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Plinasti vodik - Polnilne postaje - 1. del: Splošne zahteve

Gaseous hydrogen - Fueling stations - Part 1: General requirements

Gasförmiger Wasserstoff - Betankungsanlagen - Teil 1: Allgemeine Anforderungen

Hydrogène gazeux - Stations de remplissage - Partie 1 : Exigences générales

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Gaseous hydrogen - Fueling stations - Part 1: General requirements

Hydrogène gazeux - Stations de remplissage - Partie 1 : Exigences générales

Gasförmiger Wasserstoff - Betankungsanlagen - Teil 1: Allgemeine Anforderungen

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

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European foreword

This document (prEN 17127:2017) 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 document is currently submitted to the CEN Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Introduction

The European Commission in its standardization request M533 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 M533, 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 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 [1].

The European Standardization Organisations (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 M533 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 European Standard deals with items 1 and 3. Item 2 is covered by prEN 17124, and item 4 is covered by EN ISO 17268:2016, as a replacement for ISO 17268:2012.

1) The energy to be supplied is hydrogen as a fuel and this fuel is dispensed in a hydrogen refuelling station meeting interoperability requirements.

1 Scope

This European Standard defines the minimum requirements to ensure the interoperability of public hydrogen refuelling points including refuelling protocols that dispense gaseous hydrogen to road vehicles (e.g. Fuel Cell Electric Vehicles).

The safety and performance requirements for the entire hydrogen refuelling station (HRS), addressed in accordance with existing relevant European and National legislation, are not included in this European Standard.

NOTE Guidance on considerations for hydrogen refuelling stations (HRS) is provided in ISO/TS 19880-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

3 Terms and definitions

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

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

3.1
compressed Hydrogen Storage System
CHSS
system designed to store hydrogen fuel in a hydrogen-fuelled vehicle and composed of a pressurized container, thermally activated pressure relief devices (TPRDs), and shut off device(s) that isolate the stored hydrogen from the remainder of the fuel system and its environment

3.2
hydrogen refuelling station
HRS
facility for the dispensing of compressed hydrogen vehicle fuel and includes the supply of hydrogen compression, storage and dispensing systems

3.3
HRS Interoperability
capacity of an infrastructure to supply energy at the HRS/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 and temperatures

3.4
maximum allowable pressure
PS
maximum pressure for which the stationary equipment is designed, as specified by the manufacturer, and defined at a location specified by him, being either the connection of protective and/or limiting devices, or the top of equipment or, if not appropriate, any point specified

3.5
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

3.6
maximum operating pressure
MOP
maximum fill pressure that the component or system of the vehicle is subjected to during normal operation

Note 1 to entry: This is the pressure for which hydrogen at a temperature of 85 °C would settled at the NWP at 15 °C.

3.7
nominal working pressure
NWP
settled gauge pressure at a gas temperature of 15 °C

3.8
refuelling protocol
protocol to ensure a safe filling of vehicles, called refuelling algorithms in the AFI Directive

3.9
safety distance
distance to acceptable risk level or minimum risk-informed distance between a hazard source and a target (human, equipment or environment) which will mitigate the effect of a likely foreseeable incident and prevent a minor incident escalating into a larger incident

3.10
safety measure
measure intended to protect a protected item located outside the facility from the effects of an identifiable gas leak caused by a malfunction when the facility is not operated as intended

Note 1 to entry: Safety measures include, but are not limited to, safety distances, sufficiently tall pressure relief lines, firewalls.

3.11
state of charge
SOC
ratio of CHSS hydrogen density to the density at NWP rated at the standard temperature 15 °C, expressed as a percentage and computed based on the gas density per the formula below:

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

Note 1 to entry: The densities of the two major pressure classes at 100 % SOC are:

— density of H35 at 35MPa and 15 °C = 24,0 g/L;

— density of H70 at 70MPa and 15 °C = 40,2 g/L.

