BS EN ISO 17268:2020

BSI Standards Publication

Gaseous hydrogen land vehicle refuelling connection devices

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National foreword

This British Standard is the UK implementation of EN ISO 17268:2020. It is identical to ISO 17268:2020. It supersedes BS EN ISO 17268:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/3/8, Gas containers - Hydrogen technologies.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Gaseous hydrogen land vehicle refuelling connection devices (ISO 17268:2020)

Dispositifs de raccordement pour le ravitaillement des véhicules terrestres en hydrogène gazeux (ISO 17268:2020)

This European Standard was approved by CEN on 24 January 2020.

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European foreword

This document (EN ISO 17268:2020) has been prepared by Technical Committee ISO/TC 197 "Hydrogen technologies" in collaboration with Technical Committee CEN/TC 268 “Cryogenic vessels and specific hydrogen technologies applications” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2020, and conflicting national standards shall be withdrawn at the latest by August 2020.

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Foreword

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This document was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 268, *Cryogenic vessels and specific hydrogen technologies applications*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 17268:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 1, Clause 2, 3.1, 4.9. 5.8, 5.9, 5.17, 6.1, 6.9, 7.2, 7.5, 7.7, 7.8, 7.12.2, 7.12.3, 7.12.4, 7.16, 7.22, 7.25, 7.26, 7.27, 7.28, Clause 9, Table 1, Figure 3, Figure 4, Annex A, Annex B, Annex C, Annex D, Annex E and Annex F have been modified.

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.

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Gaseous hydrogen land vehicle refuelling connection devices

1 Scope

This document defines the design, safety and operation characteristics of gaseous hydrogen land vehicle (GHLV) refuelling connectors.

GHLV refuelling connectors consist of the following components, as applicable:

— receptacle and protective cap (mounted on vehicle);

— nozzle;

— communication hardware.

This document is applicable to refuelling connectors which have nominal working pressures or hydrogen service levels up to 70 MPa.

This document is not applicable to refuelling connectors dispensing blends of hydrogen with natural gas.

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

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

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 12103-1, *Road vehicles — Test contaminants for filter evaluation — Part 1: Arizona test dust*

ISO 15501-1, *Road vehicles — Compressed natural gas (CNG) fuel systems — Part 1: Safety requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
communication hardware
infrared data association (IrDA) components which are used to transmit signals from the vehicle (*receptacle*) (3.15) to the dispenser (*nozzle*) (3.11) and designed to meet SAE J2799 or equivalent

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

Note 1 to entry: Components designed to the maximum allowable pressure per the European Pressure Equipment Directive (PED) represent the component ratings by the manufacturer that is indicated by the value of "PS."

Note 2 to entry: See Table 1 for required component pressure ratings for various *pressure classes* (3.13) of fuelling *connectors* (3.3).

Note 3 to entry: Further guidance on dispenser pressure terminology is included in ISO 19880-1.

Table 1 — Dispensing system pressure levels and refuelling connector ratings

NWP **(3.10) of vehicle (*receptacle*) (3.15) or *HSL* (3.7) of dispenser (*nozzle*) (3.11)**	***Pressure class*** **(3.13)**	***Maximum operating pressure (MOP)*** **(3.9)**	**Minimum dispenser component pressure rating (PS)**
Equal to NWP of the vehicle storage system per vehicle label		*1,25 × HSL/1,25 × NWP* *Highest fill pressure during normal fuelling*	*1,375 × HSL* *Highest permissible set-point for dispenser pressure protection in ISO 19880-1:—*, 8.2.2.3
11 MPa	H11	13,75 MPa	15,125 MPa
25 MPa	H25	31,25 MPa	34,375 MPa
35 MPa	H35 or H35HF[a]	43,75 MPa	48,125 MPa
70 MPa	H70	87,5 MPa	96,25MPa
[a] High-flow connectors for heavy-duty commercial vehicles.			

3.3
connector
joined assembly of *nozzle* (3.11) and *receptacle* (3.15) which permits the transfer of hydrogen

3.4
cycle
process of making a positive connection between the *nozzle* (3.11) and the *receptacle* (3.15), pressurizing to the *maximum operating pressure* (3.9), depressurizing and disconnecting

3.5
dry helium
helium with a dew point adequate to prevent condensation during testing and at least 99 % pure

3.6
dry hydrogen
hydrogen which meets or exceeds the quality level in ISO 14687-2

3.7
hydrogen service level
HSL
pressure level used to characterize the hydrogen service of the dispenser based on the *NWP* (3.10) rating of the vehicle

Note 1 to entry: The numerical value of HSL also matches the number after the "H" in the *pressure class* (3.13).

