Second edition
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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

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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_8 using two packed columns*

— *Part 4: Determination of nitrogen, carbon dioxide and C_1 to C_5 and C_{6+} hydrocarbons for a laboratory and on-line measuring system using two columns*

— *Part 5: Determination of nitrogen, carbon dioxide and C_1 to C_5 and C_{6+} hydrocarbons for a laboratory and on-line process application using three columns*

— *Part 6: Determination of hydrogen, helium, oxygen, nitrogen, carbon dioxide and C_1 to C_8 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_2, He, O_2, N_2, CO_2 and hydrocarbons, either as individual components or as a group, for example all hydrocarbons above C_5, defined as C_{6+}. 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]).