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Standards

Irish Standard  
I.S. EN ISO 6974-1:2012

# Natural gas - Determination of composition and associated uncertainty by gas chromatography - Part 1: General guidelines and calculation of composition (ISO 6974-1:2012)

## I.S. EN ISO 6974-1:2012

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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## **Foreword**

This document (EN ISO 6974-1:2012/AC:2012) has been prepared by Technical Committee ISO/TC 193 "Natural gas" in collaboration with Technical Committee CEN/SS N21 "Gaseous fuels and combustible gas" the secretariat of which is held by CCMC.

### **Endorsement notice**

The text of ISO 6974-1:2012/Cor 1:2012 has been approved by CEN as a EN ISO 6974-1:2012/AC:2012 without any modification.

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**I.S. EN ISO 6974-1:2012**  
**INTERNATIONAL STANDARD ISO 6974-1:2012**  
**TECHNICAL CORRIGENDUM 1**

Published 2012-11-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

## **Natural gas — Determination of composition and associated uncertainty by gas chromatography —**

### **Part 1: General guidelines and calculation of composition**

#### **TECHNICAL CORRIGENDUM 1**

*Gaz naturel — Détermination de la composition et de l'incertitude associée par chromatographie en phase gazeuse —*

*Partie 1: Lignes directrices générales et calcul de la composition*

*RECTIFICATIF TECHNIQUE 1*

Technical Corrigendum 1 to ISO 6974-1:2012 was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcommittee SC 1, *Analysis of natural gas*.

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*Page 26, Clause B.1, Figure B.1*

Correct the flowchart as follows:

- above the left-hand box containing the text “Raw mole fractions”, replace the symbol  $x_i^+$  with the symbol  $x_i^*$ ;
- above the right-hand box containing the text “Raw mole fractions”, replace the symbol  $x_{i,l}^+$  with the symbol  $x_{i,l}^*$ ;
- above the box containing the text “Bridged mole fractions”, replace the symbol  $x_{i,l}^*$  with the symbol  $x_{i,l}^+$ .

*Page 27, Clause B.1, first paragraph after Figure B.2*

Replace the first sentence with the following text:

“Subclauses 5.2.2, 5.2.3 and 5.5 describe, respectively, procedures equivalent to converting  $x_{i,l}^*$  to  $x_{i,l}^+$ , the case in which  $x_{i,l}^+$  and  $x_{i,l}^*$  are identical, and the procedure for converting  $x_{i,l}^*$  to  $x_{i,l}$ .”



English Version

**Natural gas - Determination of composition and associated uncertainty by gas chromatography - Part 1: General guidelines and calculation of composition (ISO 6974-1:2012)**

Gaz naturel - Détermination de la composition et de l'incertitude associée par chromatographie en phase gazeuse - Partie 1: Lignes directrices générales et calcul de la composition (ISO 6974-1:2012)

Erdgas - Bestimmung der Zusammensetzung und der zugehörigen Unsicherheit durch Gaschromatographie - Teil 1: Allgemeine Leitlinien und Berechnung der Zusammensetzung (ISO 6974-1:2012)

This European Standard was approved by CEN on 14 May 2012.

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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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## **Foreword**

This document (EN ISO 6974-1:2012) has been prepared by Technical Committee ISO/TC 193 "Natural gas".

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 November 2012, and conflicting national standards shall be withdrawn at the latest by November 2012.

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 supersedes EN ISO 6974-1:2001.

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, 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.

### **Endorsement notice**

The text of ISO 6974-1:2012 has been approved by CEN as a EN ISO 6974-1:2012 without any modification.

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STANDARD**

**ISO  
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**Natural gas — Determination of  
composition and associated uncertainty  
by gas chromatography —**

Part 1:  
**General guidelines and calculation of  
composition**

*Gaz naturel — Détermination de la composition et de l'incertitude  
associée par chromatographie en phase gazeuse —*

*Partie 1: Lignes directrices générales et calcul de la composition*



Reference number  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 6974-1 was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcommittee SC 1, *Analysis of natural gas*.

This second edition of ISO 6974-1, together with ISO 6974-2:2012, cancels and replaces ISO 6974-1:2000 and ISO 6974-2:2001, which have been technically revised.

ISO 6974 consists of the following parts, under the general title *Natural gas — Determination of composition and associated uncertainty by gas chromatography*:

- *Part 1: General guidelines and calculation of composition*
- *Part 2: Uncertainty calculations*
- *Part 3: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and hydrocarbons up to C<sub>8</sub> using two packed columns*
- *Part 4: Determination of nitrogen, carbon dioxide and C<sub>1</sub> to C<sub>5</sub> and C<sub>6+</sub> hydrocarbons for a laboratory and on-line measuring system using two columns*
- *Part 5: Determination of nitrogen, carbon dioxide and C<sub>1</sub> to C<sub>5</sub> and C<sub>6+</sub> hydrocarbons for a laboratory and on-line process application using three columns*
- *Part 6: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and C<sub>1</sub> to C<sub>8</sub> hydrocarbons using three capillary columns*

Future subsequent parts of ISO 6974 are planned.