Note 2 to entry: HSL is expressed in MPa.

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3.8
leak test gas
gas for testing leaks that consists of *dry hydrogen* (3.6), or *dry helium* (3.5), or blends of a minimum 10 % of hydrogen or helium with nitrogen

3.9
maximum operating pressure
MOP
highest pressure that is expected for a component or system during normal operation

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

Note 2 to entry: The maximum operating pressure is 125 % of the *nominal working pressure* (3.10) or *hydrogen service level* (3.7), as applicable, for the purpose of testing of *nozzles* (3.11) and *receptacles* (3.15) in this document.

3.10
nominal working pressure
NWP
pressure of a full vehicle compressed hydrogen storage system at a gas temperature of 15 °C

Note 1 to entry: See ECE/TRANS/180/Add. 13 Global Technical Regulation No. 13 clause II-3.37.

Note 2 to entry: See Table 1 for NWPs covered in this document.

Note 3 to entry: Further guidance on pressure terminology is included in ISO 19880-1.

Note 4 to entry: NWP is also known as "settled pressure" in ISO 10286.

3.11
nozzle
device connected to a fuel dispensing system, which permits the quick connect and disconnect of fuel supply to the vehicle or storage system

3.12
positive locking device
device with the feature which requires actuation of an interlocking mechanism to achieve proper connection of the *nozzle* (3.11) to the *receptacle* (3.15) before pressure is applied

3.13
pressure class
non-dimensional rating of components that indicates the components are designed to dispense hydrogen to road vehicles at the required pressure and temperature

Note 1 to entry: See Table 1 for pressure classes of fuelling *connectors* (3.3).

Note 2 to entry: Further guidance on dispenser pressure terminology is included in ISO 19880-1.

3.14
protective cap
means to prevent dirt and other contaminants from getting into the inlet of the vehicle *receptacle* (3.15)

3.15
receptacle
device connected to a vehicle or storage system which receives the *nozzle* (3.11)

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

4 General construction requirements

4.1 Nozzles and receptacles shall be designed in accordance with reasonable concepts of safety, durability and maintainability.

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4.2 Nozzles and receptacles designed and tested in accordance with this document shall

a) prevent hydrogen fuelled vehicles from being filled by fuelling stations with working pressures and/or flow rates higher than the design values specified for the vehicle;

b) prevent hydrogen fuelled vehicles from being filled by other compressed gas fuelling stations, for example, natural gas and hydrogen-natural gas blends; and

c) prevent other gaseous fuelled vehicles from being filled by hydrogen fuelling stations.

4.3 Nozzles and receptacles shall be well fitted and manufactured in accordance with good engineering practice.

4.4 Nozzles and receptacles shall be

a) designed to minimise the possibility of incorrect assembly;

b) designed to be secure against displacement, distortion, warping or other damage;

c) constructed to maintain operational integrity under normal and reasonable conditions of handling and usage; and

d) designed with no self-evident means of defeating the safety features.

4.5 Nozzles and receptacles shall be manufactured of materials suitable and compatible for use with compressed hydrogen at the pressure and the temperature ranges to which they will be subjected as specified in 3.2, 5.8 and 6.9. Materials used in the construction of nozzles, receptacles and protective caps shall be non-sparking or spark-reducing. All pressure bearing and wetted components shall also be made from material that is compatible with deionised water. Non-metallic material compatibility shall be documented by the component manufacturer or an independent third party.

4.6 The nozzle shall be connected to or disconnected from the receptacle without the use of tools.

4.7 The H11 and H25 receptacles shall be mounted on the vehicle in compliance with ISO 15501-1. All other receptacles shall be mounted on the vehicle in compliance with the envelope requirements specified in Annex A.

4.8 Protective caps are intended to protect the receptacle from foreign debris and shall not hold pressure. Resistance shall be appropriate to prevent inadvertent dislodging. All protective caps shall have a retainer to attach them to the receptacle or vehicle.

4.9 Communications hardware which is supplied by the manufacturer and permanently integrated into the nozzle shall be attached to the nozzle and subjected to all of the nozzle tests. The communications hardware shall operate correctly upon completion of the all type and quality testing.

