SLOVENSKI STANDARD
SIST EN 16726:2016

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Infrastruktura za plin - Kakovost plina - Skupina H

Gas infrastructure - Quality of gas - Group H

Gasinfrastruktur - Beschaffenheit von Gas - Gruppe H

Infrastructure gazière - Qualité du gaz - Groupe H

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This European Standard was approved by CEN on 24 October 2015.

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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
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European foreword

This document (EN 16726:2015) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

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

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

The need for a European Standard concerning the specification of the quality of gases of group H is derived from the mandate M/400 issued to CEN by the European Commission.

According to this mandate the goal is to define specifications that are as wide as possible within reasonable costs. This means that the specifications enhance the free flow of gas within the internal EU market, in order to promote competition and security of supply minimizing the negative effects on gas infrastructure and gas networks, efficiency and the environment and allow appliances to be used without compromising safety.

Some requirements specified in this European Standard, Clause 5, cannot be applied in Germany, Hungary and the Netherlands due to existing conflicting national legislation. The related A-Deviations are listed in Annex G.

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

Introduction

This European standard sets requirements for gas quality with the aim to allow the free flow of gas between the CEN member states and to enable the security of supply taking into account the impact on the whole value chain from gas production and supply to end uses.

However, at the moment of publication of this European standard, a common Wobbe Index range cannot be defined because of different regulations in CEN Member States and limited knowledge of the influence of broadening Wobbe Index range on integrity, efficiency and safe use of appliances in some countries (see Annex D).

In order to find a common Wobbe Index range, further studies, such as the Gas Quality Harmonization Implementation Pilot, are necessary. The Wobbe Index should be defined when the pending results of these studies are available. The common Wobbe Index range should be implemented in a revised standard in due time.

For hydrogen, at present it is not possible to specify a limiting value which would generally be valid for all parts of the European gas infrastructure (see Annex E).

Responsibility and liability issues in the context of this European standard are subject to European or national regulations.

1 Scope

This European standard specifies gas quality characteristics, parameters and their limits, for gases classified as group H that are to be transmitted, injected into and from storages, distributed and utilized.

NOTE For information on gas families and gas groups see EN 437.

This European standard does not cover gases conveyed on isolated networks.

For biomethane, additional requirements indicated in prEN 16723-1 apply.

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

EN ISO 14532, *Natural gas - Vocabulary (ISO 14532)*

ISO 14912, *Gas analysis — Conversion of gas mixture composition data*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 14532 and the following apply.

3.1
isolated network
network where transmission, distribution and utilization of gas are combined and which is physically unconnected to other networks

3.2
entry point
point at which gas enters a gas distribution or gas transmission system

3.3
interconnection point
physical point connecting adjacent entry-exit systems or connecting an entry-exit system with an interconnector

[SOURCE: Commission Regulation (EU) No 984/2013, modified]

3.4
maximum operating pressure
maximum pressure at which a network can be operated continuously under normal conditions expressed as absolute pressure

Note 1 to entry: Normal conditions are: no fault in any device or stream.

[SOURCE: EN 1594:2013, 3.23, modified]

3.5
application
equipment that utilizes the transported and distributed gas

Note 1 to entry: Some examples of gas applications are: gas appliances (domestic or commercial), processes (chemical or industrial), power plants, vehicles, greenhouses etc.

4 Reference conditions and pressure units

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 European standard 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 (25/0 °C) are used according to the Network Code Interoperability and Data exchange. These are indicated in Table 1 for information.

5 Requirements

Gas shall comply with the requirements given in Table 1 and shall be accepted for conveyance.

Table 1 — Requirements

Parameter	**Unit**	**Limits based on standard reference condition 15 °C/15°C**		**Limits based on normal reference condition 25°C /0°C (for information)**		**Reference standards for test methods**[d] (informative)
		Min.	Max.	Min.	Max.	
Relative density	no unit	0,555	0,700	0,555	0,700	EN ISO 6976, EN ISO 15970
Total sulfur without odorant	mg/m^3	not applicable	20[a]	not applicable	21[a]	EN ISO 6326-5, EN ISO 19739
	For sulfur in high pressure networks and on interconnection points the maximum acceptable sulfur content for conveyance is 20 mg/m^3, where in high pressure networks non-odorized gas is current practice. However, for existing practices with respect to transmission of odorized gas between high pressure networks higher sulfur content value up to 30 mg/m^3 may be accepted. NOTE On distribution networks the odorization is considered as a national safety issue. Some information about sulfur odorant content is given in Annex B.					
Hydrogen sulphide + Carbonyl sulphide (as sulfur)	mg/m^3	not applicable	5[a]	not applicable	5[a]	EN ISO 6326-1, EN ISO 6326-3, EN ISO 19739

