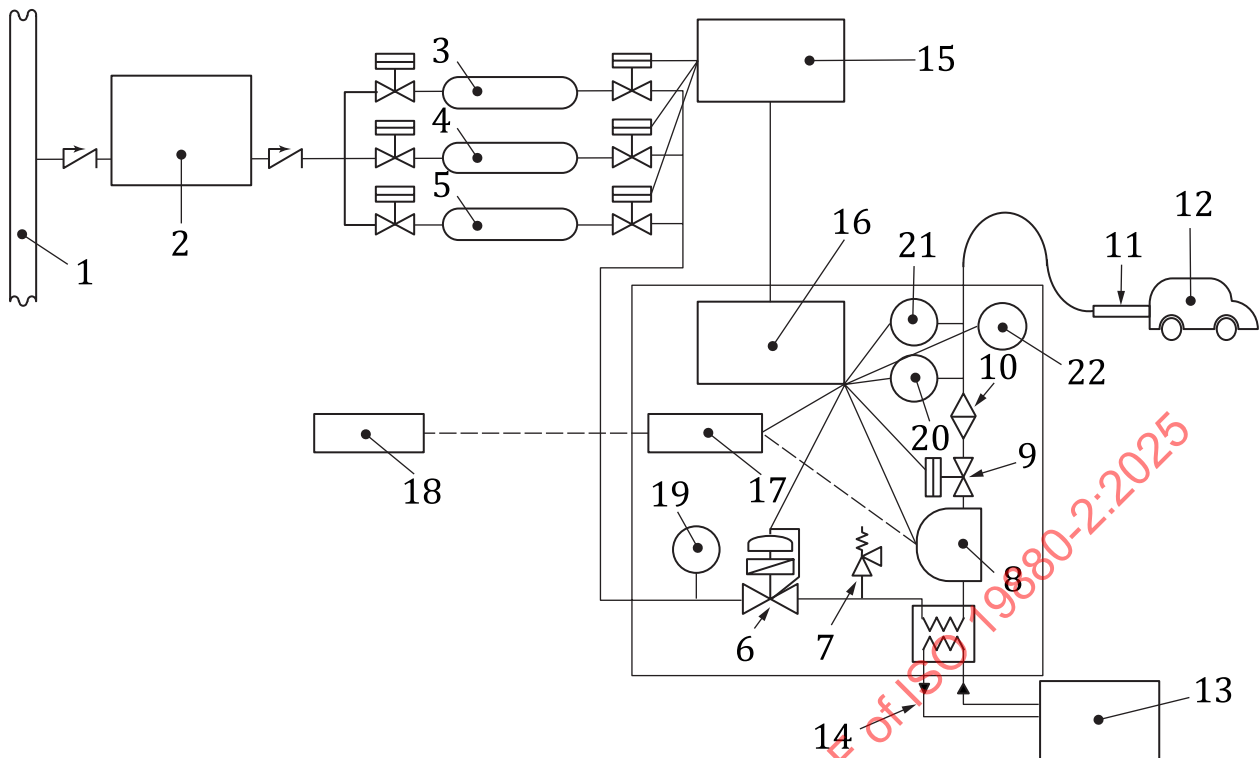
[SOURCE: ISO 19880-3:2018, 3.8]

4 General

[Figure 1](#) shows the main components of the dispenser integrated into one enclosure. Note that some manufacturers may include the heat exchanger inside the dispenser cabinet. Examples in [Annex A](#) provide many of the dispenser system components outside the dispenser cabinet, including the dispenser control system, which can be located, for example, with the hydrogen fuelling station controls. The position of each device in [Figure 1](#) is also an example and may vary.

The components that shall be part of the dispenser cabinet are:

- a) fuelling hose assembly with a nozzle and nozzle resting system;
- b) fuel temperature and pressure sensors;
- c) filter (downstream of shutoff valve);
- d) user interface: start/stop sequence inputs and display of dispenser operation.



Key

1	H ₂ pipeline 2 MPa	10	filter	18	connection to the banking system
2	compressor	11	nozzle	19	pressure sensor (P1)
3	S-1 90 MPa	12	fuel cell vehicle	20	pressure sensor (P2)
4	S-2 90 MPa	13	cooling machine	21	gas temperature sensor (T1)
5	S-3 90 MPa	14	coolant loop	22	ambient temperature sensor (T2)
6	flow control valve	15	cascade panel		
7	pressure safety valve	16	dispenser control system		
8	flow meter	17	point of sale (POS)		
9	shutoff valve				

Figure 1 — Integrated dispenser system

Requirements contained herein are all the requirements to function as a whole system. If a whole system is not available, then the sections of this document that are applicable shall be defined and the required verification tests and analyses shall be performed for these applicable requirements.

NOTE Verification tests not performed based on the above are expected to be performed as part of integration of the whole dispensing system.

5 Requirements

5.1 General material requirements

Materials shall comply with the following.

- Materials exposed to hydrogen shall be compatible with hydrogen.
- Materials used shall be rated for the temperature and pressure to which they will be exposed.
- For non-metallic materials such as rubber or plastic, select those that are appropriate for the service conditions, including environmental conditions, so that no failure will occur during the expected service life.

- d) Materials and coatings shall be adequate for the service conditions.
- e) Metallic materials, used where environmental degradation is expected, shall be selected based on the service environment, or be coated to be protected from this environment for the duration of the expected service life or to make them highly resistant to corrosion.
- f) For electrical insulation, use materials appropriate for the application and environmental conditions such as temperature extremes and moisture.
- g) For the exterior cabinet of an outdoor dispenser, use materials with high weather resistance such as metal with anticorrosion treatment or synthetic resin. Exterior materials, including synthetic resin, shall not blister, crack or fracture under working conditions.
- h) Select materials in accordance with local environment requirements, avoiding the use of materials that do not comply with these requirements such as mercury, lead or asbestos.

NOTE ISO/TR 15916 gives guidance on typical material compatibility with hydrogen.

5.2 Construction and assembly requirements

5.2.1 General construction and assembly

A compressed hydrogen gas dispenser shall meet the following requirements.

- a) Where the area, including the interior of equipment, enclosure, dispenser, housing and cabinet, is classified as a hazardous area pursuant to IEC 60079-10-1, appropriate precautions shall be taken against explosions in accordance with IEC 60079-0 (or other parts of the IEC 60079 series which describe the protection level), IEC 60079 14 regarding selection, erection, installation and inspection, and ISO 80079-36 and ISO 80079-37 for mechanical (non-electrical) level of protection.

NOTE The definition of “area” in IEC 60079-10-1:2020,3.3.1 refers to “a three-dimensional region or space.”