4 Characteristics and properties of hydrogen refuelling points

4.1 General requirements

The hydrogen refuelling point should be able to refuel hydrogen vehicles certified according to UNECE R134 or EC 79/2009/EC as appropriate 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.

Publically accessible refuelling points that would potentially be harmful to vehicles compliant with UNECE R134 or EC 79/2009/EC (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 stations where the protocol could be unsafe for vehicles compliant with UNECE R134 or EC 79/2009/EC are provided in Annex B ISO/TS 19880-1.

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 comply with EN ISO 17268.

4.2 Fuel Quality

The hydrogen quality at the nozzle shall meet the requirements of prEN 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 prEN 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.

4.3 Validated refuelling protocol

4.3.1 Refuelling protocol process limits

The station dispenser shall terminate the refuelling within 5 s if any of the following refuelling protocol l requirements are not fulfilled:

— ambient temperature range between −40 °C and +50 °C;

— maximum operating pressure (MOP) shall be less than or equal to 125 % of the nominal working pressure. For example for 35 MPa the MOP is 43,75 MPa and for 70MPa it is 87,5 MPa;

— dispensers shall not fuel a vehicle which arrives with a pressure lower than 0,5 MPa, or a pressure greater than the appropiate vehicle NWP (i.e. 35 MPa or 70 MPa);

— minimum gas temperature shall be greater than or equal to −40 °C;

— maximum CHSS material temperature shall be less than 85 °C;

— maximum communicated CHSS temperature (where applicable) shall be less than 85 °C;

— maximum vehicle state of charge should be 100 % of the nominal state of charge;

— maximum fuel flow rate shall be no greater than 60 g/s for road vehicles, or 120 g/s for vehicles with this capability provided sufficient lockout measures are included (excluding non-refuelling time, for instance momentary excursions during the pressure pulse during start-up or leak checks);

— where communications are used, an abort or halt signal is received from the vehicle being filled;

— maximum pauses during refuelling of 10 times where the fuel flow rate drops below 0,6 g/s;

— the maximum hydrogen mass allowed to be transferred to the vehicle prior to the start of refuelling should be 200 g.

The above limits shall also be considered as part of the dispenser risk assessment, see Clause 5, with the possibility that additional countermeasures (beyond normal termination of the refuelling) may be required to prevent these limits from being exceeded.

If a fault condition leads to any of these refuelling protocol limits being exceeded repeatedly (>3 times), the station shall go into a state where no further vehicles can be fueled at this dispenser until the correct functionality of the dispenser has been confirmed.

If the refuelling process start-up procedure fails to lead to a refuelling event repeatedly (>3 times), the station should go into a state where subsequent refuellings at this dispenser are suspended for a pre-defined period of time.

The refuelling protocol should be appropriate for the range of vehicle tank capacities that are intended to be refuelled.

Lockout measures shall be included to prevent vehicles that are not suitable for the refuelling protocol from being filled.

For example, dispensers for heavy-duty vehicles should have adequate lock-out measures in place, see Annex B.

4.3.2 General requirements for the refuelling protocol

In order to ensure that the refuelling is conducted within the refuelling protocol process limits for vehicles compressed hydrogen storage systems as defined in 4.3.1 over the full range of ambient temperature defined in 4.3.1, hydrogen dispensers shall either:

— use an approved published refuelling protocol developed by a recognized standards development organization (SDO) such SAE J2601; or

— use protocols, that have been approved by the manufacturers of each vehicle to fuel at that station using that protocol.

The refuelling station operator shall take measures to prevent the refuelling of vehicles where refuelling protocols are not approved by the manufacturer(s) of the vehicles using the station.

NOTE Examples of countermeasures that can be employed to prevent vehicles refuelling at stations where the protocol has not been approved are provided in Annex B.

Measures shall be taken to ensure that H35 refuelling prior to H70 refuelling, or vice versa, cannot lead to an unsafe situation.