

**Natural gas - Determination of composition
with defined uncertainty by gas
chromatography - Part 1: Guidelines for
tailored analysis**

Natural gas - Determination of composition with
defined uncertainty by gas chromatography - Part 1:
Guidelines for tailored analysis

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 6974-1:2002 sisaldab Euroopa standardi EN ISO 6974-1:2001 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 14.02.2002 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN ISO 6974-1:2002 consists of the English text of the European standard EN ISO 6974-1:2001.</p> <p>This document is endorsed on 14.02.2002 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p>Käsitlusala: This part of EN ISO 6974 gives guidelines for the quantitative analysis of natural-gas-containing constituents within the application ranges given in Table 1.</p>	<p>Scope: This part of EN ISO 6974 gives guidelines for the quantitative analysis of natural-gas-containing constituents within the application ranges given in Table 1.</p>
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ICS 75.060

Võtmesõnad: chemical analysis and test, chemical analysis and testing, chemical composition, composition, definition, determination, determination of content, gas analysis, gas chromatography, gas phase chromatography, guidelines, management, natural gas, policy, uncertainties

English version

**Natural gas – Determination of composition with
defined uncertainty by gas chromatography**

Part 1: Guidelines for tailored analysis

(ISO 6974-1 : 2000)

Gaz naturel – Détermination de la composition avec une incertitude définie par chromatographie en phase gazeuse – Partie 1: Lignes directrices pour l'analyse spéciale (ISO 6974-1 : 2000)

Erdgas – Bestimmung der Zusammensetzung mit definierter Unsicherheit durch Gaschromatographie – Teil 1: Richtlinien für die maßgeschneiderte Analyse (ISO 6974-1 : 2000)

This European Standard was approved by CEN on 2001-06-22.

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

International Standard

ISO 6974-1 : 2000 Natural gas – Determination of composition with defined uncertainty by gas chromatography – Part 1: Guidelines for tailored analysis,

which was prepared by ISO/TC 193 'Natural gas' of the International Organization for Standardization, has been adopted by CEN/CMC as a European Standard.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, and conflicting national standards withdrawn, by February 2002 at the latest.

In accordance with the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard:

Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 6974-1 : 2000 was approved by CEN as a European Standard without any modification.

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Introduction

This part of ISO 6974 gives guidelines for the "tailored" analysis of natural gas with the aim of determining the mole fractions of the principal components.

ISO 6974 (all parts) describes methods of analysis of natural gas with definable levels of uncertainty. The approach is suitable for the calculation of calorific value and other additive physical properties of the gas, again with a definable uncertainty.

Part 2 of ISO 6974 describes the determination of the measuring system characteristics and the statistical approach to data handling and error calculation with the aim of defining the uncertainties in the component mole fractions.

Part 3 and subsequent parts of ISO 6974 describe different possible methodologies for tailored analyses, which can only be applied in conjunction with parts 1 and 2 of ISO 6974.

Parts 1 and 2 represent the body of ISO 6974. The method chosen from Part 3 and subsequent parts or from any other source requires compliance with parts 1 and 2 of ISO 6974.

Informative annex A gives a comparison of the characteristics of typical analytical methods as described in part 3 and subsequent parts of ISO 6974.

ISO 6974 (all parts) is designed for the measurement of H_2 , He, O_2 , N_2 , CO_2 , individual hydrocarbons and/or a total figure for hydrocarbons for example above C_5 defined as C_{6+} . It is not applicable to other minor components where their contribution to physical properties is not significant or can be regarded as constant. Among these are potentially natural components such as Ar, H_2O and sulfur compounds, and components arising from gas treatment such as methanol, glycols and amines.

The described method allows air contamination in the sample to be recognized and measured in the case of spot sampling and laboratory analysis, but not necessarily for on-line analysis.

Although "tailored" analysis itself is relatively simple, it can produce an analysis with high accuracy, provided that elaborate preparations are carried out. These include outlining the structure of the analysis, defining the working ranges and establishing the analytical procedure. However, in practice, only a limited number of steps are necessary for setting up the method to meet the requirements for specific application. The amount of work and calculations necessary will then be relatively restricted.