- b) All components in a housing used in a dispenser shall be assembled in such a manner so as to be secure against distortion, warping or other damage, and shall be supported to maintain a fixed relationship with each other.
- c) All parts which can come into contact, during normal servicing and operation, shall be free from sharp projections or edges and projecting screw ends.
- d) Components requiring scheduled servicing, adjustment or replacement shall be readily accessible to the service technician authorized by the manufacturer.
- e) Dispensers for outdoor installation shall be compatible with climatic conditions or equipped with a means to protect all operating controls and electrical wiring from climatic conditions. See [9.12](#).
- f) Each dispenser shall be provided with a mounting means for sufficient support.
- g) Dispensers shall be equipped with a means to secure and protect the fuelling assembly. See item of [5.9 b](#)).
- h) Any component covered under this document shall be capable of operating over the entire temperature and pressure range specified by the manufacturer.
- i) The dispenser shall be constructed so that the cabinet, frame and similar non-current-carrying metal parts are electrically bonded to the point of connection of the equipment grounding means. See [9.9](#)

The risk assessment conducted in accordance with 7 shall consider possible accidents and incidents and, if physical measures are not adequate, detection of physical disturbance shall be incorporated, for example using a tilt sensor or a hydrogen sensor, which can cause subsequent emergency shutdown if necessary.

5.2.2 Housings and cabinets

Dispenser cabinets, housings, enclosures and frames for dispenser equipment shall meet the following requirements. For simplicity and brevity, the term “cabinet” is used in place of “enclosures” and “housings”.

- a) The dispenser cabinet shall be structurally adequate to protect the equipment contained within from the elements while protecting the operator and the general public from the equipment within.
- b) Dispensers shall be classified in accordance with IEC 60079-10-1 or other applicable standards. See [Annex B](#) for a specific example. Ventilation rates of enclosures shall meet the requirement for the hazardous area classification and also for the management of possible heat buildup.

NOTE IEC 60079-10-1 provides the use of protection systems, including gas-tight partitions or walls, pressurization (from a safe area), ventilation, continuous vapour barriers and other means, for explosive atmosphere area classification exemption.

- c) The dispenser cabinet shall be durable and facilitate normal operation of the device.
- d) It shall be demonstrated that a recess or depression in the dispenser cabinet which has a possibility to collect water shall incorporate a means to drain the water to an appropriate location.
- e) Where a hazard from ingress of solid foreign objects or ingress of water exists, the manufacturer shall determine the required IP (Ingress Protection) rating as classified in IEC 60529. No additional ingress protection is required where components and equipment are individually protected to the required levels.
- f) The construction of the dispenser cabinet not specifically covered herein shall be in accordance with industry-recognized concepts of safety, sustainability and durability.
- g) The dispenser cabinet shall accommodate field connections of gas piping and electrical equipment. Openings shall be provided to accommodate field connections, inspection and adjustments.
- h) Where required for safety reasons or protection against accidental equipment contact or vandalism, the openings shall have removable covers which require a key or tool to open or remove them.
- i) To prevent the accumulation of hydrogen and manage possible heat build-up, the enclosure containing fuel-bearing components shall be adequately ventilated.
- j) A plastic panel used as part of the dispenser cabinet shall remain intact when subjected to room temperature and cold impact tests as described in [9.5](#). Except when otherwise stated, testing at room temperature shall be conducted between 15 °C and 30 °C.
- k) Plastic parts shall be resistant to deterioration from conditions imposed on them in service.
- l) The protective cabinet of a dispenser shall be made of non-combustible and anti-static materials.
- m) Plastic parts used for viewing panels shall be resistant to deterioration of transparency from conditions imposed on them in service.

5.3 Dispenser hydrogen systems

In order to achieve the MOP needed to fill the CHSS of the hydrogen vehicle under the full range of operating conditions, the recommended minimum component pressure ratings needed for the dispenser hydrogen system relative to the dispenser hydrogen service level (HSL), the pressure class and the dispenser system MAWP are shown in ISO 19880-1:2020, Table 1. See ISO 19880-1 for explanation of dispenser pressure levels.

If components that are below the pressure ratings in ISO 19880-1:2020, Table 1 are used, then the MAWP of the dispenser system shall be accordingly lowered to the lowest-rated component. All the components in the hydrogen dispensing system shall be rated, as minimum, for the following conditions:

- a component pressure rating equal to or greater than 137,5 % of the dispenser hydrogen service level (HSL) as indicated in ISO 19880-1:2020, Table 1.

- an ambient temperature range of $-40\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$. The manufacturer may determine a smaller ambient temperature range. All dispensers shall have a means to detect and prevent operation if the system is outside its rated operating temperatures.
- compatibility of materials normally in contact with hydrogen. Particular attention should be given to hydrogen embrittlement, permeability and hydrogen-accelerated fatigue. The material compatibility shall be documented by the component manufacturer or an independent third party. See ISO 19880-1 and ISO TR 15916.
- a specified cycle life before maintenance or replacement.

NOTE According to ISO 19880-1, the target cycle life is 100 000 cycles with the pressure based on the applicable H class rating for the fuelling assembly.

Pressure and leak test requirements for dispenser hydrogen systems shall be in accordance with 9.3. See also ISO 19880-1.

High-pressure components shall be mounted in strict compliance with the supplier's instructions, following a well-defined assembly procedure.

The assembled system shall be cleaned so as not to affect fuel quality as established in ISO 14687.

A compressed hydrogen gas line inlet or outlet for field connection shall be plugged, capped or otherwise sealed by the manufacturer prior to shipment to prevent entrance of foreign materials.

The dispensing system including the fuelling hose assembly shall be designed to provide electrical bonding from the point where the nozzle contacts the vehicle to the station ground (see 9.9.1).

The hose shall be protected with some means to ensure that it will not touch the ground if it is long enough to do so even if holstered.

5.4 Piping and fittings

Piping and fittings shall meet the following:

- a) Piping and fittings used to transport hydrogen in the dispenser shall conform to ISO 15649 or a national or regional standard. See 5.3 for the service requirements.
- b) Component pressure ratings shall meet or exceed the dispenser system MAWP. See 5.3 and ISO 19880-1:2020, Table 1.
- c) Piping and fittings shall be made of materials compatible with hydrogen service. See 5.3.
- d) Piping and tubing design, fabrication, testing and welded joints shall be done in accordance with ISO 15649 (or selected piping standard(s) per item 5.4 a) above).
- e) Where used, fittings shall be chemically compatible with associated components and shall be designed to resist electrolytic action.
- f) Cut ends and drilled holes in piping and tubing shall be carefully deburred. Deburring is the process where metal chips formed during the cutting or machining process are mechanically removed.
- g) An elastomeric part, not already evaluated as part of an approved component or assembly, when used in contact with compressed hydrogen gas, shall be tested as specified in ISO 3601-1, ISO 3601-2 and ISO 3601-3 for the following properties.