4.10 Nozzles and receptacles defined in this document can be used to fuel different types of GHLVs. The refuelling stations for these vehicles may have significantly different process limits and refuelling protocols. The nozzle and receptacle alone may not ensure that a GHLV cannot refuel at an incompatible station. If this occurs, the GHLV may be exposed to conditions outside of its intended limits, such as fuel container overheating. If this is a potential problem, the user and station manufacturer should develop additional controls to mitigate this risk.

4.11 As stated in ECE/TRANS/180/Add. 13 Global Technical Regulation No. 13 (Global technical regulation on hydrogen and fuel cell vehicles — 19 July 2013), "Assurance of capability to sustain multiple occurrences of over-pressurization due to fuelling station failure is provided by the requirement to demonstrate absence of leak in 10 exposures to 150 per cent NWP fuelling." It is presupposed that

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nozzles and receptacles defined in this document are tested in this way to accommodate similar fuelling station over-pressurization occurrences.

5 Nozzles

5.1 Nozzles shall be in accordance with the dimensional requirements of 6.1 to ensure proper interchangeability. Nozzles shall couple with receptacles of equal or higher nominal working pressures and they shall be designed so that they will not couple with receptacles of lower nominal working pressures. The nozzle shall extend to within 1 mm of the stop ring for all nominal working pressures. Nozzles shall be designed so that they will not couple with gaseous fuelled vehicles other than GHLV.

5.2 Nozzles shall be one of the following three types.

a) TYPE A — A nozzle for use with dispensing hoses that may remain fully pressurized at dispenser shutdown. The nozzle shall not allow gas to flow until a positive connection has been achieved. The nozzle shall be equipped with an integral valve or valves, incorporating an operating mechanism which first stops the supply of gas and safely vents the trapped gas before allowing the disconnection of the nozzle from the receptacle. The operating mechanism shall ensure the vent connection is open before the release mechanism can be operated and the gas located between the nozzle shut-off valve and the receptacle check valve is safely vented prior to nozzle disconnection.

b) TYPE B — A nozzle for use with dispensing hoses that may remain fully pressurized at dispenser shutdown. A separate three-way valve connected directly, or indirectly, to the inlet of the nozzle shall be used to safely vent trapped gas prior to nozzle disconnection. The nozzle shall not allow gas to flow until a positive connection has been achieved. Venting shall be achieved prior to disconnection of the nozzle. External three-way valves shall be constructed and marked so as to indicate clearly the open, shut and vent positions.

c) TYPE C — A nozzle for use with dispensing hoses which are depressurized (0,5 MPa and below) at dispenser shutdown. The nozzle shall not allow gas to flow until a positive connection has been achieved. The function of preventing flow may be controlled by the dispenser as long as it is receiving a positive connection signal from the nozzle.

5.3 Nozzles shall be designed for a life of 100 000 cycles with manufacturer specified maintenance. The three-way valve used for actuating Type B nozzles shall meet the same number of cycles as the nozzle (i.e. 100 000 cycles).

5.4 The act of venting, or de-pressurizing, of the connection space between all nozzle types and receptacles shall be performed prior to disconnection. A provision shall be made for the venting or de-pressurizing of all nozzle types to be directed to a safe location.

5.5 The means for attaching the nozzle to the fuel dispensing system hose shall not rely on the joint between the male and female threads for sealing, such as tapered pipe threads.

5.6 The H11 and H25 nozzles shall fit within the envelope described in ISO 15501-1. All other nozzles shall fit within the envelope specified in Annex A.

5.7 Nozzles shall have a means to prevent the ingress of solid matter from upstream sources. For example, the requirement shall be deemed met if the nozzle has a filter upstream of adequate size to protect its functionality.

5.8 The nozzle shall be designed to operate at ambient temperatures ranging from −40 °C to 65 °C and at hydrogen gas temperatures ranging from −40 °C to 85 °C.

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5.9 The nozzle shall be designed so that it does not freeze on the receptacle for more than 30 s after fuelling.

5.10 The nozzle shall not have any mechanical means of opening the receptacle check valve.

5.11 The appearance of the nozzle and receptacle shall be such as to clearly suggest the proper method of use.

5.12 It shall not be possible to deliver gas using any nozzles unless the nozzle and receptacle are connected properly and positively locked.

5.13 It shall not be possible to remove a nozzle when the contained pressure is greater than 1,0 MPa.

5.14 Upon disconnection, all types of nozzles shall stop the flow of gas. No hazardous condition shall result from disconnection.

