IECEx OD 290

Edition 2.0 2024-10

IECEx OPERATIONAL DOCUMENT

IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres (IECEx System)

IECEx certified equipment scheme – Harmonized procedures for IECEx certification of equipment, components and systems associated with the production, dispensing and use of gaseous hydrogen

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INTERNATIONAL
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IECEx operational document OD 290 –

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FOREWORD

This IECEx operational document OD 290 is an IECEx Scheme Document that sets out the harmonized procedures for IECEx certification of equipment, components and systems associated with the production, dispensing and use of gaseous hydrogen.

Document history

Date	Summary
2022-11	Original issue (Edition 1.0)
2024-10	Second edition to provide greater guidance on assessment and testing of Gaseous Hydrogen Fuel Dispensers

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INTRODUCTION

This document has been prepared to provide a uniform approach to certification of equipment, components and systems, associated with the production, distribution, dispensing and use of hydrogen, including gaseous hydrogen dispensing equipment, components and systems for light and heavy-duty vehicles, within the international IECEx equipment certification scheme of the IECEx System.

Certification of equipment suitable for use where hydrogen or other flammable gases, vapours or mists may be present has long been covered by IECEx. This document supplements the suite of IECEx rules and standard operating procedures, referred to as operational documents, (ODs) that govern the IECEx certified equipment scheme and has been prepared in close cooperation with officers and experts from ISO/TC 197: Hydrogen technologies.

An international standardized approach to testing and certification, as provided by the IEC Conformity Assessment System, known as IECEx, facilitates international trade and supports both the traditional hydrogen industries as well as the emerging low emission (also referred to as Low Carbon) hydrogen economy.

In support of this document, IECEx has issued the following forms:

a) a dedicated test report format (ExTR blank) to support the consistency in reporting test and assessment results by IECEx approved Testing Laboratories (ExTLs) and Certification Bodies (ExCBs).

b) A technical capability document (TCD) to assist in determining the capability of ExTLs/ExCBs to conduct testing and assessment according to this IECEx OD 290 and International Standards referenced in this IECEx OD 290

This document is to be used by all IECEx certification bodies and IECEx test laboratories when assessing and issuing IECEx certificates of conformity according for gaseous hydrogen dispensing equipment, components and systems for light and heavy-duty vehicles to the requirements of IEC TS 60079-46.

Attention is drawn to work within ISO TC 197 to develop a dedicated international standard for hydrogen dispensing equipment and that, when finalized, this operational document will be updated to take this new standard into account.

Additional information concerning this document or any other aspects of the international IECEx System can be found at www.iecex.com or contacting the IECEx Secretariat info@iecex.com.

Harmonized procedures for IECEx certification of equipment, components and systems associated with the production, dispensing and use of gaseous hydrogen

1 Scope

This document sets out the approach for certification of equipment, components and systems, associated with the production, distribution, dispensing and use of hydrogen, including gaseous hydrogen dispensing equipment, components and systems for light and heavy-duty vehicles, within the IECEx equipment certification scheme. It supplements existing scheme documents such as IECEx 02, IECEx OD 009 and IECEx OD 280. It covers information relevant to:

- IECEx certification bodies (ExCBs) and IECEx testing laboratories (ExTLs);
- manufacturers/applicants seeking IECEx certification; and
- assessment processes

This document shall be used in conjunction with IECEx OD 280.

This document is presented as an IECEx Scheme document and may contain requirements of a technical nature, for equipment, components and systems, in order to achieve a uniform application by all ExCBs and ExTLs when assessing compliance to certain international standards, for example, IEC TS 60079-46 for assemblies. This IECEx OD 290 will be further revised and updated as new or revised international standards have been published. For example, Annex A and Annex B contain technical requirements for gaseous hydrogen ispensers as an assembly, that align with requirements contained in current draft standard ISO/DIS 19880-2. The technical requirements in Annex A and Annex B will be deleted when that standard is published.

2 References

The following documents are referenced in this standard. The latest editions of those documents apply, except where indicated

IECEx 02, *IECEx certified equipment scheme covering equipment for use in explosive atmospheres – Rules of procedure*

IECEx OD 009, *Issuing of CoCs, ExTRs and QARs*

IECEx OD 025, *IECEx certified equipment scheme – Guidelines on the management of assessment and surveillance programmes for the assessment of manufacturer's quality systems, in accordance with the IECEx scheme*

IECEx OD 017, *Drawing and documentation guidance*

IECEx OD 024, *IECEx rules of procedure covering testing, or witnessing testing at a manufacturer's or user's facility*

IECEx OD 033, *IECEx unit verification certificates*

ExMC/271/INF *IECEx Procedures for the Processing of Applications for Extension of Scope from ExCBs and ExTLs*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

IECEx Technical Capability Document (TCD)

