INTERNATIONAL
STANDARD

ISO
6975

Second edition
1997-04-01

Natural gas — Extended analysis — Gas-chromatographic method

Gaz naturel — Analyse étendue — Méthode par chromatographie en phase gazeuse

Reference number
ISO 6975:1997(E)

Contents

Annexes

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

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.

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.

International Standard ISO 6975 was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcommittee SC 1, *Analysis of natural gas*.

This second edition cancels and replaces the first edition (ISO 6975:1986), which has been technically revised.

Annexes A to D of this International Standard are for information only.

Introduction

This International Standard describes the specifications that an accurate method for the complete and extended analysis of natural gas shall fulfil.

The analytical methods involve injection of natural gas on to packed or open tubular (capillary) columns in one or more gas chromatographs. The components coming off the columns are detected by thermal-conductivity detector (TCD) or flame ionization detector (FID).

Compared to other analytical methods, the extended gas-chromatographic analysis supplies considerable knowledge of the individual components in the natural-gas mixture. This allows quantitative measurement of particular components in the C_{6+} fraction and calculation of physical properties. Although the higher hydrocarbons influence physical properties such as calorific values and density by less than 0,3 % and 0,004 %, respectively, knowledge of them is required for evaluation of the pseudo-values for the C_{6+} fraction.

In addition, vapour phase equilibrium calculations often require detailed composition data, especially of hydrocarbons with carbon numbers higher than 6.

The simultaneous determination of benzene and other aromatics is needed for gas consumers using natural gas as a chemical feedstock since these components can interfere in some processes.

Natural gas — Extended analysis — Gas-chromatographic method

1 Scope

This International Standard describes the specifications for the quantitative analysis of the following components of natural gas:

helium
hydrogen
argon
oxygen
nitrogen
carbon dioxide
saturated hydrocarbons from C_1 to C_5
hydrocarbon fractions from C_6 upwards
aromatic compounds as benzene and toluene

The gas-chromatographic methods determine the components in the following ranges:

oxygen:	0,001 % (*n*/*n*)	to	0,5 % (*n*/*n*)
helium:	0,001 % (*n*/*n*)	to	0,5 % (*n*/*n*)
hydrogen:	0,001 % (*n*/*n*)	to	0,5 % (*n*/*n*)
argon:	0,001 % (*n*/*n*)	to	0,5 % (*n*/*n*)
nitrogen:	0,001 % (*n*/*n*)	to	40 % (*n*/*n*)
carbon dioxide:	0,001 % (*n*/*n*)	to	40 % (*n*/*n*)
methane:	50 % (*n*/*n*)	to	100 % (*n*/*n*)
ethane:	0,02 % (*n*/*n*)	to	15 % (*n*/*n*)
propane:	0,001 % (*n*/*n*)	to	5 % (*n*/*n*)

higher hydrocarbons: The method can measure hydrocarbon components from 10^{-6} (*n*/*n*) up to their maximum concentration, which is compatible with the requirement that the gas is free from hydrocarbon condensate at any pressure in the range 1×10^2 kPa to 7×10^3 kPa.

This method is not intended for the determination of oxygen compounds (water vapour, methanol, glycols) or sulfur compounds.

It is not possible to make unambiguous identifications of hydrocarbons above C_6. Even where "spiking" a gas mixture with known components shows where they elute, it cannot be stated with certainty that such a component is the only one with that retention time. Unidentified components are classified according to the carbon number which the analysis indicates to be appropriate. While this is a necessary simplification, it does allow a reasonable quantitative value to be obtained.

This method is intended for use in situations where the hexanes plus compositional breakdown and/or the complete analysis is desired.

The method is not intended for dense phase gases whose pressure exceeds the cricondebar (critical condensation pressure), or for gas samples containing any measurable hydrocarbon condensate, liquid water or process fluid such as methanol or glycols (see ISO 6570-1 and ISO 10715).

Gases which have been treated for transmission are unlikely to contain detectable levels of hydrocarbons above C_{12}. Samples taken from nearer the well head, before the gas has reached gas treatment plants, may contain hydrocarbons to C_{16} or above.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions.*

ISO 6142:1981, *Gas analysis — Preparation of calibration gas mixtures — Weighing methods.*

ISO 6143:1981, *Gas analysis — Determination of composition of calibration gas mixtures — Comparison methods.*

ISO 6326-1:1989, *Natural gas — Determination of sulfur compounds — Part 1: General introduction.*

ISO 6326-2:1981, *Gas analysis — Determination of sulfur compounds in natural gas — Part 2: Gas chromatographic method using an electrochemical detector for the determination of odoriferous sulfur compounds.*

ISO 6326-3:1989, *Natural gas — Determination of sulfur compounds — Part 3: Determination of hydrogen sulfide, mercaptan sulfur and carbonyl sulfide sulfur by potentiometry.*

ISO 6326-4:1994, *Natural gas — Determination of sulfur compounds — Part 4: Gas chromatographic method using a flame photometric detector for the determination of hydrogen sulfide, carbonyl sulfide and sulfur-containing odorants.*

ISO 6326-5:1989, *Natural gas — Determination of sulfur compounds — Part 5: Lingener combustion method.*

ISO 6570-1:1983, *Natural gas — Determination of potential hydrocarbon liquid content — Part 1: Principles and general requirements.*

ISO 6974-1:—[1], *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 1: Guidelines for tailored analysis.*

---

[1] To be published. (Revision, in parts, of ISO 6974:1984)

ISO 6974-2:—[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:—[2], *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 3: Determination of hydrogen, helium, inert gases and hydrocarbons up to C_8.*

ISO 6974-4:—[2], *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 4: Determination of nitrogen, carbon dioxide and hydrocarbons (C_1 up to C_5 and C_{6+}) for a laboratory and on-line measuring system.*

ISO 6974-5:—[2], *Natural gas — Determination of composition with defined uncertainty by gas chromatography — Part 5: Determination of nitrogen, carbon dioxide and hydrocarbons (C_1 up to C_5 and C_{6+}) for a laboratory and on-line process application.*

ISO 10715:1997, *Natural gas — Sampling guidelines.*

ISO 14111:1997, *Natural gas — Guidelines for traceability in analysis.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 resolution: Gas-chromatographic resolution is a characteristic of the separation of two adjacent peaks and is measured as twice the distance between the maxima of the named peaks divided by the sum of the intercepts on the baseline made by tangents drawn to the peaks at half their height (see figure 1). The resolution R_{AB} may be expressed by the following equation:

$$R_{AB} = 2 \times \frac{d_R(B) - d_R(A)}{w(B) + w(A)}$$

where

$d_R(A)$ and $d_R(B)$ are the retention distances of the eluted components A and B;

$w(A)$ and $w(B)$ are the widths of the respective peaks at their base.

3.2 main components: The nitrogen, carbon dioxide and saturated hydrocarbons from methane to n-pentane present in a natural-gas sample.

3.3 associated components: The helium, hydrogen, argon and oxygen present in a natural-gas sample.

3.4 trace components: The hydrocarbons and/or groups of hydrocarbons from n-pentane upwards present in a natural-gas sample.

3.5 other components: Those components for which this method is not intended, such as oxygen compounds (water vapour, methanol, glycol) and sulfur compounds.

3.6 response: The response is the output signal for a component that is measured as peak area or peak height (more often as peak area).

---

[2] To be published. (Revision, in parts, of ISO 6974:1984)