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Gaseous hydrogen land vehicle refuelling connection devices —

Part 1:
Flow capacities up to and including 120 g/s

Dispositifs de raccordement pour le ravitaillement des véhicules terrestres en hydrogène gazeux —

Partie 1: Capacités de débit jusqu'à 120 g/s inclus

FDIS stage

Contents

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 first edition of ISO 17268-1, together with ISO 17268-2, cancels and replaces ISO 17268:2020.

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Field Code Changed

Gaseous hydrogen land vehicle refuelling connection devices — Part 1: Flow capacities up to and including 120 g/s

1 Scope

This document ~~defines~~specifies 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 and maximum flow rates up to 120 g/s.

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*

3 Terms and definitions

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

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

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

— IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

3.1 ~~3.1~~
communication hardware
infrared data association (IrDA) components which are used to transmit signals from the vehicle *(receptacle)* ~~(3.19)~~(3.19) to the dispenser *(nozzle)* ~~(3.14)~~(3.14) and designed to meet SAE J2799 or equivalent

3.2 ~~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: See ~~Table 1~~Table 1 for required component pressure ratings for various *pressure classes* ~~(3.16)~~(3.16) of fuelling *connectors* ~~(3.3)~~(3.3).

Note 2 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 ~~(3.13)~~(3.13) **of vehicle *(receptacle)*** ~~(3.19)~~(3.19) **or *HSL*** ~~(3.9)~~(3.9) **of dispenser *(nozzle)*** ~~(3.14)~~(3.14)	***Pressure class*** ~~(3.16)~~(3.16)	***Maximum operating pressure (MOP)*** ~~(3.12)~~(3.12)	**Dispensing system maximum allowable working pressure *(MAWP)*** ~~(3.11)~~(3.11) **Minimum dispenser component pressure rating**
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 setpoint for dispenser pressure protection in ISO 19880-1:2020, 8.2.2.3
35 MPa	H35 or H35MF[a]	43,75 MPa	48,125 MPa
70 MPa	H70	87,5 MPa	96,25 MPa
[a] Medium-flow connectors for heavy-duty commercial vehicles.			

3.3 ~~3.3~~
connector
joined assembly of *nozzle* ~~(3.14)~~(3.14) and *receptacle* ~~(3.19)~~(3.19) which permits the transfer of hydrogen

3.4 ~~3.4~~
cycle
process of making a positive connection between the *nozzle* ~~(3.14)~~(3.14) and the *receptacle* ~~(3.19)~~(3.19), pressurizing to the *maximum operating pressure* ~~(3.12)~~(3.12), depressurizing and disconnecting

3.5 ~~3.5~~
dry air
air with a dew point adequate to prevent condensation during testing

3.6 ~~3.6~~
dry helium
helium with a dew point adequate to prevent condensation during testing and at least 99 % pure

3.7 ~~3.7~~
dry hydrogen
hydrogen which meets or exceeds the quality level in ISO 14687

3.8 ~~3.8~~
hydrogen grade
level of hydrogen quality based upon ISO 14687

3.9 ~~3.9~~
hydrogen service level
HSL
pressure level used to characterize the hydrogen service of the dispenser based on the *NWP* ~~(3.13)~~(3.13) rating of the vehicle

Note 1 to entry: The numerical value of HSL also matches the number after the "H" in the *pressure class* ~~(3.16)~~.(3.16).

Note 2 to entry: HSL is expressed in MPa.

3.10 ~~3.10~~
leak test gas
gas for testing leaks that consists of *dry hydrogen* ~~(3.7)~~,(3.7), or *dry helium* ~~(3.6)~~,(3.6), or blends of a minimum 50 mmol/mol of hydrogen or helium with nitrogen

3.11 ~~3.11~~
maximum allowable working pressure
MAWP
maximum pressure permissible in a system at the temperature specified for the pressure

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

3.12 ~~3.12~~
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* ~~(3.13)~~(3.13) or *hydrogen service level* ~~(3.9)~~,(3.9), as applicable, for the purpose of testing of *nozzles* ~~(3.14)~~(3.14) and *receptacles* ~~(3.19)~~(3.19) in this document.