IECEx OD 280, *IECEx certified equipment scheme – Guide to certification of non-electrical equipment and protective systems*

IECEx Guide 02A, *Guidance for Applicants seeking IECEx Certification under the IECEx Certified Equipment Scheme, IECEx 02*

ISO/TR 15916, *Basic considerations for the safety of hydrogen systems*

IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirem*ents

IEC 60079-1, *Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"*

IEC 60079-2, *Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"*

IEC 60079-7, *Explosive atmospheres - Part 7: Equipment protection by increased safety "e"*

IEC 60079-10-1, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-11, *Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"*

IEC 60079-13, Explosive atmospheres - Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"

IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation "m"*

IEC TS 60079-46, *Explosive atmospheres – Part 46 - Equipment assemblies*

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 source "b", liquid immersion "k"

ISO 19880-1, *Gaseous hydrogen – Fuelling stations - Part 1: General requirements* (for information and support for later sections, but not for certification. Relevant requirements for dispensers are included in Annex A of this OD)

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

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

ISO 17268, *Gaseous hydrogen land vehicle refuelling connection devices* (for nozzles)

3 Standards to be used

The following standards and technical specifications are to be used for certification of gaseous hydrogen fuel dispensing equipment, components and systems in the IECEx equipment certification scheme:

IEC TS 60079-46 – for assemblies,

IEC 60079 and ISO/IEC 80079 Standards as referenced in IEC TS 60079-46

ISO 19880-1 for information and support for later sections, but not for certification. Relevant requirements for dispensers are included in Annex A of this OD.

ISO 19880-3 for valves

ISO 19880-5 for hoses

ISO 17268 for nozzles

NOTE: Other standards may be identified or developed, and this guide will be updated as necessary to address them.

4 Summary of the IECEx certification process

The IECEx certification process under the IECEx 02 on certified equipment scheme is detailed in IECEx OD 009. Additional information can be found on the IECEx website (www.iecex.com) in the information tab and IECEx Guide 02A.

5 Requirements to be met by ExCBs and ExTLs

5.1 Applications

To be able to issue IECEx certificates of conformity, IECEx test reports (ExTRs) for “Gaseous hydrogen fuelling stations” as well as issuing IECEx quality assessment reports (QARs), for the manufacturing quality of these products, in line with this operational document, ExCBs and ExTLs shall make application to the IECEx Secretariat using the following forms, as relevant:

- New ExCBs and ExTLs via Forms F-008 and F-009 respectively
- Existing ExCBs and ExTLs via Form F-011

The following shall be included in the application for the purposes of certifying gaseous hydrogen dispensers:

- This OD in conjunction with IEC TS 60079-46
- ISO 19880-3
- ISO 19880-5
- ISO 17268

As testing for the above standards is likely to be done by witness testing using IECEx OD 024, some bodies may have trouble obtaining local accreditation, to ISO 19880-3, ISO 19880-5 and ISO 17268. Where this is the case, IECEx peer assessment annual surveillance visits will not be required for bodies that hold local accreditation for other standards of the IEC 60079 series and ISO 80079 series in their scope.

An IECEx Technical Capability Document (TCD) with the Sections for ISO 19880-3, ISO 19880-5, ISO 17268 and IECEx OD 290 completed by the ExTL will be checked at the next IECEx peer assessment visit, for example, midterm or reassessment.

The ExCBs/ExTLs shall have the staff resources with a thorough understanding of ISO/TR 15916 and the above documents. They shall maintain written procedures demonstrating how they propose to comply with this operational document.

Once other standards in the ISO 19880 series have been issued, they may also be included in an application for scope extension by the ExTL/ExCB.

5.2 Additional standards that must be in the scope of the ExCB and ExTL

ExCBs and ExTLs shall have the following prerequisite standards within their scope, in addition to the standards listed in 5.1 above (either existing or as part of the application): IEC 60079-0,

IEC 60079-1, IEC 60079-2, IEC 60079-7, IEC 60079-11, IEC 60079-13, IEC 60079-18, IEC TS 60079-46, ISO 80079-36 and ISO 80079-37.

Where these standards are not already in scope, they shall be applied for using the appropriate forms in 5.1.

5.3 Acceptance of ExCBs and ExTLs

The acceptance of ExCBs and ExTLs to conduct testing and certification according to this operational document shall be handled as follows, as applicable:

a) New ExCBs and ExTLs seeking to join IECEx would be subject to a full initial assessment in accordance with IECEx 02 for the standards intended to be included in their scope, including all the standards specifically mentioned in 5.2.

b) Existing ExCBs and ExTLs seeking to include IEC 60079-1, IEC 60079-2, IEC 60079-7, IEC 60079-11, IEC 60079-13, IEC 60079-18, IEC TS 60079-46, ISO 80079-36 and ISO 80079-37 within their scope would be treated under existing scope extension approaches requiring a scope extension assessment and ballot voting by the ExMC.

