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Zunanje polnilne postaje za plinasti vodik in postopki polnjenja

Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols

Gasförmiger Wasserstoff - Betankungsanlagen - Teil 1: Allgemeine Anforderungen

Points de ravitaillement en hydrogène en extérieur distribuant de l'hydrogène gazeux et intégrant des protocoles de remplissage

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Gasförmiger Wasserstoff - Betankungsanlagen - Teil 1: Allgemeine Anforderungen

This European Standard was approved by CEN on 18 October 2020.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 17127:2020) has been prepared by 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of an identical text or by endorsement, at the latest by May 2021, and conflicting national standards shall be withdrawn at the latest by May 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 17127:2018.

Compared to the previous version, the following changes apply:

— Improvement of the definitions;

— The general requirements of the characteristics and properties of hydrogen refuelling points have been completed to provide more information;

— Clarification of the fuelling protocols;

— Revision of the acceptable test for the minimum SAT to ensure interoperability;

— Correction of Figure A.1.

This document has been prepared under Mandate M/533 given to CEN by the European Commission and the European Free Trade Association.

It applies to hydrogen refuelling points dispensing gaseous hydrogen to vehicles compliant with GTR13, UNECE R134 or Regulation (EC) No 79/2009.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom

Introduction

The European Commission in its standardization request M/533 of March 12th, 2015, aims to ensure that technical specifications for interoperability of refuelling points are specified in European Standards compatible with the relevant International Standards. These specifications aim to meet the European needs, be compatible and aligned as much as possible with relevant International Standards and as far as possible with existing refuelling infrastructure already in place and leave room to accommodate the adopted standard to local technical, analytical and regulatory needs. The requested European Standards aim to be technologically and commercially neutral and based on the know-how currently in possession of the EU industry and of the public sector on a fair, reasonable and non-discriminatory basis.

According to the legal requirements given in the Alternative Fuels Infrastructure Directive (AFID) and M/533, European Standards specifying only the required specifications for ensuring the interoperability of refuelling points have to be provided. European standards and common requirements with respect to "interoperability" mean the capacity of an infrastructure to supply energy (in this document hydrogen) that is compatible with all vehicle technologies and allows seamless EU-wide mobility and a clear definition of fuel pressure and temperature levels and connector designs.

The European Standardization Organizations (ESOs) should adopt European Standards in accordance with Article 10 of Regulation (EU) No 1025/2012 of the European Parliament and of the Council, and those standards should be based on current International Standards or ongoing international standardization work, where applicable.

Direction from the standardization request M/533 for European Standards for hydrogen supply are to *develop European Standards containing technical solutions for interoperability with technical specifications in regard to Article 5 and point 2 of Annex II, in particular for:*

a) outdoor hydrogen refuelling points dispensing gaseous hydrogen;

b) hydrogen purity dispensed by hydrogen refuelling points;

c) fuelling algorithms and equipment of hydrogen refuelling points;

d) connectors for vehicles for the refuelling of gaseous hydrogen.

This document specifies Items a) and c).

Item b) is covered by EN 17124 and Item d) by EN ISO 17268.

1 Scope

This document defines the minimum requirements to ensure the interoperability of hydrogen refuelling points, including refuelling protocols that dispense gaseous hydrogen to road vehicles (e.g. Fuel Cell Electric Vehicles*)* that comply with legislation applicable to such vehicles.

The safety and performance requirements for the entire hydrogen fuelling station, addressed in accordance with existing relevant European and national legislation, are not included in this document.

NOTE Guidance on considerations for hydrogen fuelling stations is provided in ISO 19880-1:2020.

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.

EN 17124, *Hydrogen fuel — Product specification and quality assurance — Proton exchange membrane (PEM) fuel cell applications for road vehicles*

EN ISO 17268, *Gaseous hydrogen land vehicle refuelling connection devices (ISO17268)*

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:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

NOTE Units used in this document follow SI (International System of Units).

