# SLOVENSKI STANDARD
# kSIST-TS FprCEN/TS 17977:2023

**01-junij-2023**

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**[Not translated]**

Gas infrastructure - Quality of gas - Hydrogen used in rededicated gas systems

Gasinfrastruktur - Beschaffenheit von Gas - Wasserstoff zur Nutzung in umgestellten Gassystemen

Infrastructures gazières - Qualité du gaz - Hydrogène utilisé dans des réseaux de gaz convertis



**Ta slovenski standard je istoveten z:** **FprCEN/TS 17977**

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| 27.075 | Tehnologija vodika | Hydrogen technologies |
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**kSIST-TS FprCEN/TS 17977:2023** **en,fr,de**

TECHNICAL SPECIFICATION

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TECHNISCHE SPEZIFIKATION

# FINAL DRAFT FprCEN/TS 17977

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ICS 27.075; 75.180.01

English Version

# Gas infrastructure - Quality of gas - Hydrogen used in rededicated gas systems

Infrastructures gazières - Qualité du gaz - Hydrogène utilisé dans des réseaux de gaz convertis

Gasinfrastruktur - Beschaffenheit von Gas - Wasserstoff zur Nutzung in umgestellten Gassystemen

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 234.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.



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

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## European foreword

This document (FprCEN/TS 17977:2023) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

This document is currently submitted to the Vote on TS.

# Introduction

This document for hydrogen in rededicated gas systems takes into account the condition of existing piping with possible presence of liquid and solid deposits influencing the hydrogen quality.

Many parameters given in this document are deduced from EN 16726.

This document is the first edition and reflects the current situation, taking into account the existing grid. It is expected that over time the hydrogen delivered through such pipework will improve in quality. This will be taken into account in further development of the document.

This document is supposed to balance the requirements of gaseous hydrogen for the producer, the different grid operators and the end-users, respectively in order to set- up a reliable backbone of future energy supply which is (partly) based on using rededicated gas infrastructure. As a consequence, on-site pre-treatment cannot be excluded for applications and/or processes with specific stringent requirements.

The proposed parameters are verified by German project results (HyQual) which have been consulted in combination with end-users' specifications [9]. In the project, different sources of hydrogen have been evaluated, including pyrolysis, steam reforming, electrolysis (Chlorine-Alkaline process and water electrolysis). Furthermore, the proposal takes biological hydrogen production process into account.

Also, the results of the Work Package 9 of the EC-CEN/GERG PNR project 'Removing the technical barriers to use of hydrogen in natural gas networks and for (natural) gas end users' have been taken into account.



This document supports the whole value chain (producers, system operators, other related services, end-users) to produce, transport, store, deliver and/or use hydrogen in a possibly rededicated (or adapted) natural gas infrastructure and connected applications in a safe way in the CEN member countries and where applicable, without the risk to harm or damage the infrastructure or connected user applications.



However, it is recognized that some end-users are sensitive to some gas quality parameters and impurities. In these cases, purification measures can be needed, for upgrading the hydrogen quality.

This document supports the implementation of the hydrogen strategy on European and national level and will accordingly facilitate the trade of hydrogen across entire Europe.

In the context of this document, the following aspects require close co-operation respectively co-ordination with other TCs (CEN-CLC/JTC 6, CEN/TC 268, ISO/TC 197, TCs for equipment and application):

— taking into account both natural gas systems and new built hydrogen systems;

— hydrogen qualities for fuel cell applications EN 17124:2018 (CEN/TC 268 WG 5, legally binding in some countries, e.g. DE).

# 1 Scope

This document defines the quality of gaseous hydrogen, i.e. its parameters and limiting values, to be transmitted, injected into and extracted from storages, distributed and utilized in fully and/or partially rededicated gas infrastructure and connected applications in a safe way.

This document gives evidence to the end-user which minimum exit hydrogen quality can be expected and ensured from natural gas infrastructure as minimum requirement and without further purification.

NOTE 1 The rededicated gas infrastructure can include new parts of this infrastructure constructed/added after the conversion of the natural gas grid.

NOTE 2 It is expected that over time the hydrogen delivered through such pipework will improve in quality, e.g. due to the increase in share of high purity hydrogen produced by electrolysis This will be taken into account in further development of this document.

# 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 ISO 13443, *Natural gas - Standard reference conditions (ISO 13443)*

# 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/



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

**3.1**
**rededicated gas system**
**repurposed gas system**
gas infrastructure originally used to convey or store gases of the first and second family which will be used from the time of rededication for other fluids as e. g. hydrogen. It can include new parts of infrastructure constructed/added after the conversion of the natural gas grid

Note 1 to entry: After a safety and reliability assessment the components of the infrastructure should be found suited for conveying hydrogen.

**3.2**
**hydrogen**
gaseous hydrogen with a certain purity as described in Clause 5

Note 1 to entry: The definition is focussing the purpose of this document.

**3.3**
**exit point**
point at which gas leaves the gas transmission or distribution system for end-use

# 4 Reference conditions and pressure units Subclause title

Unless stated otherwise all volumes are given for the real dry gas at ISO standard reference conditions of 15 °C (288,15 K) and 1013,25 mbar (101,325 kPa). Unless otherwise stated all pressures are absolute pressures.