Existing ExCBs and ExTLs which have all prerequisite standards already in their scope and which have submitted the IECEx Scope Extension Form, F-011 thereby declaring compliance with this IECEx OD 290, in terms of implementation within their Quality Management System, staff training and documented procedures to enable compliance with this IECEx OD 290 will have this scope extension reviewed by the IECEx Secretariat and granted according to the current version of ExMC/271/INF and will be included for review at the next scheduled IECEx assessment (annual assessment, mid-term assessment or re-assessment, whichever occurs first).

Following the granting of the scope extension to include IECEx OD 290, OD 001 (for ExCBs and ExTLs) and the public area (for ExCBs) on the IECEx website shall be updated to reflect the addition of IECEx OD 290 in the scope of the ExCB, noting that IECEx Certificates will show certification to IEC TS 60079-46 or the relevant ISO standards.

NOTE 1: The ExCB and ExTL need not be from the same certification agency.

NOTE 2: IECEx OD 280 sets out requirements for ExCBs and ExTLs seeking to include ISO 80079-36 and ISO 80079-37 within their scope.

5.4 Ignition hazard assessment and project plan

ExCBs/ExTLs shall have their own procedures on how they deal with an ignition hazard assessment based on the requirements of ISO 80079-36 and ISO 80079-37, and the project plan that is developed from an assessment. IECEx OD 280 contains information relevant to ignition hazard assessment that may be used for guidance.

5.5 Compliance with the technical requirements of the standards

5.5.1 Protection technique standards

Standards ISO 80079-36 and ISO 80079-37, and the ISO 19880 parts, include some tests that differ in detail from those in the IEC 60079 series, but the compliance methodologies are similar. Some test methods used in accordance with the IEC 60079 series may be adapted to suit specific situations when applying ISO 19880 parts and ISO 80079-36 and ISO 80079-37.

5.5.2 Product standards

For product related standards (for example, for valves, hoses, nozzles, hydrogen dispensers) the requirements of the relevant clauses of the ISO standards referenced in this operational document would be applied as they relate to the equipment being certified. In practice it is expected that the manufacturer would provide test reports issued by independent testing laboratories accredited under ISO/IEC 17025 by ILAC members. The test report and test data shall be rigorously reviewed by the ExTL/ExCB prior to acceptance.

NOTE: Certificates, where available may also be provided, in particular if they are IECEx certificates.

Alternatively, testing by a manufacturer, and testing at other locations, both under the provisions of IECEx OD 024, is also accepted regarding testing requirements of the standard(s). See 5.6.

5.6 Acceptance of third-party data

The ExCB/ExTL shall make a decision on what third-party data can be accepted. In practice it is likely to be the review prior to acceptance of test data along the lines already being applied for items such as RTI/TI information, metallic materials composition, plastic materials composition, UV resistance data, plastic/elastomeric material and temperature range data, material properties (for example, strength, hydrogen brittleness), hydrogen material compatibility and materials with dissimilar corrosion potentials.

5.7 Acceptance of manufacturer's data

Where tests are required to demonstrate compliance with the standards, manufacturer's data can be accepted if tests are witnessed in accordance with IECEx OD 024.

In general, data from the manufacturer can be accepted to support their ignition hazard assessment. It can also be used to assist in establishing the temperature class, in particular where this needs to be done by calculation.

NOTE: Guidance is given in IEC 60079-10-1. It can also be used to assist in classification of areas of the dispenser, in particular where this needs to be done by calculation.

6 Requirements of manufacturers

Manufacturers will be expected to provide the ExCB with the following:

- An overview of how they deem that their equipment complies with the standards to which they are applying for IECEx certification. This may include the preparation and submission to ExCB of an initial ignition hazard assessment as defined in ISO 80079-36.
- If required, make personnel with knowledge of the product available to assist the ExCB/ExTL personnel review the ignition hazard assessment.
- Provide documentation in the form addressed by OD 017 and as required by the relevant standards (for example, Clause 9.1 of ISO 80079-36 mandates the provision of certain information and there are also requirements in ISO 80079-37).
- Provide equipment as required for testing and assessment.

7 Treatment of equipment, components and systems for IECEx certification

7.1 Treatment of equipment, components and systems associated with gaseous hydrogen, other than hydrogen fuel dispensers

Manufacturers may apply for an IECEx Certificate of Conformity for compliance to an ISO or IEC International Standard related to gaseous hydrogen, to an ExCB in accordance with the IECEx scheme rules of IECEx 02 and related IECEx operational documents, for example, IECEx OD 009 and provide the ExCB with the information and detail specified in Clause 6 above.