Minimum tensile strength and elongation after oven aging shall be as specified in ISO 3601-1, ISO 3601-2 and ISO 3601-3. The maximum service temperature used to determine the conditioning time and temperature for oven aging is $75\text{ }^{\circ}\text{C}$ unless the product is designated for use at a higher temperature or tests show that it will be exposed to a higher temperature.

Volume change and extraction shall be as specified in ISO 3601-3 except that the conditioning shall be for 96 h at 20,7 MPa at a temperature of 65 °C for compressed hydrogen gas, and for 70 h immersion in IRM903 oil and methanol. Volume change limits shall be -1 % to +25 %. Maximum extraction shall be + 10 %.

ISO 3601-3 provides for the testing of either finished elastomeric parts or sheet or slab material. The material tested shall be the same as that used in the device; however, sheet or slab material shall be tested when the subject parts are O-rings having diameters of less than 25 mm.

- h) Formed supply piping and tubing shall have all bends made in accordance with ISO 15649 (or selected piping standard per item a) above).
- i) Fittings shall be suitable for the pressure class and temperature rating of the dispenser.
- j) The use of tapered threaded components shall be minimized as much as possible. Close pipe nipples shall not be used.

5.5 Overpressure protection devices

In addition to the fault management by the dispensing system control system, dispensing system pressure protection by a pressure safety valve (PSV) or equivalent measure (such as an instrumented safeguarding system with an appropriate SIL (safety integrity level)) shall be provided in the dispensing system or on the hydrogen supply to the dispenser to protect against over-pressurization of the components and piping in the dispensing system as well as the vehicle high-pressure hydrogen storage system. As an alternative, an equivalent SIL-rated control may be used when allowed by local/national regulations.

Overpressure protection devices shall meet the following requirements.

- a) The set point for a dispenser PSV shall be no higher than the MAWP which corresponds to 137,5 % of HSL as defined in ISO 19880-1:2020, Table 1. For example, for 70 MPa HSL fuelling (the H70 pressure class), the PSV may be set at as high as 96,25 MPa.
- b) If any components in the dispenser system are rated below the pressure in [5.3](#), then the set point of the dispenser PSV shall be lowered to protect the lowest-rated component in the dispenser system.
- c) If a dispenser system is designed to dispense fuel at more than 1 HSL, then pressure protection is required to protect dispenser components that are unique to a particular HSL including the fuel assembly and the vehicle at each HSL. The set point for each HSL may be up to 1,375 % of HSL as defined above. See ISO 19880-1 for guidance.
- d) If such overpressure protection is not a part of a dispenser, instruction shall be provided to the installer of the dispenser on the requirement of such protection upstream of the dispenser connection.
- e) PSVs shall be designed and installed in accordance with ISO 19880-3 or the ISO 4126 series, when used.
- f) The discharge piping system from a PSV shall not restrict flow and shall be vented to a safe location. See ISO 19880-1 for additional guidance.

5.6 Filters

The dispenser shall include a filter located upstream of, and as close as possible to the dispenser hose breakaway device (see ISO 19880-1:2020, 9.2). Filters and other clean-up devices shall meet the following requirements.

- a) The rating of the filter housing component shall meet or exceed the dispenser system MAWP. See [5.3](#) and [5.4](#).
- b) Filters shall be of adequate size and construction for the applications. Particulate concentration shall be minimized to avoid contamination, clogging and erosion of hydrogen system components.
- c) The filter shall have a capability to prevent particulates larger than 5 µm with a minimum removal efficiency of 99 % under expected process conditions or alternatively be a 5 µm filter.

- d) Filters shall be installed in such a manner that the force required to install or open the filter will not permanently distort the piping or other components of the dispenser.
- e) It shall be possible for filters to be isolated and vented, and they shall be accessible for inspection, cleaning and replacement. The maintenance of filters shall be made available with minimum disturbance to the related device assembly or assemblies.

NOTE ISO 4022 and ISO 12500-1 and ISO 12500-3 provide recommended methodologies for the testing of filter efficiencies.

5.7 Valves

Valves used in piping systems for gaseous hydrogen shall be designed in accordance with ISO 15649 or a national or regional piping standard and meet ISO 19880-3.

The testing specified in ISO 19880-3 may be waived when sufficient evidence exists that the valve is acceptable for service in accordance with ISO 15649 or national/regional regulations and is shown to be suitable for use with compressed hydrogen gas. Suitability can be determined by test (ISO 19880-3) or acceptance by piping code or by field history.

Component ratings of dispenser valves shall meet or exceed the dispenser system MAWP and operating temperature range. See 5.3 and 5.4 as well as ISO 19880-1:2020, Table 1.

5.8 Venting

Venting shall be provided as follows.

- a) A dispenser shall be equipped with means for venting the release of hydrogen gas to an appropriate location or captive system. See ISO 19880-1 for guidance.
- b) When the nozzle has only a supply hose (no vent hose), the dispenser shall be equipped with a means to depressurize the fuel hose when fuelling is interrupted through activation of the ESS or when power to the dispenser is lost, so as to enable disconnection of the fuel hose from the vehicle.

5.9 Dispenser fuelling assembly

The station manufacturer shall ensure that dispensers are fitted with nozzles and associated components that are appropriate to the dispenser pressure class and that the pressure limits comply with the definition of pressure class.

Dispenser fuelling assembly or assemblies shall be provided as follows.

- a) The pressure drop between the dispenser (hose) pressure sensor and the nozzle shall not exceed 15 MPa at reference flow conditions based on requirements in SAE J2601.
- b) Dispensers shall be equipped with a means to secure and protect the fuelling hose and nozzle from damage when not in use and keep the nozzle sealing surfaces clean.

The fuelling nozzle should also be securely supported when not in use and protected from the accumulation of foreign matter (e.g., snow, ice or sand) that could impede operation. The device supporting the hose should be designed to ensure it does not cause misalignment when attaching the nozzle to the vehicle receptacle.

Where hoses are attached to a hose retrieving mechanism, the breakaway device shall be installed between the point of attachment of the hose retrieving mechanism to the hose and the nozzle, unless the retrieving mechanism separates from the hose at a force less than that of the breakaway device, has no impact on the operation of the hose breakaway feature and does not result in damage to the dispenser frame.

- c) The hose assembly and dispenser shall be designed so that if a user pulls or a vehicle drives away with the nozzle still attached, the hose assembly shall not be restricted by the dispenser, housing, or associated components that would prevent the breakaway from activating properly.