Whenever data on the volume, gross calorific value (GCV), energy and Wobbe Index are communicated, it shall be specified under which reference conditions these values were calculated.

In assessing compliance with this document parameters should be determined directly at ISO standard reference conditions. If the properties are only available at other reference conditions and the actual gas composition is not known, then conversion to ISO standard reference conditions shall be carried out using the procedure described in EN ISO 13443.

NOTE Besides the ISO standard reference conditions, particular in gas transmission, normal reference conditions (25 °C/0 °C) are used.

# 5 Requirements

## 5.1 Requirements on constituents and contaminants

Hydrogen transported and distributed through rededicated gas networks shall comply with the requirements given in Table 1 and shall be accepted for conveyance.

NOTE 1 The hydrogen quality requirements apply to every exit point of the gas system.



**Table 1 — Quality requirements for hydrogen in rededicated gas networks**



| Parameter | unit | value | Reference standards for test methods (informative) |
|---|---|---|---|
| Hydrogen | mol-% | ≥ 98 | DIN 51894 |
| Wobbe Index | MJ/m³ (15 °C/15 °C) | 42,0 – 46,0 | EN ISO 6976 |
| The content and composition of the further quality parameter (e.g. sum of inerts) shall satisfy the Wobbe Index value above. | | | |
| Water | µmol/mol | ≤ 250<br>≤ 60[a] | ISO 21087 |
| Hydrocarbon dew point (HCDP)[d] | °C | < −2 °C at 1 < p < 70 bar | ISO 21087 |
| Sum of inerts ($N_2$, He, Ar) | mol-% | ≤ 2 | ISO 21087 |
| Gaseous hydrocarbons[d] | mol-% | ≤ 2 | ISO 21087 |
| Oxygen ($O_2$)[e] | mol-%<br>µmol/mol | ≤ 0,1[b]<br>≤ 10 | ISO 21087 |
| Carbon monoxide | µmol/mol | ≤ 20 | ISO 21087 |
| Carbon dioxide | µmol/mol | ≤ 20 | ISO 21087 |
| Total sulfur[d] | µmol/mol | ≤ 7[c] | ISO 21087 |
| Ammonia | µmol/mol | ≤ 13 | ISO 21087 |

| Parameter | unit | value | Reference standards for test methods (informative) |
|---|---|---|---|
| Halogenated compounds | µmol/mol | ≤ 0,05 | ISO 21087 |
| max. particulate concentration[d] | mg/kg | technically free | ISO 21087 |
| Contaminants | The gas shall not contain constituents other than listed in this table at levels that prevent its transportation, storage and/or utilization without quality adjustment of treatment. | | ISO 21087 |

[a] 250 µmol/mol at MOP less or equal to 10 bar, 60 µmol/mol at MOP over 10 bar.

[b] Max. 0,1 Mol-% in grids with no exit point to UGS or to sensitive customers, otherwise max. 10 µmol/mol.

[c] Non odorised hydrogen.

[d] These components most likely have their source in the previous use of the pipework.

[e] Rolling 24 h average.

In addition to the contaminants featured in Table 1, the hydrogen shall not contain any constituents that can impede safety or the integrity of the infrastructure and/or of gas appliances and operations of end-users. Appropriate measures shall be taken.

NOTE 2 Applications are sensitive towards variation of the gas quality depending on the type of application and the degree of variation.



In particular, during the commissioning phase of the rededicated gas system it is recommended to monitor the gas quality at the exit point closely.



For sampling the general principles of EN ISO 10715 and ISO 19880-9 can be used for guidance.

The Wobbe Index and calorific value – depending on the variation of the constituents – can vary (see Annex C).

# Annex A
(informative)

# Reasoning for the minimum content of 98 % hydrogen

Hydrogen produced by electrolysis is characterized by a very high hydrogen content whereas hydrogen produced by reforming normally has a lower hydrogen content depending on the purification technique used.

The various end user segments have different requirements regarding the required minimum hydrogen concentration. For example, end users using hydrogen to decarbonise their high temperature processes or end users that operate gas engines or gas turbines can use hydrogen fuel with a lower minimum hydrogen concentration. End users using hydrogen as a chemical reactant require for some of their processes a feedstock with a high content of hydrogen.

The hydrogen backbone, connecting production and demand, can only be operated with a certain minimum hydrogen value valid for the whole backbone system. Since the scope of this document is referring to rededicated pipelines, the possible contamination of the transported hydrogen by natural gas residues present in the pipeline needs to be taken into account as well.

A review of the existing documents on the hydrogen requirements of (industrial) customers showed that very little information is available on this topic in the public domain. Detailed forecasts are missing for the expected shares of hydrogen the end-user segments will use and how the hydrogen production is subdivided into the different hydrogen production techniques.

Furthermore, most of the specifications that are currently under development or recently published to be applied to partly rededicated gas infrastructure specify a minimum hydrogen concentration of 98 mol-%. Higher purity of hydrogen with a lesser content of contaminants can be achieved at any given exit point by the means of purification units.