Where an IEC or ISO Standard dedicated to the equipment, component or systems applicable (other than hydrogen fuel dispensers) to gaseous hydrogen exists, then that IEC or ISO Standard shall be used. In that case, the ExCB/ExTL shall have that IEC or ISO Standard in their IECEx certification Scope.

Only where no dedicated ISO Standard exists for the equipment, component or system then ISO 80079-36 shall be used.

7.2 Treatment of equipment, components and systems associated with gaseous hydrogen fuel dispensers

When assessing hydrogen fuel dispensing equipment for the purposes of IECEx certification, the equipment shall be covered as follows:

a) Individual items such as controllers, displays, user operated panels and switches. pressurized enclosures, flowmeters, and other items may be treated as equipment and covered by an IECEx Certificate of Conformity or IECEx Ex Component Certificate. For this situation it is expected that the application would come from the manufacturer of that equipment and the manufacturer would be subject to the usual quality assessments according to IECEx OD 025.

b) Some individual items of fuel dispensing equipment such as hoses, valves and nozzles where certified should be issued with IECEx Certificates of Conformity rather than Ex Component certificates. This may assist where interchangeability is needed.

c) Where the items do not hold an IECEx Certificate and they are not submitted by the manufacturer of the item, they shall be subject to assessment and where appropriate testing. Where an ExTR blank is available, the assessment and testing shall be documented and issued as an endorsed ExTR, but no individual certificates of conformity are required.

d) A collection of individual items or components forming a single operational unit (for example, a hydrogen fuel dispenser) shall be regarded as an assembly and covered by a single IECEx Certificate of Conformity, with IEC TS 60079-46 used as the primary standard for certification. In this situation, gaseous hydrogen fuel dispensing units shall also be subjected to the qualification and routine tests detailed in Annex A. The IECEx report package shall include the report cover, the IECEx ExTR blank for IEC TS 60079-46, ExTR Addendum_1A for H_2 dispensers (associated with this IECEx OD 290) and other IECEx ExTRs as necessary for the individual items/components.

NOTE: Refer to IECEx OD 033 for IECEx unit verification certificates issued for a defined number of products/items.

For hydrogen fuel dispensers being treated as assemblies, only the equipment on the assembly and the interconnections within the assembly shall be covered by certification not the installation aspects (for example, services to the assembly).

In some cases, certain tests may only be possible after assembly on site, for example, for pressure withstand test(s), temperature rise test. Final IECEx Certificates of Conformity shall not be issued until after these tests are completed successfully.

IEC TS 60079-46, Clause 4.3.2 requires for an equipment assembly with its own source of release that the manufacturer shall document the suitability of the equipment assembly for the intended end-site hazardous area classification and for the defined installation conditions.

IECEx OD 024 may need to be applied where testing on site is required.

8 Clarity of equipment covered by IECEx certification

The manufacturer applying for certification has the options provided in Clause 7 above. It is necessary to apply the specific requirements for gaseous hydrogen dispensing equipment, components and systems to the equipment being certified.

As an example for the above, where valves for use with hydrogen fuel dispensing equipment are certified, the IECEx certificate description would be expected to state, "*valves for use with gaseous hydrogen fuel dispensing equipment*".

Where equipment to be certified includes a combination of both electrical and non-electrical equipment such as a complete hydrogen fuel dispenser as an assembly, the following applies:

- IEC TS 60079-46 shall be shown on the certificate along with other Ex protection standards used in the certification process along with the relevant ISO Standards relating to the

equipment covered, for example, ISO 19880-3 for valves. The supporting ExTR shall include additional detail including a clear description of which parts/clauses of the relevant ISO Standard have been applied.

- The description of the equipment must make it clear what parts of the equipment are covered by the certification, noting the ability to add attachments to IECEx certificates.

As an example for the above, where a hydrogen fuel dispenser is being certified, the IECEx certificate would be expected to include the following as a minimum:

"Equipment" field on Page 1:	*"Gaseous hydrogen fuel dispenser type XXXXX"*
	"Gaseous hydrogen fuel valves XXXXX »
	"Gaseous hydrogen fuel meters XXXXX »
	"Gaseous hydrogen (part name) XXXXX"
"Equipment" description on Page 3:	Details of the parameters, such as:
	Rated working pressure
	Maximum working pressure
	Maximum flow rate
	Rated voltage
	Rated power

Where IECEx certification is requested only for specific batch of the dispensers, then an IECEx Unit Verification certificate can be issued according to IECEx OD 033.

9 Marking for IECEx Certification

9.1 General

The marking will have the IECEx certificate number with an "X" or "U" where required by IEC 60079-0.

For items certified under Clause 7.2 items a) and b), the marking requirements of the IEC or ISO Standard to which the equipment, part or component is certified to shall be met, for example, marking requirements of ISO 19880-3 shall be applied when issuing IECEx certificates to valves according to ISO 19880-3.

9.2 Marking requirements of collection of individual items/components forming a single operational unit (for example, hydrogen fuel dispensers).