5.15 Unpressurized nozzles shall require an axial force to connect and lock or unlock and disconnect the device of less than or equal to 90 N. On a secondary positive locking device which incorporates a rotary locking mechanism, the torque to lock or unlock the locking means shall not exceed 1 N·m. On a secondary positive locking device which incorporates an axial locking mechanism, the force to lock or unlock the locking means shall not exceed 90 N.

5.16 Pressurized Type A and B nozzles shall be capable of being disconnected with forces less than 450 N and torques less than 5 N·m.

5.17 Communication hardware which is supplied with the nozzle by the manufacturer shall be attached to the nozzle and subjected to the following design verification tests indicated by the corresponding subclause number:

7.6 Dropping

7.8 Valve operating handle

7.10 Abnormal loads

7.11 Low and high temperatures

7.12 Durability and maintainability

7.17 Corrosion resistance

7.18 Deformation

7.19 Contamination

7.20 Thermal cycle

7.21 Pre-cooled hydrogen exposure

7.25 User abuse

7.26 Freezing

If the communication hardware consists of electrical connectors, wires, covers or infrared (IR) filters, it shall be included as part of the tests.

If the IrDA receiver is replaceable in the field then the nozzle may be tested without the IrDA receiver. If the IrDA receiver is integrated into the nozzle or receptacle and cannot be replaced in the field, it

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shall be integrated into the nozzle during the tests. The IrDA transmitter may be tested without being integrated into a receptacle.

The communication hardware shall be fully operational upon completion of the above design verification tests as demonstrated by 7.28.

6 Receptacles

6.1 Standard receptacle dimensions: A receptacle shall be in accordance with the design specifications detailed in Annex B.

NOTE The main O-ring seal for all pressure ratings less than 70 MPa is situated at the leading edge of the receptacle. For the 70 MPa receptacle, the main O-ring seal is situated in the bore of the receptacle. The 70 MPa receptacle also includes an O-ring at the leading edge of the receptacle to seal with nozzles having pressure ratings less than 70 MPa.

In order to address freezing issues, the contact surface area between the nozzle and the receptacle on the back diameter (25 mm) may be reduced by modifying the shape of the receptacle body in this area. Annex F shows an example hex design which meets this criterion. The receptacle with the reduced contact area shall be in accordance with this document.

6.2 Receptacles shall be in accordance with this document. The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the receptacle design.

6.3 Receptacles shall be designed for a life of 15 000 cycles and 15 years with manufacturer specified maintenance.

6.4 Receptacle designs, which employ means on the back diameter to accommodate mounting, or for mounting accessories or marking purposes, shall not have such means extend beyond the back diameter dimensions of the profile specified in Annex B, as applicable. Acceptable means shall include wrench flats, protective cap anchoring grooves, use of hex stock, undercutting for marking, and threads for protective caps. Such receptacle designs shall not compromise proper nozzle interchangeability.

6.5 The receptacle shall be equipped with an internal check valve to prevent the escape of gas. The check valve shall be of the non-contact type, opening by differential pressure only.

6.6 The means for attaching the receptacle to the vehicle fuel system shall not rely on the joint between the male and female threads for sealing, such as tapered pipe threads.

6.7 Receptacles shall be designed so that they are either tolerant of solid contamination or have a means to protect themselves from said contamination to maintain safe functionality. For example, the requirement shall be deemed met if the receptacle has a filter upstream of adequate size to protect the functionality of the check valve. A receptacle shall have a means to prevent the ingress of fluids and foreign matter when disconnected.

6.8 The receptacle shall have provisions to be firmly attached to the vehicle and shall be in accordance with the applicable abnormal load tests specified in 7.10.

6.9 The receptacle shall be designed to operate at hydrogen gas temperatures ranging from −40 °C to 85 °C.

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7 Design verification test procedures

7.1 General requirements

Nozzles and receptacles shall meet the requirements of this document.

7.2 Test conditions

Unless otherwise stated

a) tests shall be conducted at 20 °C ± 5 °C;

b) all pressure tests shall be conducted with leak test gas unless otherwise noted;

c) all leak tests shall be conducted with leak test gas;

d) test fluids and devices shall be at equilibrium conditions with the test environment at the beginning of all tests: and

e) unless otherwise specified, the tolerances for testing temperatures and pressures are:

For low temperatures: T^{0}_{-3} °C

For high temperatures: T^{+3}_{0} °C

For pressures: P^{+3}_{0} % of the stated value

7.3 Nozzle tests

Nozzle tests shall be performed with the test fixtures identified under Annex C, Annex D or Annex E, as applicable. If a test fixture identified under Annex C, Annex D or Annex E is not specified, then receptacles specified under Annex B shall be used. A new receptacle test sample shall be used for each nozzle test. The failure of any test conducted with the nozzle and receptacle test sample shall constitute a failure of the nozzle design.