3.13 ~~3.13~~
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/Amend.1 Part II-3.37.

Note 2 to entry: See ~~Table 1~~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.

3.14 ~~3.14~~
nozzle
device connected to a fuel dispensing system, which permits the quick connect and disconnect of fuel supply to the vehicle or storage system

3.15 ~~3.15~~
positive locking device
device with the feature which requires actuation of an interlocking mechanism to achieve proper connection of the *nozzle* ~~(3.14)~~(3.14) to the *receptacle* ~~(3.19)~~(3.19) before pressure is applied

3.16 ~~3.16~~
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~~Table 1 for pressure classes of fuelling *connectors* ~~(3.3)~~.(3.3).

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

3.17 ~~3.17~~
pressure drop
difference in pressure between two specific points at specific flow conditions

3.18 ~~3.18~~
protective cap
means to prevent dirt and other contaminants from getting into the inlet of the vehicle *receptacle* ~~(3.19)~~(3.19)

3.19 ~~3.19~~
receptacle
device connected to a vehicle or storage system which receives the *nozzle* ~~(3.14)~~(3.14)

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

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

a) ~~a)~~ prevent hydrogen fuelled vehicles from being filled by fuelling stations with pressures higher than the design values specified for the vehicle, as shown in ~~Table 2~~;Table 2;

b) ~~b)~~ prevent hydrogen fuelled vehicles from being filled by fuelling stations with flow rates higher than the design values specified for the vehicle, as shown in ~~Table 2~~;Table 2;

c) ~~c)~~ prevent hydrogen fuel cell vehicles which can only use ISO 14687 Grade D hydrogen from being filled by fuelling stations that dispense ISO 14687 Grade F hydrogen, as shown in ~~Table 2~~Table 2;

d) ~~d)~~ allow for internal combustion hydrogen vehicles which use ISO 14687 Grade F hydrogen to be filled by fuelling stations that dispense ISO 14687 Grade D hydrogen, as shown in ~~Table 2~~Table 2;

e) ~~e)~~ prevent hydrogen fuelled vehicles from being filled by other compressed gas fuelling stations, including but not limited to those specified in ISO 16380, ISO 14469 and CSA NGV 1, as shown in ~~Table 3~~Table 3;

f) ~~f)~~ prevent other gaseous fuelled vehicles from being filled by hydrogen fuelling stations including but not limited to those specified in ISO 16380, ISO 14469 and CSA NGV 1, as shown in ~~Table 3~~Table 3.

Table 2 — Compatibility of nozzles and receptacles

	←Receptacle→						
Nozzle ↓	H35 Grade D	H35MF Grade D	H70 Grade D	H35 Grade F	H35MF Grade F	H70 Grade F	H35HF* H70HF*
H35 Grade D	O	O	O	O	O	O	X
H35MF Grade D	X	O	X	X	O	X	X
H70 Grade D	X	X	O	X	X	O	X
H35 Grade F	X	X	X	O	O	O	X
H35MF Grade F	X	X	X	X	O	X	X
H70 Grade F	X	X	X	X	X	O	X
H35HF* H70HF*	X	X	X	X	X	X	O

* H35HF and H70HF is mentioned in this document only for reference to future compatibility and will be specified in ISO 17268-2, when published

Key

O: Can connect

X: Cannot connect

Table 3 — Incompatibility of nozzles and receptacles with systems for other gaseous fuels

	←Receptacle→		
Nozzle ↓	ISO 16380	ISO 14469	CSA NGV1
H35 Grade D	X	X	X
H35MF	X	X	X

	←Receptacle→		
Nozzle ↓	ISO 16380	ISO 14469	CSA NGV1
Grade D			
H70 Grade D	X	X	X
H35 Grade F	X	X	X
H35MF Grade F	X	X	X
H70 Grade F	X	X	X
H35HF* H70HF*	X	X	X

* H35HF and H70HF is mentioned in this document only for reference to future compatibility and will be specified in ISO 17268-2, when published

Key

O: Can connect

X: Cannot connect

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

4.4 ~~4.4~~ Nozzles and receptacles shall be:

a) ~~a)~~ designed to minimise the possibility of incorrect assembly;

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

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

d) ~~d)~~ designed with no self-evident means of defeating the safety features without specialised knowledge and tooling;

e) ~~e)~~ designed for use by the general public with minimal training.