3.1
compressed hydrogen storage system
CHSS
hydrogen storage on-board vehicle, as defined in the GTR#13 and UNECE R134

3.2
dispenser
equipment in the dispensing system, including the dispenser cabinet(s) and support structure, that is physically located in the fuelling area

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

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

3.3
dispenser cabinet
protective housing that encloses process piping and can also enclose measurement, control and ancillary dispenser equipment

3.4
dispenser fuel pressure
pressure of the hydrogen gas supplied to the vehicle by the refuelling point

Note 1 to entry: See Annex A for discussion of pressure terminology and its application to dispensing systems.

3.5
dispenser fuel temperature
temperature of the hydrogen gas supplied to the vehicle by the refuelling point

3.6
dispensing system
system downstream of the hydrogen supply system comprising all equipment necessary to carry out the vehicle refuelling operation, through which the compressed hydrogen is supplied to the vehicle

3.7
hydrogen fuelling station
facility for the dispensing of compressed hydrogen vehicle fuel, often referred to as a hydrogen refuelling station (HRS) or hydrogen filling station, including the supply of hydrogen compression, storage and dispensing systems

3.8
hydrogen service level
HSL
pressure level in MPa used to characterize the hydrogen service of the dispenser based on the NWP rating of the vehicle

Note 1 to entry: The numerical value of HSL also matches the number after the “H” in Pressure Class.

Note 2 to entry: See Annex A for application of pressure terminology to hydrogen dispenser systems and vehicles.

3.9
interoperability
capability of a hydrogen dispensing point to supply hydrogen at the fuelling station/vehicle interface that is compatible with road vehicles and allows seamless EU-wide mobility through applying clear definitions of connector designs, fuel quality, pressure levels, temperatures and other applicable considerations

3.10
maximum allowable working pressure
MAWP
maximum pressure permissible in a vessel or system at the temperature specified for the pressure

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

Note 2 to entry: See Annex A for application of pressure terminology to hydrogen dispenser systems and vehicles.

3.11
maximum/minimum allowable temperature
TS
values of the maximum/minimum temperatures at which safe and good functioning of the component is ensured and for which it has been designed, as specified by the manufacturer

3.12
maximum developed pressure
MDP
highest pressure expected during fault management by the dispensing system

Note 1 to entry: Per the GTR, the maximum developed pressure is 1,50 × NWP.

Note 2 to entry: The estimate of maximum developed pressure is based on a “worst case” assumptions — the highest possible setpoint for the pressure protection and maximum allowable values for setpoint accuracy and “lift” to open the PSV for full relieving.

3.13
maximum fuelling pressure
MFP
maximum pressure applied to the vehicle high pressure hydrogen system during refuelling. The maximum fuelling pressure is 125 per cent of the Nominal Working Pressure

Note 1 to entry: See GTR#13 Clause II-3.36, on Page 54.

Note 2 to entry: Also referred to as Maximum fill pressure.

3.14
maximum operating pressure
MOP
highest pressure that is expected for a component or system during normal operation

Note 1 to entry: See Annex A for application of pressure terminology to hydrogen dispenser systems and vehicles.

3.15
nominal working pressure
NWP
pressure of a-vehicle CHSS at 100% SOC at a gas temperature of 15 °C

Note 1 to entry: See GTR#13 Clause II-3.37, on Page 54.

Note 2 to entry: For road vehicles, this is typically 35 MPa or 70 MPa.

Note 3 to entry: See Annex A for application of pressure terminology to hydrogen dispenser systems and vehicles.

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: The numbers following ‘H’ in the pressure class are numerically the same as HSL, but the HSL identifies only the level of the dispensing service whereas the pressure class designation shows the component are fully capable of meeting the pressure and temperature requirements for dispensing hydrogen at the indicated service level.

Note 2 to entry: See Annex A for application of pressure terminology to hydrogen dispenser systems and vehicles.