- d) The fuelling hose assembly shall be designed to ensure that air cannot enter it when the nozzle is removed from the receptacle.
- e) Hose assemblies shall comply with ISO 19880-5. Fuelling hoses shall be designed for hydrogen service and the environmental conditions at the site of use. Construction and materials shall be such as to prevent the trapping of hydrogen within or between the materials at a pressure that could damage the hose when the internal pressure is relieved. Metal mesh enforcement shall not be susceptible to corrosion from penetration of humidity, if such penetration is reasonably foreseeable during expected lifetime. The fuelling hose shall be strong enough to withstand without damage the expected loads (tensile and torsion) exerted by the user.
- f) If required for system flexibility upstream of the breakaway, the short hose assembly shall be of the length adequate for separation.
- g) Nozzles shall comply with ISO 17268 or SAE J2600. The nozzle shall match the pressure class of the dispenser.
- h) The connection points between the breakaway and the hose assembly shall be deemed compatible by both manufacturers. Transitional components not deemed suitable are prohibited.

5.10 Breakaway devices

A breakaway coupling shall be provided as part of the fuelling assembly to stop the release of high-pressure hydrogen from the dispenser in the event of a drive-away before the fuelling nozzle is disconnected from the vehicle.

The hose breakaway device shall be positioned such that when the fuelling hose is pulled along its axis, it will release without significant damage to the dispenser cabinet, the fuelling hose assembly, the venting hose assembly (if used), the nozzle, communication cables or any other connections in the dispenser hose assembly. If the fuelling assembly includes a venting hose, the latter shall also be fitted with a breakaway device that does not impede the function of the main fuel breakaway device.

Breakaway devices shall comply with ISO 19880-3.

5.11 Instruments for gaseous hydrogen systems

Instruments for gaseous hydrogen systems shall meet the following requirements.

- a) Instruments shall be rated for the pressure/temperature ratings and material shall be consistent for use in the piping system (as described in 5.4).
- b) Instruments shall be consistent with applicable provisions of IEC 60079-0 (and other parts of IEC 60079 which describe the type(s) of protection), and ISO 80079-36.
- c) Instruments dedicated for various functions on the fuelling station shall be suitable for their intended purpose.
- d) Instruments and gauges shall be designed and located such that, in the event of a leakage or rupture, and possible subsequent fire, the risk to personnel is minimised. For example, safety glass and blowout backs should be used on mechanical pressure gauges.
- e) Housings for control equipment should be designed to prevent any accumulation of hydrogen or other flammable gases.
- f) The dispenser shall be equipped with a device to indicate the hydrogen system pressure for maintenance personnel.
- g) All pressure gauges exposed to compressed hydrogen gas shall be suitable for use with it at the operating pressure and temperature range. The gauge shall read at least 1,2 times the maximum allowable working pressure of the system for which it is used, and shall have a dial face at least 63 mm in diameter

and an orifice no greater than 1,4 mm in diameter. Pressure gauges in a dispenser shall be of a safe construction in the case with a relief function.

5.12 Metering

Metering shall be provided as follows.

- a) If required for commercial sale of motor vehicle fuel, the dispenser shall feature a flow metering device or system connected to a readout giving the quantity of hydrogen dispensed for each vehicle fuelling operation (applicable national or local regulations specify the units and accuracy).
- b) When required by the fuelling protocol to calculate mass average flow of the hydrogen being dispensed, the flow meter shall measure the hydrogen flow over the operating range of flow rates and at the accuracy required by the fuelling protocol.
- c) A flowmeter housing shall meet ISO 15649 (or the selected piping standard in item a) of [5.4](#)) if the flowmeter body is in direct contact with compressed hydrogen.
- d) Flow meters shall be consistent with the explosive atmosphere area classification and service conditions of high-pressure hydrogen dispensing and shall comply with applicable provisions of ISO/TR 15916 and IEC 60079-0 (and other parts of IEC 60079 which describe the type(s) of protection) and ISO 80079-36.

5.13 Precoolers and precooler control

When precooling of hydrogen is required for dispensing, a precooler shall be provided to cool the hydrogen to a temperature of no lower than $-40\text{ }^{\circ}\text{C}$ at the fuelling hose assembly.

The precooler heat exchanger shall comply with ISO 15649 (or the selected piping standard in item a) of [5.4](#)).

The manufacturer, as part of the risk assessment, shall consider a possibility of cross-leakage of hydrogen into the coolant stream and provide required countermeasures, when necessary, to prevent over-pressurization of the coolant system and the accumulation of flammable gases within the systems.

5.14 Electrical equipment and wiring

5.14.1 General electrical requirements

Electrical components and wiring in the dispenser system shall comply with the applicable provisions of IEC 60204-1, IEC 60364 and, where located in the hazardous area, relevant parts of the IEC 60079 series.

5.14.2 Bonding and grounding

Electrical and hydrogen systems shall be bonded and provision shall be made to accommodate grounding as defined in ISO 19880-1:2020, Clauses 8 and 10 to prevent inadvertent ignition sources due to the build-up of static charges and electric shock. See [9.8](#) and [9.9](#) for required verification tests.

5.14.3 Safety instrumented systems

Electrical control systems, components of hydrogen dispensing systems and devices determined by the manufacturer to be safety-related control systems, shall comply with the requirements of IEC 60204-1 or equivalent regional standards.

The risk assessment in [7](#) shall determine what to do when there is a system fault on the process control or safety system.

Where the manufacturer's risk assessment requires a response to abnormal states (faults) with a greater reliability than that achievable from the control system, the dispenser system shall be additionally equipped with an independent safety system or layer of protection. IEC 61508 and IEC 61511 can be used for specification, design, testing, operation and maintenance of such a safety system. See ISO 19880-1:2020, Clause 11.

The safety system could be composed of several safety functions activated manually or automatically.

The configurations of process control and safety systems shall be documented. See ISO 19880-1 for guidance.

5.14.4 Illumination

Illumination techniques shall conform to the explosive atmosphere area classification of the dispenser system. See 5.2.1. Illumination hardware shall be installed per the manufacturer's instruction and conform to IEC-60204-1.

NOTE The standards from the IEC 60079 series for illumination are typically IEC 60079-0 in combination with IEC 60079-1, IEC 60079-11, and/or IEC 60079-15 or a mix of them in case of LEDs and other optical hazardous energy sources.

5.14.5 Payment terminals or fuelling authorizing systems

Payment terminals or fuelling authorization systems, where incorporated into a dispenser, shall conform to the hazardous area classification of the dispenser system. Hardware shall be installed per the manufacturer's instruction and conform to 5.14.1.