4.5 ~~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, 5.9 and 6.9.~~ 3.2, 5.9 and 6.9. All pressure bearing and wetted components shall also be made from material that is compatible with deionised water. Non-metallic material compatibility including compatibility of seal materials based on aging testing ~~(7.14)~~ (7.14) and hydrogen resistance testing ~~(7.15)~~ (7.15) for material malfunctions from diffusion and depressurization shall be documented by the component manufacturer or an independent third party.

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

4.7 ~~4.7~~ All receptacles shall be mounted on the vehicle in ~~compliance~~ conformance with the envelope requirements specified in ~~Annex A (Figure A.1).~~ Annex A (Figure A.1).

4.8 ~~4.8~~ Protective caps are intended to protect the receptacle or nozzle 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, vehicle, or nozzle.

4.9 ~~4.9~~ Nozzles and receptacles defined in this document can be used to fuel different types of GHLVs. The refuelling stations for these vehicles can have significantly different process limits and refuelling protocols. The nozzle and receptacle alone shall ensure that a GHLV cannot refuel at an incompatible station. If this occurs, the GHLV can 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.

4.10 ~~4.10~~ Nozzles and receptacles shall be tested for filling station over pressurization in accordance with Part I E. 81. (f) (iii) of ECE/TRANS/180/Add. 13/Amend 1 Global Technical Regulation No. 13 (Global technical regulation on hydrogen and fuel cell vehicles~~)..~~).

4.11 ~~4.11~~ The maximum volume of air allowed between the receptacle and nozzle after connection shall not exceed the volumes in ~~Table 4.~~Table 4.

Table 4 — Maximum volume of air allowed between nozzle and receptacle after connection

Pressure class	Nozzle allowable volume of air cm^3	Receptacle allowable volume of air cm^3
H35	4	4
H35MF	4	4
H70	2	2

4.12 ~~4.12~~ **Flow rate category**

The nozzle or receptacle shall be classified into the following maximum flow rate categories shown in ~~Table 5~~Table 5 based upon their anticipated usage. A nozzle or receptacle may have one or more maximum flow rate categories based upon their usage.

Table 5 — Maximum flow rate categories

Category	Maximum flow rate g/s
F30	30
F60	60
F90	90
F120	120

4.13 ~~4.13~~ **Pressure drop rating**

The pressure drop of a nozzle or receptacle should be measured at each of its flow rate categories using the procedure in ~~Annex G (Figures G.1–G.5).~~Annex G (Figures G.1 to G.5).

The pressure drop rating(s) should be communicated by the manufacturer through the documentation and instruction. The nomenclature of the pressure drop should be noted as the flow rate category plus P followed by the measured pressure drop in MPa. (~~e~~E.g~~., For,~~ for a nozzle with a flow rate category of 90 g/s and a measured pressure drop of 2 MPa, the nomenclature is: F90-P2.)

5 Nozzles

5.1 ~~5.1~~ Nozzles shall be in accordance with the dimensional requirements of ~~6.1~~6.1 to ensure proper interchangeability according to ~~4.2.~~4.2.

5.2 ~~5.2~~ Nozzles shall be one of the following three types.

a) ~~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) ~~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) ~~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 ~~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 ~~5.4~~ Nozzles that have been subjected to 10 over-pressurization occurrences shall be removed from service.

5.5 ~~5.5~~ 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.

5.6 ~~5.6~~ 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.

5.7 ~~5.7~~ All nozzles shall fit within the envelope specified in ~~Figure A.1. Annex A.~~Figure A.1.

5.8 ~~5.8~~ If the nozzle has means to prevent the ingress of solid matter from upstream sources, it shall be attached to the nozzle and subjected to all of the nozzle tests.

5.9 ~~5.9~~ The nozzle shall be designed to operate at the temperatures shown in ~~Table 6.~~Table 6.