For an assembly certified under Clause 7.2 item d) the Ex marking code will be similar to that provided in IEC TS 60079-46 or other applicable IEC 60079 or ISO/IEC 80079 series marking requirements, with next line after the Ex code to contain the following "H_2 pressure class xx" where the xx number is the Pressure Class according to ISO 19880-1.

Example 1:

IECEx ABC 22.0001X
Ex '60079-46' IIC T3 Gc
H_2 pressure class H70

Example 2:

IECEx ABC 22.0001X
Ex '60079-46' IIB+H_2 T3 Gc
H_2 pressure class H70

Annex A
(normative)

Requirements, dispensing requirements, dispensing fault management, qualification tests and routine tests to be conducted when assessing gaseous hydrogen dispensers as an assembly

A.1 Scope

This annex applies to gaseous hydrogen dispensing units and sets out the minimum assessment and qualification tests that are to be conducted when assessing gaseous hydrogen dispensers as an assembly according to IEC TS 60079-46, in order to ensure a consistent application of IEC TS 60079-46 when applied to gaseous hydrogen dispensers.

NOTE: The tests and requirements specified in this Annex have been selected in consultation with ISO TC 197: Hydrogen technologies, experts to align with their current work on gaseous hydrogen dispensers. Additional information is available in the latest draft ISO DIS 19880-2

The requirements of this Annex are in addition to the applicable safety requirements of the relevant industrial standards.

NOTE: It is not a requirement that compliance with the relevant industrial standards be verified.

A.2 Requirements

A.2.1 General material requirements

Materials shall comply with the following.

a) Materials exposed to hydrogen shall be compatible with hydrogen.

b) Materials used shall be rated for the temperature and pressure to which they will be exposed.

c) For non-metallic materials such as rubber or plastic, only those materials shall be selected that are appropriate for the service conditions, including environmental, 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, materials shall be selected that are 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.

NOTE: ISO TR 15619 gives guidance to typical material compatibility with hydrogen.

A.2.2 Construction and assembly requirements

A.2.2.1 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 IEC 60079 which describe the protection level), IEC 60079 14 regarding selection,

erection, installation and inspection, ISO 80079-36 for mechanical (non-electrical) level of protection.

NOTE: The definition of “area” in 3.3.1 of IEC 60079-10-1 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 with which service technicians may 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 A.5.12.

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 b) of A.2.9.

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 A.5.9.

The risk assessment conducted in accordance with 0 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, which can cause subsequent emergency shutdown if necessary.

A.2.2.2 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 (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 may 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 parts 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 A.5.5. Except as 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.

A.2.3 Dispenser hydrogen systems

In order to achieve the maximum operating pressure (MOP) needed to fill the compressed hydrogen storage system (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 maximum allowable working pressure (MAWP) are shown in Table 1 in ISO 19880-1. See ISO 19880-1 for explanation of dispenser pressure levels.

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

– a component pressure rating equal to or greater than 137.5 % of the dispenser hydrogen service level (HSL).
– an ambient temperature range of –40 °C to +50 °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, 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 A.5.3 and A.5.4. 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 A.5.9).

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.

A.2.4 Piping and fittings

Piping and fittings shall meet the following:

a) Piping and fittings used to transport hydrogen in the dispenser shall conform as a minimum to ISO 15649. See A.5.3 for the service requirements.

b) Component pressure ratings shall meet or exceed the dispenser system MAWP. See Table 1 in ISO 19880-1 and A.5.3.

c) Piping and fittings shall be made of materials compatible with hydrogen service. See A.5.3.

d) Piping and tubing design, fabrication, testing and welded joints shall be done in accordance with ISO 15649 as minimum.

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, 3601-2 and 3601-3 for the following properties.

   Minimum tensile strength and elongation after oven aging shall be as specified in ISO 3601-1, 3601-2 and 3601-3. The maximum service temperature used to determine the conditioning time and temperature for oven aging is 75 °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.

A.2.5 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 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.

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 Table 1 in ISO 19880-1. 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 A.2.3, 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 x 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, 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.

A.2.6 Filters

The dispenser shall include a filter located upstream of, and as close as possible to the dispenser hose breakaway device. [SOURCE: 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 A.2.3 and A.2.4.

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 5µm with a minimum removal efficiency of 99% under expected process conditions or be alternatively a 5µm 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 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 12500-1 and 12500-3 provide recommended methodologies for the testing of filter efficiencies.

A.2.7 Valves

Valves used in piping systems for gaseous hydrogen shall be designed in accordance with ISO 15649 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 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 A.2.3 and A.2.4 as well as Table 1 in ISO 19880-1.

A.2.8 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.

A.2.9 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 (for example, 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 fuelling hose assembly 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.