Parameter	Unit	Limits based on standard reference condition 15 °C/15°C		Limits based on normal reference condition 25°C /0°C (for information)		Reference standards for test methods[d] (informative)
		Min.	Max.	Min.	Max.	
Mercaptan sulfur without odorant (as sulfur)	mg/m^3	not applicable	6[a]	not applicable	6[a]	EN ISO 6326-3, EN ISO 19739
Oxygen	mol/mol	not applicable	0,001 % or 1 % (see below)	not applicable	0,001 % or 1 % (see below)	EN ISO 6974-3, EN ISO 6974-6, EN ISO 6975
	At network entry points and interconnection points the mole fraction of oxygen shall be no more than 0,001 %, expressed as a moving 24 hour average. However, where the gas can be demonstrated not to flow to installations sensitive to higher levels of oxygen, e.g. underground storage systems, a higher limit of up to 1 % may be applied.					
Carbon dioxide	mol/mol	not applicable	2,5 % or 4 % see below	not applicable	2,5 % or 4 % see below	EN ISO 6974 parts 1 to 6, EN ISO 6975
	At network entry points and interconnection points the mole fraction of carbon dioxide shall be no more than 2,5 %. However, where the gas can be demonstrated not to flow to installations sensitive to higher levels of carbon dioxide, e.g. underground storage systems, a higher limit of up to 4 % may be applied.					
Hydro carbon dew point[b,c] at any pressure from 0,1 to 7 MPa (70 bar) absolute pressure	°C	not applicable	−2	not applicable	−2	ISO 23874, ISO/TR 12148
Water dew point[b,c] at 7 MPa (70 bar) or, if less than 7 MPa (70 bar), at maximum operating pressure of the system in which the gas flows	°C	not applicable	−8	not applicable	−8	EN ISO 6327, EN ISO 18453, EN ISO 10101 parts 1 to 3
Methane number	no unit	65	not applicable	65	not applicable	see normative Annex A
Contaminants	The gas shall not contain constituents other than listed in Table 1 at levels that prevent its transportation, storage and/or utilization without quality adjustment or treatment.					

[a] Figures are indicated without post-comma digits due to analytical uncertainty.

[b] Under given climatic conditions, a higher water dew point and hydrocarbon dew point may be accepted at national level.

[c] For further information on water dew point and hydrocarbon dew point see Annex C.

[d] Test methods other than those listed in the reference standards indicated in Table 1 may be applied, provided their fitness for purpose can be demonstrated.

Gas quality shall not impede safety of gas appliances and operations of end users. Appropriate measures shall be taken.

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

For sampling, reference is made to Annex F.

Annex A
(normative)

Calculation of methane number of gaseous fuels for engines

A.1 Introduction

The methane number of a gaseous fuel can be calculated from its composition according to several different methods, all of which can give different results. For the purposes of compliance with this European standard the methodology described in this Annex shall be employed.

The method is based on the original data of the research program performed by AVL Deutschland GmbH /1/ for FVV (the Research Association for Combustion Engines) but employs amendments implemented in 2005 and 2011 by MWM GmbH. These amendments have been unpublished until the publication of this European standard.

The method requires input of composition in the form of volume fractions at reference conditions of 0 °C and 101,325 kPa and expressed as a percentage. Composition is more likely to be available either as mole fraction (e.g. in the natural gas transmission and distribution industry) or as mass fraction (e.g. in the automotive fuel industry) and conversion to volume fraction shall be performed using the methods in ISO 14912.

Numerical examples are provided so as to enable software developers to validate implementations of the methodology described in this annex. As an aid to validation a relatively large number of decimal places has been retained. For expression of the final result rounding to zero decimal points is recommended.

A.2 Calculation of methane number

A.2.1 Applicability

The method described in this European Standard is applicable to gaseous fuels comprising the following gases: carbon monoxide; butadiene; butylene; ethylene; propylene; hydrogen sulphide; hydrogen; propane; ethane; butane; methane; nitrogen and carbon dioxide. The method treats hydrocarbons other than those specified as butane and is therefore applicable to gaseous fuels containing such higher hydrocarbons.

