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SIST EN 17124:2018
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Vodik kot gorivo - Specifikacija proizvoda in zagotavljanje kakovosti plinastega vodika na polnilnih postajah - Gorivne celice z membrano za protonsko izmenjavo (PEM) za cestna vozila

Hydrogen fuel - Product specification and quality assurance for hydrogen refuelling points dispensing gaseous hydrogen - Proton exchange membrane (PEM) fuel cell applications for vehicles

Wasserstoff als Kraftstoff - Produktfestlegung und Qualitätssicherung - Protonenaustauschmembran (PEM) - Brennstoffzellenanwendungen für Straßenfahrzeuge

Carburant hydrogène - Spécification de produit et assurance qualité pour les points de ravitaillement en hydrogène distribuant de l'hydrogène gazeux - Applications des piles à combustible à membrane à échange de protons (MEP) pour les véhicules

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Wasserstoff als Kraftstoff - Produktfestlegung und Qualitätssicherung - Protonenaustauschmembran (PEM)-Brennstoffzellenanwendungen für Fahrzeuge

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Contents

Page

European foreword

This document (EN 17124:2022) 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of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by September 2022.

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1 Scope

This document specifies the quality characteristics of hydrogen fuel dispensed at hydrogen refuelling stations for use in proton exchange membrane (PEM) fuel cell vehicle systems, and the corresponding quality assurance considerations for ensuring uniformity of the hydrogen fuel.

2 Normative references

There are no normative references in this document.

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 https://www.electropedia.org/

3.1
constituent
component (or compound) found within a hydrogen fuel mixture

3.2
contaminant
impurity that adversely affects the components within the fuel cell system or the hydrogen storage system

Note 1 to entry: An adverse effect can be reversible or irreversible.

3.3
detection limit
lowest quantity of a substance that can be distinguished from the absence of that substance with a stated confidence limit

3.4
fuel cell system
power system used for the generation of electricity on a fuel cell vehicle, typically containing the following subsystems: fuel cell stack, air processing, fuel processing, thermal management and water management

3.5
hydrogen fuel index
fraction or percentage of a fuel mixture that is hydrogen

3.6
irreversible effect
effect which results in a permanent degradation of the fuel cell power system performance that cannot be restored by practical changes of operational conditions and/or gas composition

3.7
on-site fuel supply
hydrogen fuel supplying system with a hydrogen production system in the same site

3.8
off-site fuel supply
hydrogen fuel supplying system without a hydrogen production system in the same site, receiving hydrogen fuel which is produced out of the site

3.9
particulate
solid or liquid particle (aerosol) that can be entrained somewhere in the delivery, storage, or transfer of the hydrogen fuel

3.10
reversible effect
effect which results in a non-permanent degradation of the fuel cell power system performance that can be restored by practical changes of operational conditions and/or gas composition

4 Requirements

The fuel quality requirements at the dispenser nozzle shall meet the requirements of Table 1.

NOTE The fuel specification is not process or feedstock specific. Non-listed contaminants have no guarantee of being benign.

Table 1 — Fuel quality specifications for PEM fuel cell road vehicle applications

Constituent	Characteristics
Hydrogen fuel index (minimum mole fraction) [a]	99,97 %
Total non-hydrogen gases	300 µmol/mol
Maximum concentration of individual contaminants	
Water (H_2O)	5 µmol/mol
Total hydrocarbons (THC) [b] (Excluding Methane)	2 µmol/mol
Methane (CH_4)	100 µmol/mol
Oxygen (O_2)	5 µmol/mol
Helium (He)	300 µmol/mol
Nitrogen (N_2)	300 µmol/mol
Argon (Ar)	300 µmol/mol
Carbon dioxide (CO_2)	2 µmol/mol
Carbon monoxide (CO) [c]	0,2 µmol/mol
Total sulfur compounds (H_2S basis)	0,004 µmol/mol
Formaldehyde (HCHO) [c]	0,2 µmol/mol
Formic acid (HCOOH) [c]	0,2 µmol/mol
Ammonia (NH_3)	0,1 µmol/mol
Halogenated compounds [d] (Halogenate ion basis)	0,05 µmol/mol
Maximum particulates concentration	1 mg/kg
For the constituents that are additive, such as total hydrocarbons and total sulfur compounds, the sum of the constituents shall be less than or equal to the acceptable limit.	
[a] The hydrogen fuel index is determined by substracting the “total non-hydrogen gases” in this table, expressed in mole percent, from 100 mol percent. [b] Total hydrocarbons include oxygenated organic species. Total hydrocarbons shall be measured on a carbon basis (µmolC/mol). [c] Total of CO, HCHO, HCOOH shall not exceed 0,2 µmol/mol. [d] All halogenated compounds which could potentially be in the hydrogen gas (for example, hydrogen chloride (HCl), and organic halides (R-X)) should be determined according to the hydrogen quality assurance discussed in Clause 5 and the sum shall be less than 0,05 µmol /mol).	