A.2.10 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

A.2.11 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 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 63mm in diameter and an orifice no greater than 1.4mm in diameter. Pressure gauges in a dispenser shall be of a safe construction in the case with a relief function.

A.2.12 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.

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 A.2.4), 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 15649 and IEC 60079-0 (and other parts of IEC 60079 which describe the type(s) of protection) and ISO 80079-36.

NOTE: The fuelling protocol determines the process and the rate for a dispenser to safely fill a vehicle.

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°C at the fuelling hose assembly.

The precooler heat exchanger shall comply with ISO 15649 (or the selected piping standard in item a) of A.2.4).

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.

A.2.13 Electrical equipment and wiring

A.2.13.1 General electrical requirements

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

NOTE: See Clause A.1 regarding industrial standards.

A.2.13.2 Bonding and grounding

Electrical and hydrogen systems shall be bonded and provision shall be made to accommodate grounding as defined in Clauses 8 and 10 of ISO 19880-1 to prevent inadvertent ignition sources due to the build-up of static charges and electric shock. See A.5.8 and A.5.9 for required verification tests.

A.2.13.3 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 5.4 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.

A.2.13.4 Illumination

Illumination techniques shall conform to the explosive atmosphere area classification of the dispenser system. See A.2.2.1. Illumination hardware shall be installed per the manufacturer’s instruction and conform to IEC 60204-1.

A.2.13.5 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 A.2.13.1.

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

A.2.13.6 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 shall comply with the applicable parts of the IEC 61000 series of standards. See ISO 19880-1 for guidance.

A.2.14 Emergency shutdown system (ESS)

The dispensing system shall operate in conjunction with an emergency shutdown system (ESS), 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 5.4 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 shutdown 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 5.4).

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 E stop shall be defined in the manufacturer’s documentation. See ISO 19880-1 for guidance.

[SOURCE: ISO 19880-1, 8.2.2.2 modified]

A.3 Dispensing requirements

A.3.1 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:

i) 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,

ii) Commencing the automated fuelling process by a second action, for example, pressing a button or through a human-machine interface (HMI). The user may only be able to initiate fuelling once 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.

A.3.2 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 dispenser hose breakaway device and as defined by the fuelling protocol, if applicable. 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 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 A.2.11 and the flow meter shall meet those of A.2.12.

A.3.3 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.

A.3.4 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.

A.3.5 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.

A.4 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 A.2.14 and ISO 19880-1.

Examples of fault 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.

A.5 Qualification tests

A.5.1 General

The following tests have been selected in consultation with ISO TC 197 experts to support a common approach in assessing gaseous hydrogen fuel dispensers and shall be conducted by the ExTL as part of the type testing programme when issuing an IECEx test report (ExTR) using the IECEx ExTR blank IEC 60079-46, along with the ExTR Addendum_1A for H_2 dispensers (associated with this OD 290), which are available from the IECEx website at www.iecex.com/members-area/documents/extr-blanks.

These qualification tests are intended to be performed to verify a design. Changes to the initial design require requalification and testing as deemed necessary.

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.

A.5.2 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, helium, hydrogen mixtures or helium mixtures for leakage tests,

– liquids (for example, water) or gases for strength tests, or

– 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 maximum allowable working pressure (MAWP), unless otherwise specified.

Tests are to be conducted at room temperature. Unless otherwise stated, testing at room temperature shall be conducted between 15 °C minimum and 30 °C maximum.

A.5.3 Proof pressure test

A.5.3.1 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.

A.5.3.2 Acceptance criteria

The system or component under test shall show no visible deformation and no loss of functionality. It shall be checked for leakage as provided in A.5.4 and present no leakage.

A.5.4 Leakage test

A.5.4.1 Test method

This test shall be conducted using test gases for leak tests as specified in A.5.2.

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 higher value of either the MAWP or no less than 90% of the set point of the pressure relief device protecting the dispenser components and vehicle tank.

A.5.4.2 Acceptance criteria

With the exception of leakage to a safe vent during the disconnection of a nozzle, all dispenser parts, including joints and connections, shall

a) be bubble-free for at least 1 min and not show detectable pressure loss.

b) meet the test criteria as stated in ISO 19880-1

A.5.5 Impact test

A.5.5.1 Test method

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

The panel should be in place on the dispenser cabinet. It shall be struck with a single 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 A.1 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 minimum ambient temperature specified by the manufacturer for at least 24 h.

The conditioned samples shall be removed from the conditioning environment and impacted as previously described.