5.14.6 Electromagnetic compatibility and interference (EMC)

Hydrogen dispensers shall not emit electromagnetic noise that will interfere with other equipment at or near their sites and shall not be adversely affected by electromagnetic noise at or near their sites.

The electrical equipment and systems of hydrogen fuelling stations should comply with the applicable parts of the IEC 61000 series of standards. See ISO 19880-1 for guidance.

5.15 Emergency shutdown system (ESS)

The dispensing system shall operate in conjunction with an emergency shutdown system, which may be automatically activated by the dispensing system control system or manually activated. See ISO 19880-1 for guidance in establishing automatic actions based on the risk assessment in [Clause 7](#) and for provisions required for manual ESS connection and for coordination with the fuelling station control.

The emergency shutdown system shall be operational at all times and override all other functions and operations in all operating modes of the dispensing system.

Activation of the emergency shutdown shall cut off the flow of hydrogen gas to the dispenser and vehicle for the dispensing system which initiated the shutdown by closing the automatic isolation valves.

Other emergency shutdown functions that may need to be considered in the risk assessment include:

- vent any remaining gas in the dispensing system to an appropriate location;
- send a shut-down signal to the hydrogen station control system;
- send a shut-off signal to remove power to electrical components in the vicinity of the dispenser that are not suitable for classified areas.

Other emergency stop functions may need to be considered to leave the dispensing system in a safe state.

If the forecourt incorporates multiple dispensers, the need to execute an emergency shutdown for dispensers other than the affected dispenser shall be based on the risk assessment. (See [Clause 7](#)).

Operation of the dispenser after the emergency shutdown is tripped shall require, as a minimum, an inspection as to the cause of the shutdown and a manual reset.

Recommended selection, placement and connection of the emergency stop device shall be defined in the manufacturer's documentation. See ISO 19880-1 for guidance.

(Content sourced from ISO 19880-1:2020, 8.2.2.2 with modification).

6 Dispensing requirements

6.1 Control of dispensing

The dispenser shall meet the following requirements.

- a) The user of the dispenser shall have the ability to start and stop the automatic fuelling process from the dispensing area. The user shall not be provided with the ability to control the fuel process manually.
- b) The controls for start-up of the dispenser shall be located or oriented so that there is no possibility of accidental actuation. Switches, valves, etc., that can be activated with the power off and that can cause the system to function as soon as the power is restored shall not be used.
- c) The fuelling process shall involve at least two steps to initiate hydrogen flow to the vehicle:
 - 1) Removing the nozzle from the mounting and connecting it onto the vehicle receptacle (with instruction to the operator to ensure that the nozzle is correctly locked on to the vehicle receptacle); and,
 - 2) Commencing the automated fuelling process by a second action, for example, pressing a button or through a human-machine interface (HMI). The user shall be able to initiate fuelling only after the nozzle is properly connected and locked to the vehicle.
- d) The user interface of the dispenser shall provide all necessary information to operate and safely perform the fuelling process.

6.2 Dispensing temperature, pressure and flow rate

The ambient temperature at the fuelling station, and the temperature, pressure and mass flow rate of the hydrogen being dispensed shall be monitored. The station dispenser controller uses this data for the control system to manage the fuelling process.

The hydrogen temperature and pressure sensors measuring the delivery conditions of hydrogen to the vehicle shall be located upstream of and as close as possible to the connection point of the fuelling assembly to the dispenser, to detect any pressure degradation that can indicate a leak. Dispensing temperature of the hydrogen fuel shall be measured at less than 1 m upstream of the fuelling assembly.

NOTE An example of fuelling protocol requirements for the fuel temperature and pressure sensor location is described in ISO 19880-1.

The ambient temperature sensor shall not be located in the direct sunlight or influenced by other thermal sources so as to provide an accurate reading.

The accuracy of the ambient and fuel delivery temperature sensors shall be within ± 2 °C.

The accuracy of the pressure sensor(s) shall be within 1 % full scale.

Flow measurement shall be installed at the location in the dispensing system in the manner the manufacturer recommends, where minimum effect on the accuracy is expected.

Temperature and pressure sensors shall meet the applicable requirements of [5.11](#) and the flow meter shall meet those of [5.12](#).

6.3 Pressure integrity check (leak check)

Control systems on fuelling stations shall be designed to verify the integrity of the fuel hose, breakaway, nozzle and connection to the vehicle before the start of each fuelling process. The integrity test shall be able to detect a significant degradation of pressure (indicating a leak) and shall stop the fuelling process in the event of detection.

Additional high-pressure integrity checks during and/or after fuelling should be used until such time as the dispenser components have generated a satisfactory field data history.

6.4 Fuelling protocol and process limits

Dispensers shall be equipped with a control system that utilizes a fuelling protocol to control the fuelling process. The fuelling protocol shall meet the requirements in ISO 19880-1.

Isolation valve(s) shall meet the requirements in ISO 19880-1 to shut off hydrogen flow to the dispenser and shall not be used for process control.

Subject to the fuelling station design, a second isolation valve may be required per ISO 19880-1 to automatically shut off in the station at the inlet of the hydrogen line to the dispenser; this possibility shall be accommodated in the dispenser control.

Separate control valve(s) shall be used for process control of the fuelling protocol.

NOTE ISO 19885-1 is being developed to define the design requirements and verification of fuelling protocols for a wide range of applications including road vehicles and forklift trucks.

6.5 Post dispensing

If the fuelling hose needs to be depressurized after dispensing, for example, to release the nozzle, it shall be designed to ensure air cannot enter into the dispensing system and hydrogen shall be vented to a safe location.

7 Dispenser fault management

A risk assessment shall be conducted on the dispenser system. See ISO 19880-1 for the definition of dispenser system faults that shall be addressed as a minimum and for guidance in conducting the risk assessment.

The ability to activate an automatic emergency shutdown system (ESS) shall be provided if the dispensing control system detects a fault requiring isolation. See 5.15 and ISO 19880-1.

Examples of faults to activate the shutdown are as follows:

- mechanical ventilation failure, if applicable;
- hydrogen sensor (alarm);
- activation of tilt sensor, if applicable;
- gas leak sensor, if applicable;
- emergency stop button, if applicable.

Each dispenser shall be equipped with means to indicate the reason for any shutdown in a readily interpretable format for maintenance personnel.

8 Marking

8.1 General requirements

Marking material shall be identified by class number and meet the specifications in [Annex C](#). The specification of any class of marking shall not preclude the use of marking of a lower number class.

All metal marking materials shall be rustproof and shall be reasonably compatible with events and substances normally encountered in the fuelling environment (e.g., fuels, lubricants, sunlight, air, etc.).

All markings shall be suitable for surfaces upon which they are applied and shall demonstrate suitable legibility as specified under [9.12](#).