3.17
Pressure safety valve
PSV
pressure activated valve that opens at specified set point to protect a system from rupture and re-closes when the pressure falls below the set point. PSVs protecting the dispensing system can reclose above the MOP

3.18
refuelling protocol
automated process to ensure safe filling of vehicles, called refuelling algorithms in the Alternative Fuel Infrastructure Directive (2014/94/EU)

3.19
state of charge
SOC
density (or mass) ratio of hydrogen in the compressed hydrogen storage system (CHSS) between the actual CHSS condition and the capacity at NWP when the system is equilibrated at 15 °C

Note 1 to entry: SOC is expressed as a percentage and is computed based on the gas density according to formula below.

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

$$SOC\ (\%) = \frac{\rho(P,\ T)}{\rho(NWP, 15\,°C)} \times 100 \qquad (1)$$

The hydrogen densities at the two major nominal working pressures are:

— density of H_2 at 35 MPa and 15 °C = 24,0 g/l;

— density of H_2 at 70 MPa and 15 °C = 40,2 g/l

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

3.20
target pressure
dispenser fuel pressure that the hydrogen fuelling protocol targets for the end of refuelling

4 Abbreviated terms

H35 Indication for 35 MPa NWP hydrogen refuelling as defined in EN ISO 17268

H70 Indication for 70 MPa NWP hydrogen refuelling as defined in EN ISO 17268

5 Characteristics and properties of hydrogen refuelling points

5.1 General requirements

The hydrogen refuelling point shall be able to refuel hydrogen vehicles certified according to UNECE R134 or Regulation (EC) No 79/2009 without compromising their specification limits.

NOTE 1 Assumptions made on the minimum characteristics of the hydrogen vehicle necessary to ensure interoperability with the refuelling points defined in this document are outlined in Annex A.

Hydrogen refuelling points that would potentially be harmful to vehicles compliant with UNECE R134 or Regulation (EC) No 79/2009 (for example, due to the protocol used) should use countermeasures to prevent unsafe refuelling from occurring.

NOTE 2 Examples of countermeasures that can be employed to prevent vehicles refuelling at refuelling points where the protocol could be unsafe for vehicles compliant with UNECE R134 or Regulation (EC) No 79/2009 are provided in Annex B.

Refuelling points shall provide hydrogen at either H35 and/or H70 (relating to an NWP in the vehicle of 35 MPa and 70 MPa respectively) via appropriately rated components.

The refuelling nozzle shall be compatible with vehicle hydrogen receptacles that comply with EN ISO 17268.

Instructions for use of the hydrogen refuelling point by the general public shall be included on or in the vicinity of each dispenser. The fuel (i.e. hydrogen) and pressure class shall be clearly indicated. Dispenser operation instructions for dispensing hydrogen into a vehicle may be displayed as markings or as an electronic display at the dispenser.

These instructions shall include prohibitions against:

— the use of adapters (e.g. 35 MPa vehicle refuelling from 70 MPa nozzle, or alternative fuel nozzles);

— the refuelling of cylinder systems (whether in a vehicle or not) that are incompatible with the fuelling protocol employed at the refuelling point, see 5.3.

NOTE 3 EN 16942 includes information on labelling requirements for hydrogen refuelling points, and hydrogen vehicles, in Europe

5.2 Fuel Quality

The hydrogen quality at the nozzle shall meet the requirements of EN 17124.

To prevent hydrogen containing function-impairing impurities (i.e. particulates) that would affect the high pressure hydrogen system of the vehicle, specifically the vehicle CHSS valves, hydrogen filters shall be included as part of the dispenser. There shall be a filter with a capability to prevent particulates of a maximum size of 5 µm with a minimum removal efficiency of 99 % under expected process conditions, or alternatively a 5 µm filter. The filter shall be installed downstream of dispenser components which could create particulates, such as a heat exchanger, flow controller, valves, etc. and be as close as possible to the nozzle or hose breakaway device. This shall filter out the particulate concentration in the hydrogen as per EN 17124.

All filters located at the nearest side to the nozzle shall be carefully selected by taking the robustness into account (for example the durability limitations of powdered sintered metal filters).

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