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Gas analysis — General quality assurance aspects in the use of calibration gas mixtures — Guidelines

Analyse des gaz — Aspects généraux de l'assurance qualité dans l'utilisation de 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.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 14167 was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

Introduction

Gas analyses are performed on samples covering a wide range of compositions.

All gas analyses fall into one of two categories:

— those for which calibration gas mixtures exist with compositions that are traceable to reference gas mixtures (e.g. primary or national standards);

— those for which the above do not exist.

In both cases, this Technical Specification provides the overall guidance on quality assurance aspects required to achieve a result with a valid measurement uncertainty.

It is applicable only to calibration gas mixtures of gaseous, or totally vaporized, components which do not react with each other or with the cylinder walls.

The user of this Technical Specification chooses, prior to any analyses, an appropriate measurement procedure depending on the application of the final results of the analyses and the requirements for a particular measurement uncertainty. This use may vary considerably, ranging from qualitative analysis to accurate quantitative analysis for which evidence has to be provided that claimed measurement uncertainty levels are met. Each type of measurement procedure involves a number of issues, which are considered beforehand. Typically, for gas analysis these include:

a) sampling;

b) selection and use of calibration gas mixtures;

c) selection and validation of measurement method;

d) identification of uncertainty sources;

e) quantification of uncertainty contributions;

f) documentation.

For a given measurement procedure, the effect of the above issues, influencing the uncertainty of the final measurement result, is calculated approximately. This may imply that several calculations have to be made in advance, with different sets of values for the parameters involved, before the required level of uncertainty is achieved. In practice, this calculation process is repeated until the desired target uncertainty is reached. This process of defining target uncertainties is an effective way of finding correct solutions for specific measurement procedures. The final analysis is then performed using this evaluated procedure.

To illustrate the use of this Technical Specification, two practical examples are given in Annex A.

Annex B gives information on the validation of reference gas mixtures in those cases where calibration gases of widely acknowledged composition do not exist.

Annex C describes the traditional hierarchy of reference gas mixtures.

The references are given in the Bibliography.

Gas analysis — General quality assurance aspects in the use of calibration gas mixtures — Guidelines

1 Scope

This Technical Specification provides guidance on the quality aspects in the field of gas analysis that are implemented in order to achieve a result with a valid measurement uncertainty.

It provides guidelines on quality aspects to be employed in gas analysis using calibration gas mixtures and their subsequent validation and/or verification, and the testing of the analytical performance of gas analysis instruments. These guidelines have the overall objective of defining procedures which will ensure that measurements of gas composition are reliable, comparable and consistent between different organizations and countries.

This Technical Specification explains, in particular, the concepts of measurement uncertainty and of traceability as effective quality assurance tools for defining the measurement uncertainty of particular measurement results. It also gives guidance on how to identify and estimate measurement uncertainty components of the result, and how to combine these uncertainty components in order to obtain the overall uncertainty.

2 Terms and definitions

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

2.1
traceability
property of a result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties

NOTE 1 The unbroken chain of comparisons is called a “traceability chain”.

NOTE 2 A calibration gas mixture is traceable at best to a primary reference gas mixture.

[VIM [1]]

2.2
uncertainty (of measurement)
parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand

NOTE 1 The parameter may be, for example, a standard deviation or a given multiple of it, or the half-width of an interval having a stated level of confidence.

NOTE 2 Uncertainty of measurement comprises, in general, many components. Some of these components may be evaluated from the statistical distribution of the results of series of measurements and can be characterized by experimental standard deviations. The other components, which can also be characterized by standard deviations, are evaluated from assumed probability distributions based on experience or other information.