International Standard

ISO 6143

Gas analysis — Comparison methods for determining and checking the composition of calibration gas mixtures

Analyse des gaz — Méthodes de comparaison pour la détermination et la vérification de la composition des mélanges de gaz d'étalonnage

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Foreword

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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 document 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 238, *Test gases, test pressures, appliance categories and gas appliance types*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 6143:2001), which has been technically revised.

The main changes are as follows:

— update of definitions, in particular those taken from the VIM;

— update of the bibliography and the corresponding references in the text;

— update of the information in Annex C on the computer programme B_LEAST; information on alternative software (Annex D);

— amendment of 6.2 (now 7.2) “Comparison of several calibration gas mixtures” and related statements in other parts of the document

— amendment of the recommendations concerning the number of replicate measurements per sample;

— revision of the requirements for the report of results (“Test report”);

— new Annex D (informative) “Additional information on data evaluation”;

— deletion of A.1 “Uncertainty specifications for reference gas mixtures”;

— additional references to relevant ISO standards (ISO 12963, ISO 14912, ISO 15796);

— correction of Formula (4) for the power functions.

— recommendation added to Annexes B and C not to use B_LEAST for evaluations using the exponential function (due to recently demonstrated errors) or to calculate the parameter uncertainties (standard uncertainties and covariances) separately.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In gas analysis, calibration of analytical systems is most often confined to the determination of a straight line through the origin, or of a straight-line segment, using only the minimum number of calibration standards (one for a straight line through the origin, two for a line segment). This approach was also adopted in the first edition (ISO 6143:1981). However, this document is intended for a specific task: the derivation of calibration gases from appropriate reference gases. Consequently, the multiplier effect of errors in calibration gases – an error in a calibration gas can cause errors in thousands of analytical results – implies high demands on the metrological quality of the analysis of calibration gases. In the development of the second edition (ISO 6143:2001), it was therefore decided to use the best available measurement strategy and data evaluation method. The main changes in the revision of ISO 6143:1981 related to calibration as well as to uncertainty evaluation:

— including non-linear response curves and/or functions;

— replacing interpolation by regression;

— taking into account the uncertainty on the calibration standards;

— including validation of calculated response curves and/or functions;

— calculating uncertainties by uncertainty propagation.

After twenty years, the principles and procedures specified in the second edition of this document are still fit for purpose. The current revision therefore mainly concerns additional supporting information.

As a consequence of adopting non-linear response models, advanced regression techniques (errors in both variables) and uncertainty propagation, the main calculation procedures can only be performed on a computer, using a specific program. A dedicated program (B_LEAST) is available and provided without cost as a part of this document (see Annex C)[1)]. Information on other publicly available software that can be used for at least the vast majority of the calculations required by this document is given in Annex D. As an alternative, sufficient information is given in this document to enable the user to develop a program on their own.

1) The software "B_LEAST" can be obtained via the following link: https://standards.iso.org/iso/6143/ed-3/en.