Markings and warnings shall comply with the requirements in ISO 19880-1. If, for example, filtration devices are used, the area adjacent to the devices shall be provided with a label or tag containing the following or

equivalent: “WARNING – Shut off the high-pressure hydrogen at the inlet and exit and depressurise the filter assembly per manufacturer’s instructions before servicing filter”.

Symbols shall comply with ISO 3864-2, note that applicable national or local regulations for the symbols can exist.

8.2 Dispenser name plate

Each dispenser assembly shall bear a plate or a combination of adjacent plates of Class IIIA marking material in [Annex C](#) located so as to be easily legible when the dispenser is in a normally installed position. This plate shall include, at a minimum, the following information:

- a) manufacturer’s name, trade name or other identification;
- b) date of manufacture;
- c) model name;
- d) manufacturing or serial number;
- e) operating service temperature;
- f) operating service pressure.

Other markings can be required by regulatory authorities.

8.3 Self-serve dispenser instructions

Dispensers intended for self-serve operation shall bear operating instructions which are easily read when the dispenser is in a normally installed position. Such instructions may be displayed via a Class III A or Class III B marking, operation screen or other method similarly resistant to removal. The instructions shall be understandable by an untrained, public user in the region of use.

9 Qualification tests

9.1 General

These qualification tests are intended to be performed to verify a design of a compressed hydrogen gas dispensing system.

The performance of a compressed hydrogen gas dispensing system shall meet the applicable requirements when tested as described herein. During these tests the dispensing system shall be operated according to the manufacturer’s instructions. If any indications are observed during the tests that the equipment will not continue to meet the requirements in normal service conditions, supplementary tests shall be conducted as deemed necessary to ensure safe service.

9.2 Standard test conditions

Representative samples of a dispensing system and its component parts are to be subjected to the tests described in these requirements.

Test gas and liquids as specified in these requirements shall be:

- hydrogen or helium for leakage tests;
- liquids (e.g., water) or gases for strength tests;
- hydrogen, helium, nitrogen or dry air for all other tests.

NOTE The above selections presume that individual components have already been tested for hydrogen compatibility as part of their component qualification. The purpose of these tests is to ensure proper assembly within the dispenser system.

All tests shall be conducted with the inlet pressure maintained at least 110 % of the manufacturer's specified MAWP, unless otherwise specified.

Tests are to be conducted at ambient temperature. Each component of a dispenser is tested at $20\text{ °C} \pm 15\text{ °C}$. Testing of a dispenser may be conducted at any temperature.

9.3 Proof pressure test

9.3.1 Acceptance criteria

The system or component under test shall show no visible deformation and no loss of functionality. It shall be checked for leakage in accordance with 9.4 and present no leakage.

9.3.2 Test method

The dispenser system and its components are tested for leakage under proof pressure. Components such as breakaways and hoses that are already proof-pressure tested and qualified are not subject to this test.

The inlet of the test system or component shall be connected to a source capable of supplying the necessary test pressure. Test media shall be either liquid or gas. With the inlet open and its outlet sealed, and the internal blocks made to assume the open position, the pressure shall be slowly increased to 150 % of the system or component pressure rating in the case of liquid or 110 % in the case of gas and that pressure shall be maintained for 10 min.

9.4 Leakage test

9.4.1 Acceptance criteria

Excluding leakage to a safe vent during the disconnection of a nozzle, all dispenser parts, including joints and connections, shall either:

- a) be bubble-free for 1 min and not show detectable pressure loss;
- b) meet the test criteria in accordance with ISO 19880-1.

9.4.2 Test method

This test shall be conducted using test gases for leak tests as specified in 9.2.

All manual and shut-off valves shall be held in the normal operating position for fuelling.

The dispenser, including any fuel temperature cooling system associated with the dispenser, shall be tested at the MAWP or no less than 85 % of the set point of the pressure relief device protecting the dispenser components and vehicle tank.

9.5 Impact test

9.5.1 Acceptance criteria

A plastic or polymeric-material panel used as part of the dispenser cabinet shall withstand a single impact of 6,7 J without developing cracks or other openings that expose bare live parts or gas-containing parts when subjected to the impact at cold temperature as described in the following test method.

9.5.2 Test method

This test shall be conducted at room temperature and minimum temperature specified by the manufacturer.

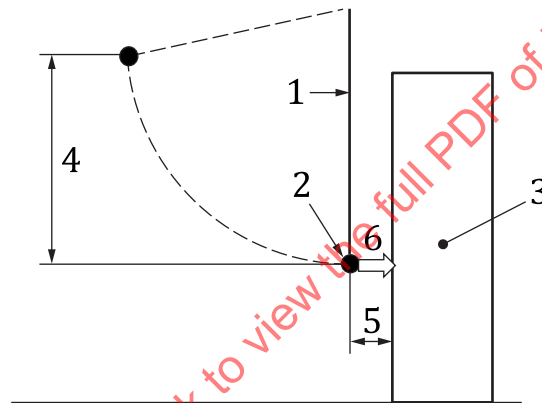
The panel should be in place on the dispenser cabinet. It shall be struck with an impact produced by a pendulum consisting of a 50 mm diameter steel ball weighing 0,525 kg suspended by a cable that provides a minimum of 1,3 m between the centre of the ball and the hinge point at the other end of the cable. See [Figure 2](#) for the test setup.

The ball shall have an at-rest position not more than 25 mm clear of the panel without any object interfering with the cable. The point of impact shall be determined as the point most likely to result in a failure when hit. The pendulum shall be raised along its arc until the ball is 1,3 m vertically above its at-rest position, and then released.

For the cold impact test, samples shall be conditioned at a minimum ambient temperature specified by the manufacturer for at least 24 h.

The conditioned samples shall be removed from the conditioning environment, quickly clamped into place on the dispenser cabinet, and impacted as previously described.

Alternatively, the impact test for enclosures in IEC 60079-0 may be used with an impact of 6,7 J at a minimum.



Key

1	cable > 1,3 m	4	1,3 m
2	steel ball Φ 50 mm, 0,525 kg	5	> 25 mm
3	dispenser	6	6,7 J

Figure 2 — Setup for impact test

9.6 Dispenser shutdown test

9.6.1 Acceptance criteria

A dispenser shall disable the flow of gas to the vehicle when ESS is activated. See [5.15](#). The dispenser shall cause gas flow to stop within 5 s of the activation of the ESS and all safety functions determined during the ESS risk assessment shall be activated.