5 Hydrogen Quality Assurance Methodology

5.1 General Requirements – Potential sources of impurities

A quality assurance plan for the entire supply chain shall be created to ensure that the hydrogen quality will meet the requirements listed in Clause 4. The methodology used to develop the quality assurance plan can vary but shall include one of the two approaches described in this document. The general description of these two approaches are described in 5.2 and 5.3.

For a given Hydrogen Refuelling Station (HRS), the contaminants listed in the hydrogen specification referred to Table 1 could be present. There are several parts of the supply chain where impurities can be introduced. Annex B describes potential impurities at each step of the supply chain.

When a contaminant is classified as potentially present, it shall be taken into account in the Quality Assurance methodology (risk assessment or prescriptive approach) described below.

5.2 Prescriptive Approach for Hydrogen Quality Assurance

A prescriptive approach can be applied for clearly identified supply chains. The prescriptive approach is not defined in this document.

5.3 Risk Assessment for Hydrogen and Quality Assurance

Risk assessment consists of identifying the probability of having each impurity above the threshold values of specifications given in Table 1 and evaluating the severity of each impurity for the fuel cell car. As an aid to clearly defining the risk(s) for risk assessment purposes, three fundamental questions are often helpful:

— What might go wrong: which event could cause the impurities to be above the threshold value?

— What is the likelihood (probability of occurrence) that impurities could be above the threshold value?

— What are the consequences (severity) for the fuel cell car?

In doing an effective risk assessment, the robustness of the data set is important because it determines the quality of the output. Revealing assumptions and reasonable sources of uncertainty will enhance confidence in this output and/or help identify its limitations. The output of the risk assessment is a qualitative description of a range of risk. The probability of an occurrence, in which each hydrogen impurity exceeds the threshold value, is defined by the following table of occurrence classes:

Table 2 — Occurrence classes for an impurity

Occurrence class	Class name	Occurrence or frequency	Occurrence or frequency (example) [a]
0	**Very unlikely (Practically impossible)**	Contaminant above threshold never been observed for this source / supply chain / station	1 per 10 000 000 refueling
1	**Unlikely**	Known to occur at least once for this source / supply chain/ station	1 per 1 000 000 refueling
2	**Possible**	Has happened once a year for this source / supply chain / station	1 per 100 000 refueling
3	**Likely**	Has happened more than once a year for this source / supply chain / station	1 out of 10 000 refueling
4	**Very likely**	Happens on a regular basis for this source / supply chain / station	More than 1 out of 1 000 refueling
[a] Based on a refueling station supplying 100 000 refuelings per year.			

The range of severity class (level of damage for vehicle) is defined in Table 3.

Table 3 — Severity classes for an impurity

Severity class	FCEV Performance impact or damage	Impact categories		
		Performance impact	Hardware impact temporary	Hardware impact permanent
0	— No impact	No	No	No
1	— Minor impact — Temporary loss of power — No impact on hardware — Car still operates	Yes	No	No
2	— Reversible damage — Requires specific light maintenance procedure — Car still operates	Yes or No	Yes	No
3	— Reversible damage — Requires specific immediate maintenance procedure. Gradual power loss that does not compromise safety	Yes	Yes	No
4 [a]	— Irreversible damage — Requires major repair (e.g. stack change) — Power loss or Car Stop that compromises safety	Yes	Yes	Yes or No

[a] Any damage, whether permanent ornon-permanent, which compromises safety will be categorized as 4, otherwise non-permanent damage will be categorized as 1, 2 or 3.

The final risk is defined by Table 4, titled "Acceptability table", and which combines results from Tables 2 and 3.