The numerical examples provided in this annex are appropriate to gases of the second family and hence consider mixtures comprising methane, ethane, propane, butane, nitrogen and carbon dioxide. Hydrogen is also included in one example because of the growing interest in injection of hydrogen into gas pipelines. During the preparation of this standard MWM GmbH has confirmed that the method is applicable to both 2H and 2L gases.

Oxygen and water vapour shall be ignored and the fuel gas composition shall be calculated on a dry, oxygen-free basis.

A.2.2 General approach

The methane number of a gaseous fuel is calculated from its composition in five steps. The steps are outlined below and discussed more fully in turn in A.3. Additional examples are discussed in A.4 and A.5. Table A.10 provides results of calculations for further software validation purposes.

a) The composition of the gaseous fuel is simplified by converting it into an inert-free mixture comprising the combustible compounds carbon monoxide, ethylene, propylene, hydrogen sulphide, hydrogen, propane, ethane, butane and methane.

For gases of the second family conveyed in pipeline systems carbon monoxide, ethylene, propylene, hydrogen sulphide are unlikely to be present at concentrations that would impact on methane number and can be ignored.

b) The simplified mixture is sub-divided further into a number of partial ternary mixtures. The number and particular partial ternary mixtures chosen is decided by inspection of available ternary systems in a given order, including those systems that contain the relevant combustible compounds. Selection is ceased when all combustible compounds are contained in at least two ternary systems.

c) The composition and fraction of the selected partial mixtures is adjusted iteratively so as to minimize the difference between the methane numbers of each partial mixture.

d) The methane number of the simplified mixture is determined from the weighted average of the methane number of the selected partial mixtures.

e) Finally, the methane number of the gaseous fuel is calculated by correcting the methane number of the simplified mixture to allow for the presence of inerts in the original fuel gas.

A.3 Example 1: 2H-gas

A.3.1 Simplification of the composition of the gaseous fuel

The description of the calculation is illustrated by reference to a 2H-gas of composition shown in Table A.1. The composition of the gas (column 1) is simplified by increasing the quantity of butanes to allow for the presence of butadiene, butylene, pentanes and hydrocarbons of carbon number greater than 5. The adjustment made is as follows:

— Butadiene and butylene are replaced with an equivalent amount of butanes by multiplying their quantities by 1.

— Pentanes are replaced with an equivalent amount of butanes by multiplying the quantity of pentanes by 2,3.

— Hydrocarbons of carbon number greater than 5 ("hexanes+") are replaced with an equivalent amount of butanes by multiplying the quantity of hexanes+ by 5,3.

In the case of example 1 the quantity of butanes

$$= 0{,}2100 + 0{,}1900 + (0{,}0400 + 0{,}0500) \times 2{,}3 + 0{,}0600 \times 5{,}3$$

$$= 0{,}9250 \text{ (Column 2)}$$

The simplified mixture is then re-normalized to 100 % (Column 3).

A.3.2 Selection of the ternary systems

A.3.2.1 Ternary mixtures

The ternary mixtures are chosen from the following list:

— A1: Methane – Hydrogen – Ethane

— A2: Propane – Ethane – Butane

— A3: Hydrogen – Propane - Propylene

— A4: Methane – Ethane – Propane

— A5: Methane – Hydrogen – Propane

— A6: Methane – Hydrogen – Butane

— A7: Methane – Propane – Butane

— A8: Methane – Ethane – Butane

— A9: Methane – Ethylene – Butane

— A10: Methane – Hydrogen Sulphide – Butane

— A11: Methane – Ethane – Hydrogen Sulphide

— A12: Methane – Propylene

— A13: Ethane – Propylene

— A14: Carbon Monoxide – Hydrogen

— A15: Ethane – Ethylene

— A16: Propane – Ethylene

— A17: Butadiene

— A18: Butylene

NOTE Mixtures A12 – A16 are clearly not ternary systems; however, for ease of mathematical treatment the coefficients have been adjusted so as to allow the expression of the methane number using a single equation.

A.3.2.2 Range of applicability of ternary mixture data

The range of applicability of most ternary systems is wide (each component can vary from 0 to 100 %). However, for some ternary systems there is a reduced range of applicability. This is a major issue when selecting ternary mixtures. The range of applicability of each ternary system is specified in Table A.2, expressed as maximum and minimum content of each component.