9.6.2 Test method

The dispenser shall be tested using gas at least once. A device simulating an ESS shall be provided on the dispenser in accordance with the dispenser manufacturer's instructions. The dispenser shall be used to fill an appropriate storage container. The gas supply pressure to the dispenser shall be maintained within the pressure limits specified by the dispenser manufacturer for normal operation. The dispenser shall be operated to allow gas to flow into the storage container. While gas is flowing, the simulated ESS shall be activated.

For all inputs that can activate the ESS, the dispenser shall be tested without fuelling.

9.7 Hose rupture

9.7.1 General

If it is possible to carry out this test without a fuelling protocol, then it shall be conducted as a type test for the dispenser. If this is not possible, the test shall be conducted when the dispenser is integrated with a fuelling protocol as the first-of-the-kind test.

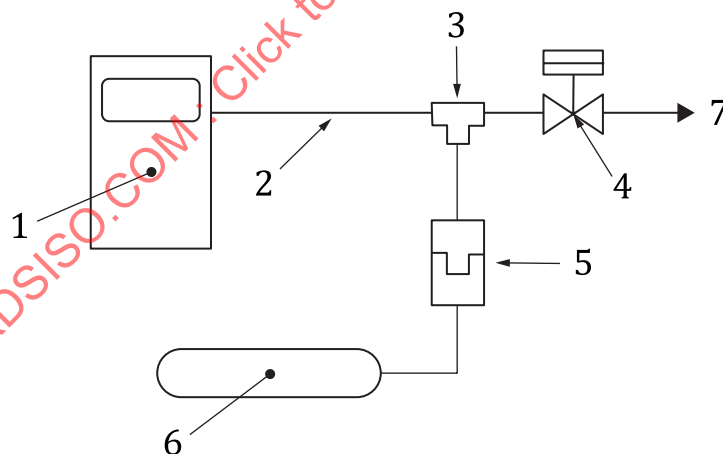
9.7.2 Acceptance criteria

Dispenser controls shall incorporate shutdown protection in the event of a rupture or rapid depressurization of the fuelling hose during refuelling. The dispenser shall stop the flow of gas within 5 s of opening the fast-opening valve.

9.7.3 Test method

A tee fitting shall be installed at the downstream of the dispenser fuelling hose and upstream of the nozzle. The hose shall be attached to one of the “through” ports of the tee fitting. A fast-opening valve shall be installed on the other “through” port. The nozzle shall be attached to the “stub” port of the tee. The test setup is shown in Figure 3. The tank size shall be between 50 l and 249 l. The tee fitting and valve shall have a combined C_v as close as practical to that of the hose. A valve permanently mounted inside the dispenser with a C_v less than the hose may be used in place of the temporary test setup. For safety reasons, the valve shall be secured so as not to move when the valve is opened to allow full flow. The nozzle shall be attached to an appropriate storage container.

The gas supply pressure to the dispenser shall be maintained 90 % of the MOP or higher. With the valve closed, the dispenser shall be operated to cause gas to flow into the storage container. After the fuelling hose pressure reaches 100 % of the MOP, the test valve shall be opened. This test shall be successfully conducted 5 times.



Key

- | | | | |
|---|-----------------|---|--|
| 1 | dispenser | 5 | nozzle & receptacle with a check valve |
| 2 | dispenser hose | 6 | storage container |
| 3 | tee fitting | 7 | vent to safe place |
| 4 | fast open valve | | |

Figure 3 — Setup for hose rupture test

9.8 Hose breakaway test

9.8.1 Acceptance criteria

When tested in accordance with the following method, the device shall separate upon application of a maximum pull force as specified in ISO 19880-3 when the device is installed as specified by the manufacturer. Upon separation under the pressurized condition, the flow of gas from the inlet component shall cease, and the flow of gas from the outlet component shall either cease within 1 s or bleed down the attached hose through a maximum 1,5 mm orifice.

Additionally, there shall be no significant damage, distortion or deformation of the hardware attaching the breakaway to the dispenser.

9.8.2 Test method

The device being tested shall be installed as specified by the manufacturer in a simulated dispenser with a breakaway device and simulated fuelling hose assembly. The test shall be performed at ambient temperature and the component pressure rating in the most critical direction. If the most critical direction cannot be determined, then additional tests will be required to test all directions that are a concern.

A direct tensile force shall be applied in the most critical direction beginning at zero force and increasing until the device separates. The device shall separate within the range of values specified in ISO 19880-3. If pressurized, the flow of gas from either half shall cease and shall not leak in excess of the specification in ISO 19880-3.

9.9 Prevention of electrostatic discharge

9.9.1 Acceptance criteria

The dispenser nozzle and fuelling hose shall be electrically continuous with (see [5.3](#)) the dispenser electrical grounding means.

The bonding resistance from the point where the nozzle contacts the vehicle receptacle back to the bonding connection to ground shall be less than 1 MΩ.

Even though the fuelling assembly needs to provide the electrical continuity required to meet this requirement, the hose assembly does not necessarily have to meet this requirement if separate bonding is provided within the fuelling assembly.

All dispenser hydrogen piping, equipment, frames and enclosures not addressed in [9.9](#) shall also be bonded to the bonding connection to the ground described above or another ground with a resistance of less than 1 MΩ.

9.9.2 Test method

An electrical potential ranging from 0 to 1 000 V dc shall be applied between the outlet of the dispenser nozzle and the point on the dispenser that is intended for attachment of the electrical grounding means. The bonding connection(s) may be also connected to the bonding connection to ground in [9.10](#).

The current between these two points shall be measured. The electrical resistance shall be calculated using [Formula \(2\)](#):

$$R = V/I \quad (2)$$

where

R is the resistance (Ω);

V is the applied potential (V dc);

I is the measured current (A).

NOTE See ISO 19880-1 for guidance.

9.10 Dispenser ground continuity test

9.10.1 Acceptance criteria

A dispenser shall be constructed so the dispenser cabinet, frame and similar non-current-carrying metal parts are electrically continuous to the means provided for equipment bonding. This provision shall be deemed met when the electrical resistance between the point of connection of the equipment grounding means and any non-current-carrying metal part is not more than 10 Ω , unless not in compliance with applicable electrical codes (nonconductive finishes may be scraped from the test points).

Electrical equipment and associated frames and enclosures that can become energised under first fault conditions shall be bonded and designed to be grounded as defined in IEC 60204-1 to prevent electric shock. See [9.8](#) for additional bonding and grounding requirements to prevent electrostatic discharges in hazardous areas.

9.10.2 Test method

The electrical resistance between the point of connection of the equipment bonding means and each non-current-carrying metal part shall be determined by measuring the potential drop between the two points when an alternating current of 20 A, derived from a power supply of not more than 12 V, is passed between the two points, dividing the measured potential drop by the current.