This part of ISO 6974 describes all the essential steps for setting up a "tailored" analysis.

Assuming that the analytical results follow the normal distribution, control charts give an indication as to whether the measuring system and the established method is working satisfactorily. For this reason the use of control charts is described in informative annex B of this part of ISO 6974.

ISO 6974 (all parts) can be used in daily practice in a laboratory and for on-line field applications and covers the following options or alternatives.

- Straight-line or polynomial calibration plots.
- Single-point or multi-level calibration.
- Recombination of components by backflushing to vent, recombination of components by backflushing to measure, or forward elution of all components.
- Calibration one-to-one, or by relative response factors to a reference component.
- The use of a thermal conductivity detector (TCD) is necessary and in certain cases a flame ionisation detector (FID) may be used in addition.

When setting up a tailored analysis, a series of choices are to be made from these options. The consequences of the combination chosen should be assessed. The procedure for this assessment is described in this part of ISO 6974. If the assessment shows that the performance is poorer than desired, another combination can be chosen, in which case the assessment is to be repeated in full.

1 Scope

This part of ISO 6974 gives guidelines for the quantitative analysis of natural-gas-containing constituents within the application ranges given in Table 1.

Individual methods, as described in part 3 and subsequent parts of ISO 6974, may have more restricted application ranges than those in Table 1, but in all cases they will fall within this overall scope of the ranges given.

Table 1 — Application ranges

Component	Mole fraction range %
Hydrogen	0,001 to 0,5
Helium	0,001 to 0,5
Oxygen	0,001 to 5
Nitrogen	0,001 to 60
Carbon dioxide	0,001 to 35
Methane	40 to 100
Ethane	0,02 to 15
Propane	0,001 to 25
Butanes	0,000 1 to 5
Pentanes	0,000 1 to 1
Hexanes and heavier	0,000 1 to 0,5

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 6974. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 6974 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6974-2, *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 2: Measuring-system characteristics and statistics for data treatment.*

ISO 6974-3, *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 3: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and hydrocarbons up to C₈ using two packed columns.*

ISO 6974-4, *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 4: Determination of nitrogen, carbon dioxide and C₁ to C₅ and C₆₊ hydrocarbons for a laboratory and on-line measuring system using two columns.*

ISO 6974-5, *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 5: Determination of nitrogen, carbon dioxide and C₁ to C₅ and C₆₊ hydrocarbons for a laboratory and on-line process application using three columns.*

ISO 6974-6, *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 6: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and hydrocarbons up to C₈ using three capillary columns.*

ISO 6975, *Natural gas — Extended analysis — Gas-chromatographic method.*

ISO 10715, *Natural gas — Sampling guidelines.*

3 Terms and definitions

For the purposes of this part of ISO 6974, the following terms and definitions apply.

3.1 response

output signal of the measuring system for a component that is measured as peak area or peak height, expressed in counts

3.2 reference component

component present in a working-reference gas mixture (WRM) (see 3.9), which is used to calibrate the analyser response to other, similar components in the sample which are not themselves present in the working-reference gas mixture

NOTE For example, if the WRM contains hydrocarbons up to and including *n*-butane, but no pentanes or higher, then *n*-butane contained in the WRM can be used as a reference component for the quantification of pentanes and heavier components in the sample. The reference component should have a response function which normally is a first-order polynomial with zero intercept, i.e. a straight line through the origin

3.3 relative response factor

K_j

ratio of the molar amount of component *j* to the molar amount of reference component which gives an equal detector response

3.3.1 relative response factor for flame ionisation detector (FID)

calculated as the ratio of the carbon number of the reference component to the carbon number of the sample component

NOTE The values of the relative response factors are described in ISO 6974-2.

3.3.2 relative response factor for thermal conductivity detector (TCD)

determined using reference gas mixtures as described in ISO 6974-2

3.4 other components

components in the gas sample which are not measured by tailored analysis in accordance with ISO 6974 (all parts) and/or can be regarded as being present at a constant mole fraction