7.4 Receptacle tests

Receptacles shall be evaluated with nozzle(s) which have met the requirements of this document. The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the receptacle design.

7.5 User — Machine interface

This test shall be performed to verify the connection and disconnection forces and torques of an unpressurized and pressurized device.

The testing shall be performed at room temperature with the minimum temperature as specified in 5.8.

The disconnection forces and torques shall be applied in a direction that tends to disconnect and release the nozzle. The torque shall be applied to the disconnection/release actuator or three-way valve. For example, if there is a handle, the torque shall be applied through axis rotation of the nozzle handle equal to the exterior handling surface of the nozzle mechanism and in such a direction that tends to unhook and release the nozzle.

All nozzle types shall be connected to a receptacle using the tight test fixture specified in Annex D. The gas pressure in the assembly shall be less than 0,1 MPa. The force to connect and lock or unlock shall meet the requirements in 5.15 and 5.16.

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All nozzle types shall be connected to a receptacle using the loose test fixture specified in Annex C. The gas pressure in the assembly shall be set to 1,0 MPa. It shall not be possible to remove the nozzle from the receptacle.

A Type A or B nozzle shall be connected to a receptacle using the loose test fixture specified in Annex C. The gas pressure in the assembly shall be set to 7,5 MPa, 50 % and 100 % of the hydrogen service level.

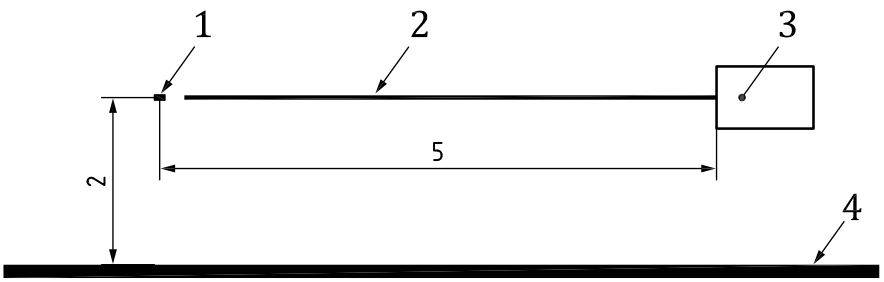
Upon disconnection, all types of nozzles shall stop the flow of gas. No hazardous condition shall result from disconnection.

7.6 Dropping

This test shall be performed to verify that a nozzle can safely withstand a drop of 2 m under –40 °C conditions.

A nozzle conditioned at –40 °C for 24 h shall be connected to a 5 m length of the appropriately rated fuelling hose, and then dropped 2 m onto a concrete floor as shown in Figure 1. The nozzle shall be dropped ten times within 5 min of removal from the conditioning chamber, then pressurized to the maximum operating pressure and subjected to ten additional drops within another 5 min.

Dimensions in metres



Key

1 support

2 11 mm diameter fuelling hose

3 nozzle

4 concrete floor

Figure 1 — Test arrangement for dropping test

Following all drops described previously, the nozzle shall be capable of normal connection to the receptacle. In addition, the nozzle shall meet the requirements of the leakage tests specified in 7.7 and 7.11, as well as the hydrostatic strength test specified in 7.16.

7.7 Leakage at room temperature

These tests shall be performed to verify the leakage rate of nozzle, receptacle, connector and receptacle check valve at room temperature using the loose and tight test fixtures specified in Annexes C and D, respectively.

Tests shall be conducted at 0,5 MPa and 150 % of the nominal working pressure or hydrogen service level, as applicable. All devices shall be checked for leakage from the time of connection, through pressurization, to the time of disconnection.

The pressurized leak test gas shall be applied to the inlet of the connector, the disconnected nozzle and the outlet of the disconnected receptacle, to verify the leakage rate of the nozzle.

To verify the leakage rate of the receptacle check valve, pressurized leak test gas shall be applied to the inlet of the connector. The nozzle shall be quickly disconnected and the receptacle check-valve checked for leakage.

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