9.11 Dielectric voltage-withstand test

9.11.1 Acceptance criteria

Adequate dielectric shall be interposed between ungrounded current-carrying parts and those external surfaces which can be contacted.

9.11.2 Test method

When connected in the manner intended to a supply circuit of rated voltage and frequency, the dispenser shall be operated to equilibrium temperature. At the conclusion of the operating period specified, the applicable dielectric withstand test(s) specified below shall be conducted.

During the dielectric withstand tests, a 500 V-A or larger transformer, having an essentially sinusoidal output voltage which can be varied, shall be used. The applied potential shall be increased gradually from zero until the required test voltage is reached and shall be held at that value for 1 min. The use of a 500 V-A or larger transformer is not necessary if the high-potential testing equipment used maintains the specified high-potential voltage at the equipment during the test.

a) A dispenser shall be capable of withstanding, for 1 min without breakdown, the application of a rated frequency potential between high-voltage live parts and dead metal parts, and between live parts of high- and low-voltage circuits. The test potential shall be:

— 1 000 V plus twice rated voltage; except,

— 1 000 V for motors rated at not more than 373 W and not more than 250 V.

When higher than rated voltage is developed in a motor circuit through the use of capacitors, the rated voltage of the appliance shall be employed to determine the dielectric withstand test potential, unless the developed steady state capacitor voltage exceeds 500 V, in which case the test potential for the parts affected shall be 1 000 V plus twice the developed voltage.

- b) A low-voltage circuit shall be capable of withstanding, for 1 min without breakdown, a rated frequency potential of 500 V applied between low-voltage live parts of opposite polarity and between low-voltage live parts and dead metal parts.

The dielectric withstand test between low-voltage parts of opposite polarity need not be conducted on the complete assembly if the components have been separately subjected to this test condition.

The arrangement of the test circuit shall be such that, if the dielectric material breaks down, a positive signal will be obtained, rather than depending upon a visual inspection of the material.

The above test shall be conducted at the conclusion of the operating period of the test in [9.11](#).

9.12 Dispenser cabinet test

9.12.1 Acceptance criteria

A dispenser for outdoor installation shall be constructed so that it will function normally when subjected to a simulated water conditions representing the conditions at the area of installation.

It shall also prevent any significant foreign objects from entering. See item e) of [5.2.2](#).

9.12.2 Test method

This test shall be conducted in accordance with the required IP rating under IEC 60529.

9.13 Marking material adhesion and legibility test

9.13.1 Acceptance criteria

The adhesive quality and the legibility of marking materials shall not be adversely affected when the marking materials are exposed to heat and moisture as specified in the following test method.

9.13.2 Test method

The test shall be conducted as follows:

- a) Adhesive-type marking materials shall be applied to the particular type of finish used on the dispenser in production. A sample metal panel of this finish shall be cleaned with a solvent and dried. Half of the panel shall be wiped with a clean cloth lightly oiled with SAE-30 medium machine oil. Two samples of marking material shall be applied to the panel, one on the dry area and one on the oiled area. Test samples shall be applied with firm pressure, unless the manufacturer's application instructions specify otherwise. Each sample shall be allowed to set for 24 h at ambient temperature.

Each sample of marking material shall exhibit:

- 1) good adhesion and no curling at edges;
 - 2) no illegible or defaced printing when rubbed with thumb or finger pressure;
 - 3) good adhesion when a dull metal blade (as the back of a pocketknife blade) is held at 90 degrees (1,57 rad) to the applied marking and scraped across the edges of the marking.
- b) Non-adhesive-type marking material shall exhibit no illegible or defaced printing when rubbed with thumb or finger pressure. Two samples of marking material shall be tested.

- c) Samples of both adhesive- and non-adhesive-type marking materials shall then be placed in an oven for a period of 2 weeks with the oven temperature maintained at either:
- 1) 175 °C for Classes II A1, II A2, II A3, II A4 and III A1 marking materials;
 - 2) 120 °C for Classes III A2 and III B marking materials.

Following the oven test, adhesion and legibility of the samples shall be checked again as specified in items a) and b) above.

Samples shall then be immersed in water for a period of 24 h, after which adhesion and legibility shall be rechecked as specified in items a) and b) above.

Good adhesion and legibility qualities shall be obtained for all samples under the above-specified test conditions.

Final acceptance of marking materials shall be based on the suitability of the application of the marking material to the dispenser.

10 Routine tests

Each dispensing device assembly shall satisfy the acceptance criteria specified in [9.4.1](#), [9.10.1](#), and [9.11.1](#) when tested according to the test method described in [9.4.2](#), [9.10.2](#), and [9.11.2](#) respectively as routine production line tests.

11 Product literature

11.1 General

The dispenser manufacturer shall prepare and make available information required for product and station approval as well as information needed for proper and safe installation, operation and maintenance. Instructions or manuals should be in accordance with IEC/IEEE 82079-1.

The content of this literature will likely include process and electrical diagrams, illustrations, drawings or pictures, and instructions and explanations needed by the targeted audience. The documents should be clear and concise and in a form that can be easily understood in the country or region of use.

11.2 Installation

The installation manual typically defines proper storage (prior to installation) and handling of the equipment, siting requirements and restrictions, and instructions for mounting, electrical and process connection, and check-out prior to use.

Since the operation of the dispenser is highly dependent on the storage system, physical and functional interface requirements and restrictions should be clearly defined, including the expected range of operation and operating limits needed for the dispenser to operate correctly.

Instructions shall define methods to lift or move equipment so as not to expose site workers to physical hazards and avoid damage to the dispenser during siting. The proper method of mounting and the type of structure(s) that each device is intended to be mounted on shall be defined.

The installation shall be in accordance with the requirements of ISO 19880-1.

11.3 Maintenance and service

The manufacturer shall provide maintenance instructions for the dispenser, which may include instructions from respective component manufacturers (e.g., filters and seals).

Instructions for replacement of equipment shall define methods, when appropriate, to de-energize or depressurize/purge systems as well as any other steps necessary to safely conduct the maintenance or service activity. Instructions should address methods to properly install equipment such that the fuel system cleanliness is maintained. Instructions should also consider steps required to restore the equipment to operation such that personnel are not exposed to unnecessary hazards and that the hydrogen being dispensed meets ISO 14687.

11.4 Operation

Information needed by station operators and customers (users) to properly and safely fuel the vehicle should be provided.

NOTE 1 The station operator is responsible for maintenance and safe operation of the dispenser.

NOTE 2 In some jurisdictions, the user of the dispenser is the general public. In other jurisdictions, such as Japan, New Jersey and Oregon, the user is trained operator/personnel.

STANDARDSISO.COM : Click to view the full PDF of ISO 19880-2:2025