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Gas analysis — Handling of calibration gases and gas mixtures — Guidelines

Analyse des gaz — Mise en oeuvre des gaz et des mélanges de gaz pour étalonnage — Lignes directrices

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

This second edition cancels and replaces the first edition (ISO 16664:2004), which has been technically revised. The major changes are the following:

— Figures 1 and 5 have been revised to more clearly depict the arrangements;

— several references and terminological entries have been updated.

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Introduction

This document uses the terms “calibration gas” for both gas mixtures and pure gases as the limiting case of gas mixtures.

The quality of calibration gases in cylinders as certified by producers is defined by

a) the correct analyte content;

b) a known uncertainty which is appropriate for its intended use;

c) the stability;

d) the homogeneity.

During its utilization period, the quality of calibration gases is influenced by

— storage conditions at the manufacturer’s and user’s sites;

— transport conditions;

— modes of calibration gas withdrawal and transfer;

— the transfer system employed.

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Gas analysis — Handling of calibration gases and gas mixtures — Guidelines

SAFETY PRECAUTIONS — National and international safety regulations concerning storage, use and transportation of pure gases and gas mixtures are to be followed in addition to this document.

1 Scope

This document describes factors that may influence the composition of pure gases and homogeneous gas mixtures used for calibration purposes. This document only applies to gases or gas mixtures that are within the "utilization period". It provides the following guidelines for the handling and use of calibration gas mixtures:

— storage of calibration gas cylinders;

— calibration gas withdrawal from cylinders;

— transfer of calibration gas from cylinders to the point of calibration.

It also outlines a method of assessing the stability of a gas mixture, taking into account the gas composition uncertainty given on the certificate and the user's measurement uncertainty.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
calibration gas
pure gas or gas mixture used for calibration

3.2
calibration gas mixture
gas mixture of known *stability* (3.9) and *homogeneity* (3.4) whose composition is well established for use in the calibration or verification of a measuring instrument or for the validation of a measurement

Note 1 to entry: Calibration gas mixtures are measurement standards (Annex A) as defined in ISO/IEC Guide 99:2007.

[SOURCE: ISO 7504:2015, 5.1]

3.3
component
chemical entity at a defined physical state present in a material or in a mixture

[SOURCE: ISO 7504:2015, 3.3]

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3.4
homogeneity
state of a gas mixture wherein all of its components are distributed uniformly throughout the volume occupied by the gas mixture

[SOURCE: ISO 7504:2015, 3.1]

3.5
impurity
undesired minor component present in a parent gas (and thus detectable in a gas mixture made of this parent gas

[SOURCE: ISO 7504:2015, 5.5]

3.6
leak rate
volume of fluid leaking from the system per unit of time due to incomplete sealing of materials

3.7
leak tightness
conformity to a specified leak rate

3.8
step response time
duration between the instant when an input quantity value of a measuring instrument or measuring system is subjected to an abrupt change between two specified constant quantity values and the instant when a corresponding indication settles within specified limits around its final steady value

[SOURCE: ISO/IEC Guide 99:2007]

3.9
stability
attribute of a gas mixture, under specified conditions, to maintain its composition within specified uncertainty limits for a specified period of time (maximum storage life)

[SOURCE: ISO 7504:2015, 3.2]

3.10
maximum storage life
period after which the properties stated for a gas mixture cannot be warranted to lie within their limits

Note 1 to entry: This period is usually identified as that for which the producer ensures that the gas mixture maintains its composition within the specified limits when it is stored in accordance with the requirements based upon the concepts defined in ISO 7504:2015, 7.1 to 7.4.

Note 2 to entry: The end of this period may be indicated by an “expiry date” (see also ISO 6142-1).

[SOURCE: ISO 7504:2015, 7.5]

3.11
transfer system
gas-conducting system which begins at the cylinder valve and ends at the gas sample inlet to the measuring instrument and includes all structural elements

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3.12
measurement uncertainty
non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

Note 1 to entry: Measurement uncertainty includes components arising from systematic effects, such as components associated with corrections and the assigned quantity values of measurement standards, as well as the definitional uncertainty. Sometimes estimated systematic effects are not corrected for but, instead, associated measurement uncertainty components are incorporated.

Note 2 to entry: The parameter may be, for example, a standard deviation called standard measurement uncertainty (or a specified multiple of it), or the half-width of an interval, having a stated coverage probability.

Note 3 to entry: Measurement uncertainty comprises, in general, many components. Some of these may be evaluated by Type A evaluation of measurement uncertainty from the statistical distribution of the quantity values from series of measurements and can be characterized by standard deviations. The other components, which may be evaluated by Type B evaluation of measurement uncertainty, can also be characterized by standard deviations, evaluated from probability density functions based on experience or other information.

Note 4 to entry: In general, for a given set of information, it is understood that the measurement uncertainty is associated with a stated quantity value attributed to the measurand. A modification of this value results in a modification of the associated uncertainty.

[SOURCE: ISO/IEC Guide 99:2007, 2.26]

3.13
utilization period
time between the date of certification and the expiry date

3.14
permeability
property of a material of transmitting gases and liquids by passage through one surface and out at another surface by diffusion and sorption processes

Note 1 to entry: Not to be confused with porosity.

[SOURCE: ISO 472:2013, 2.690]

4 Transport and storage

4.1 General remarks

After preparation of the calibration gas, the gas cylinder is transported to the user. The environment in which the cylinders are transported is not normally regulated in terms of temperature and humidity. Low temperatures may have a detrimental impact on the mixture composition, especially when condensable components are present in the mixture. As a consequence of this, environmental conditions during transport and storage should never exceed those recommended by the manufacturer.

Gas cylinders and especially cylinder valves shall be free of grease and other lubricants. During storage and transportation, cylinder valves shall be closed, sealing nuts or plugs shall be tightened and suitable protection devices shall be attached, e.g. caps or valve guards.

The gas cylinders are transported in several ways, e.g. by air, railway, road and on water. In some specific cases, the temperature restrictions may be such that not every means of transport is acceptable.

4.2 Low temperature

The gas cylinder may be exposed to low temperatures during storage and transportation. For gas mixtures containing condensable components, it is important that the cylinder is not stored or transported at temperatures below those recommended by the manufacturer. If the mixture is exposed

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