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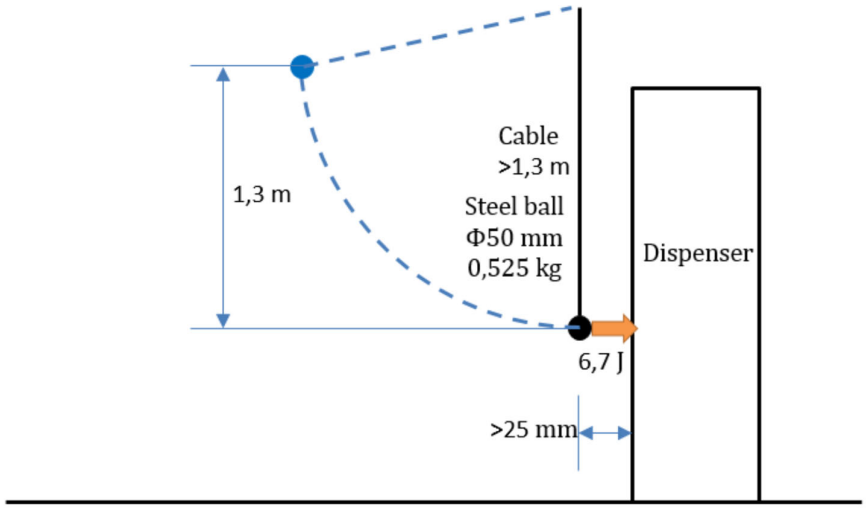


Figure A.1 – Impact test

Alternatively, the impact test for enclosures in IEC 60079-0 may be used with an impact of 6.7 J at a minimum, may be used.

NOTE: To use the test in IEC 60079-0 the dispenser will need to be placed on its back or the panel mounted in a frame that would allow it to be horizontal for the test.

A.5.5.2 Acceptance criteria

A plastic or polymeric-material panel used as part of a dispenser cabinet shall withstand a single impact of 6.7 J without developing cracks or other openings that expose bare live parts or gas-confining parts when subjected to room temperature and cold temperature impacts as described in the test method.

A.5.6 Dispenser shutdown test

A.5.6.1 Test method

The dispenser shall be tested using gas at least once. A device simulating an emergency shutdown system (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. The dispenser shall cause gas flow to stop within 5 s of the activation of the ESS.

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

A.5.6.2 Acceptance criteria

A dispenser shall disable the flow of gas to the vehicle when the ESS is activated. See A.2.14. 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.

A.5.7 Hose rupture

A.5.7.1 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.

A.5.7.2 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 A.2. The tank size (storage container in Figure A.2) shall be between 50 l and 249 l. The tee fitting and valve shall have a combined flow coefficient (Cv) as close as practical to that of the hose. A valve permanently mounted inside the dispenser with a Cv 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 at least 90% of the maximum operating pressure (MOP). 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.

A.5.7.3 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.

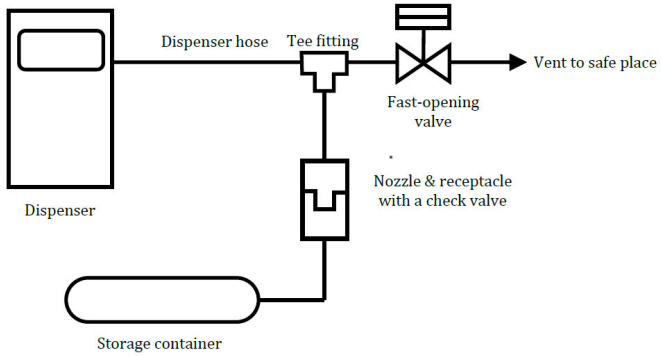


Figure A.2 – Hose rupture test setup

A.5.8 Hose breakaway test

A.5.8.1 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 maximum allowable working pressure (MAWP) 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 a force less than 220 N and increasing until the device separates. The device shall separate between 220 N and 1000 N. The flow of gas from either half shall cease and shall not leak in excess of the specification in ISO 19880-3.

A.5.8.2 Acceptance criteria

When tested in accordance with the above 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 (1) cease within 1 s or (2) 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.

A.5.9 Prevention of electrostatic discharge test

A.5.9.1 Test method

An electrical potential ranging from 0 to 1000 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 connections(s) may be also connected to the bonding connection to ground in A.5.10.

The current between these two points shall be measured. The electrical resistance shall be calculated using the following equation:

$$R = V / I$$

where

R = resistance (Ω)

V = applied potential (V dc)

I = measured current (A)

NOTE See ISO 19880-1 for guidance.

The resistance test shall be performed at a value less than or equal to 24 V.

A.5.9.2 Acceptance criteria

The dispenser nozzle and fuelling hose shall be electrically continuous with (see A.2.3) 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 A.5.8 shall also be bonded to less than 1 MΩ to the bonding connection to ground described above or another ground with a resistance of less than 1MΩ.

A.5.10 Dispenser (ground) continuity test

A.5.10.1 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.