## Introduction

ISO 6974 describes methods of analysis of natural gas and methods for calculating component mole fractions and uncertainties. ISO 6974 is intended for the measurement of H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub> and hydrocarbons, either as individual components or as a group, for example all hydrocarbons above C<sub>5</sub>, defined as C<sub>6+</sub>. This approach is suitable for a range of end applications, including calibrating gas mixtures and providing natural gas composition and uncertainty data to be used in the calculation of calorific value and other additive physical properties of the gas. Details of these end applications are provided in ISO 6974-3 and subsequent parts of ISO 6974.

This part of ISO 6974 gives guidelines for the gas chromatographic analysis of natural gas and methods of data processing to determine compositions of component mole fractions.

ISO 6974-2 describes the steps required to calculate the uncertainty of each component mole fraction.

ISO 6974-3 and subsequent parts of ISO 6974 describe different gas chromatographic methods. These methods cover both daily practice in the laboratory and on-line field applications. In this part of ISO 6974, Annex A provides a comparison of the characteristics of the analytical methods described in ISO 6974-3 and subsequent parts of ISO 6974.

In cases where only component mole fractions are required, it is intended that this part of ISO 6974 be used in conjunction with a gas chromatographic method of analysis, e.g. ISO 6974-3 or subsequent parts of ISO 6974. In cases where component mole fractions and associated uncertainties are required, it is intended that this part of ISO 6974 be used in conjunction with ISO 6974-2, in addition to a gas chromatographic method of analysis.

This part of ISO 6974 describes all the essential steps for setting up an analysis, including outlining the structure of the analysis, defining the working ranges and establishing the analytical procedure. When the working ranges of the components have been defined, an evaluation is carried out to determine whether components are to be considered as

- main components or groups of components to be analysed using direct measurement (directly measured components),
- components or groups of components to be analysed using indirect measurement, by reference to a different reference component in the calibration gas mixture (indirectly measured components), or
- components that are not measured and whose mole fraction can be assumed to be constant (components not measured).

This part of ISO 6974 provides for the use of three types of method: single operation, multiple operation with bridging and multiple operation without bridging. The last of these methods is a special case of a single operation method.

This part of ISO 6974 describes the conventional normalization approach for calculating processed mole fractions from raw mole fractions (see 5.5). When conventional normalization is used for multiple operations without bridging methods, the uncertainties of the calculated mole fractions will be conservative. If a more accurate assessment of uncertainty is required, an alternative approach for normalization, using the generalized least squares (GLS) method, can be used; this is described in Annex B, which is intended to be used when calculating uncertainties in accordance with ISO 6974-2. Further alternative approaches are available for calculating processed mole fractions, including methane-by-difference (see Annex C) and data harmonization (see Reference [1]).

**I.S. EN ISO 6974-1:2012**

# Natural gas — Determination of composition and associated uncertainty by gas chromatography —

## Part 1: General guidelines and calculation of composition

### 1 Scope

This part of ISO 6974 gives methods for calculating component mole fractions of natural gas and specifies the data processing requirements for determining component mole fractions. This part of ISO 6974 provides for both single and multiple operation methods and either multi-point calibration or a performance evaluation of the analyser followed by single-point calibration. This part of ISO 6974 gives procedures for the calculation of the raw and processed (e.g. normalized) mole fractions, and their associated uncertainties, for all components. The procedures given in this part of ISO 6974 are applicable to the handling of data obtained from replicate or single analyses of a natural gas sample.

### 2 Normative references

The following referenced documents are indispensable for the application 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.

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 6143, *Gas analysis — Comparison methods for determining and checking the composition of calibration gas mixtures*

ISO 10723, *Natural gas — Performance evaluation for on-line analytical systems*

### 3 Terms and definitions

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

#### 3.1 response

$y$   
output signal of the measuring system for a component that is measured as peak area or peak height

#### 3.2 reference component

component present in a certified reference gas mixture (CRM) (see 3.10), which is used to calibrate the analyser response to other similar components in the sample which are not themselves present in the CRM

NOTE For example, if the CRM contains hydrocarbons up to and including *n*-butane, but no pentanes or higher, then *n*-butane contained in the CRM 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 that normally is a first-order polynomial with zero intercept, i.e. a straight line through the origin.

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