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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 17 December 2023.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 17127:2024) 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of an identical text or by endorsement, at the latest by August 2024, and conflicting national standards shall be withdrawn at the latest by August 2024.

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 17127:2020.

The main changes compared to the previous edition are listed below:

— Improvement of the definitions;

— The general requirements of the characteristics and properties of hydrogen refuelling points have been extended for higher flow rates needed for the refuelling of Heavy Duty Road vehicles;

— Communication is considered to improve the level of safety.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, Türkiye and the United Kingdom.

Introduction

The European Commission in its standardization requests M/533 of March 12th, 2015 and M/581 of March 24th, 2022, 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 the 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 Directive 2014/94/EU and the future EU Regulation repealing the Directive 2014/94/EU (AFIR) and M/533 and M/581, European Standards specifying only the required specifications for ensuring the interoperability of refuelling points should be provided. European standards and common requirements with respect to “interoperability” mean the capability 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.

This document also addresses the standardization request M/581 for a European standard supporting an interoperable infrastructure for hydrogen supply for road transport and containing technical specifications with a unified solution for hydrogen refuelling points dispensing compressed (gaseous) hydrogen for heavy duty vehicles.

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.

This document applies to hydrogen refuelling points dispensing gaseous hydrogen to vehicles compliant with UN R134 (Regulation No. 134), Regulation (EC) No 79/2009.

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 for hydrogen refuelling points dispensing gaseous hydrogen - Proton exchange membrane (PEM) fuel cell applications for vehicles*

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

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:

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

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

3.1
compressed hydrogen storage system
CHSS
hydrogen storage on-board vehicle

Note 1 to entry As defined in the UN R134 (Regulation No. 134)

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, one or more fuelling assemblies consisting of a nozzle, hose and break-away coupling, 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, such as compressor, pressure storage.

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
hydrogen refuelling point
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

[SOURCE: ISO 19880-1:2020]

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 refuelling 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 can also be defined as the design pressure, the maximum allowable operating pressure, the maximum permissible working pressure, or the maximum allowable pressure for the rating of pressure vessels and equipment manufactured in accordance with national pressure vessel codes.

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

3.11
maximum developed pressure
MDP
highest pressure expected during fault management by the dispensing system

Note 1 to entry: Per the UN R134 (Regulation No. 134), the maximum developed pressure is 1,50 × NWP.

Note 2 to entry: The estimate of maximum developed pressure is based on “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.

3.12
maximum fuelling pressure
MFP
maximum pressure applied to the vehicle high pressure hydrogen system during refuelling; 125 per cent of the nominal working pressure

Note 1 to entry: See UN R134 (Regulation No. 134) Clause II-3.36.

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

3.13
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.

3.14
nominal working pressure
NWP
pressure of a-vehicle CHSS at 100% SOC at a gas temperature of 15 °C

Note 1 to entry: See UN R134 (Regulation No. 134) Clause II-3.37.

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.

3.15
pressure class
non-dimensional rating of components that indicates that 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 the 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.

3.16
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 and which can reclose above the MOP

3.17
refuelling protocol
technical descriptions, instructions, or constructs that define how the dispensing of compressed gaseous hydrogen to storage systems on vehicles should be conducted and that serves as the basis for defining control strategies and algorithms for implementation in the basic process control of the dispensing control system hardware and software

Note 1 to entry: Fuelling protocols can range from simple descriptions that can be performed in hardware to complex programmable control functions using prescribed values, tables, and/or reduced-order models as well as conventional process controls such as feed-forward/feedback and predictor/corrector control functions.

Note 2 to entry: A refuelling protocol can be also referred to as a refuelling algorithm.

3.18
state of charge
SOC
density ratio of hydrogen in the 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 1 below.

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

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 up to 120 MPa at the time of publishing of this document.

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.