A.5.10.2 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 energized under first fault conditions shall be bonded and designed to be grounded as defined in IEC 60204-1 to prevent electric shock. See A.2.13.2 for additional bonding and grounding requirements to prevent electrostatic discharges in hazardous areas

A.5.11 Dielectric voltage-withstand test

A.5.11.1 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 at least 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:

   1000 V plus twice rated voltage; except:

   1000 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 1000 V plus twice the developed voltage.

b) A low-voltage circuit shall be capable of withstanding, for at least 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.

A.5.11.2 Acceptance criteria

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

A.5.12 Dispenser cabinet test

A.5.12.1 Test method

Dispenser cabinets shall be subjected to the IP test aligned with the IP rating declared by the manufacturer but as a minimum shall be subjected to IP23 in accordance with IEC 60529.

A.5.12.2 Acceptance criteria

A dispenser for outdoor installation shall be constructed so that it will function normally when subjected to weather conditions representing the conditions at the area of installation as defined in the instructions. It shall also prevent any significant foreign objects from entering. See item e) of A.2.11.

A.6 Routine tests

Each dispensing device assembly shall satisfy the acceptance criteria specified in A.5.3 when tested according to the test method described in A.5.3.1, as a routine production line test.

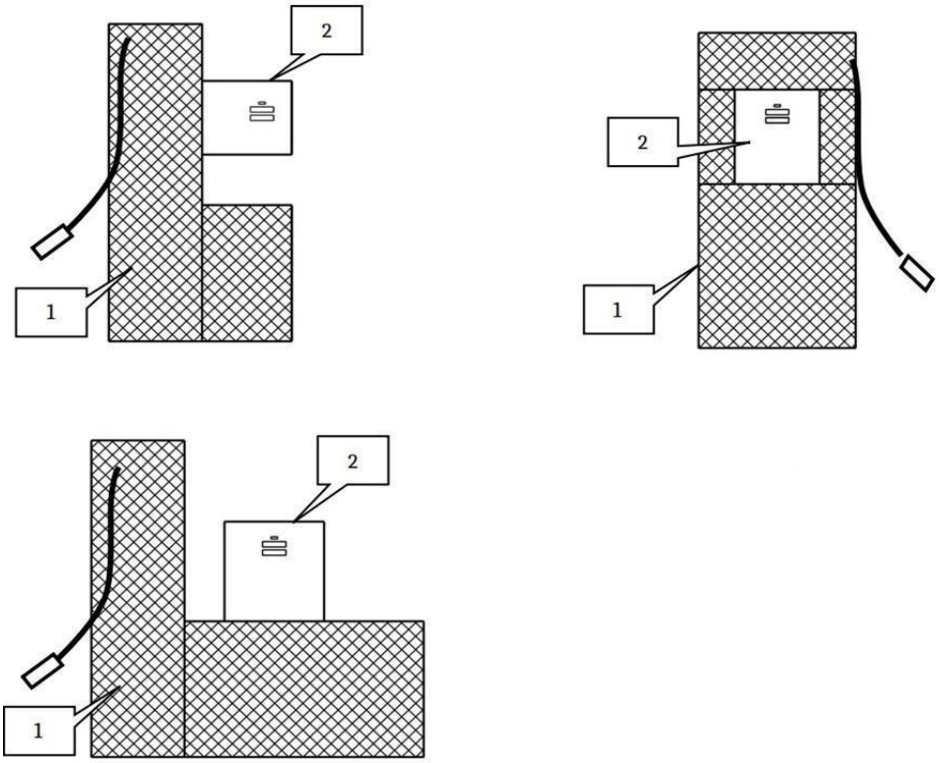
Annex B
(Informative)
Examples of hazardous area classification

Figure B.1 is informative and shows typical examples of the internal hazardous area classification of several dispenser styles. For a naturally ventilated dispenser, the area inside the enclosure containing hydrogen components and pipework is considered to be Zone 1, unless the assessment on release and ventilation in accordance with IEC 60079-10-1 results in a Zone 2 classification.

These examples are based on the current approach reflected in ISO DIS 19880-2 second edition. Refer to ISO DIS 19880.2 for further information.

NOTE: It is intended that Annex B of this document will be removed upon publication of ISO 19880-2 with a direct refence to it.

The electronic display housing may be non-hazardous by applying protective measures. These may include gas tight partitions or walls, pressurization (from the non-hazardous area), gas



detection or other means. Alternatively, if the interior of the electronic display housing is classified as a hazardous area, protection concepts in accordance with the IEC 60079 series of standards should be used.

Key

1. Enclosed area (hazardous\ area)
2. Electronic display enclosure (non-hazardous if protective measures are applied)

Note 1: A hose and nozzle connection point is not considered to create a hazardous area.

Note 2: Protective measures include gas-tight partitions or walls, pressurisation (from a safe area), gas detection, ventilation, continuous vapour barriers, and other means. Certified protection systems may also be used.

Figure B.1 — Examples of internal hazardous areas for dispenser