INTERNATIONAL STANDARD

ISO 6145-7

Second edition
2009-04-01

Gas analysis — Preparation of calibration gas mixtures using dynamic volumetric methods —

Part 7: Thermal mass-flow controllers

Analyse des gaz — Préparation des mélanges de gaz pour étalonnage à l'aide de méthodes volumétriques dynamiques —

Partie 7: Régulateurs thermiques de débit massique

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Contents

Page

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 6145-7 was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

This second edition cancels and replaces the first edition (ISO 6145-7:2001). In preparation of the first edition, it was assumed that each thermal mass-flow controller (TMC) would be configured for use at its optimum performance, and the uncertainty in the method was estimated on that basis. In this edition, therefore, extra precautionary text has been added to make it clear that the method shall not be employed, for example, to make a 10:1 binary mixture by using two thermal mass-flow controllers of identical range with one operated at its maximum, say, of 1 000 ml/min and the other at 100 ml/min. In the first edition, this necessary provision was only stated briefly in an informative annex; it has now been expanded and stated more explicitly in a normative part. Another major update is separation of the original Clause 3 into two clauses, one of which (Clause 4) defines the principle while the other (Clause 5) presents additional explanation to the user. The latter of these clauses now includes the necessary requirements. By introducing two new and relevant bibliographic references, the understanding of Annex B has been improved. Finally, some typing errors have been corrected.

ISO 6145 consists of the following parts, under the general title *Gas analysis — Preparation of calibration gas mixtures using dynamic volumetric methods*:

— *Part 1: Methods of calibration*

— *Part 2: Volumetric pumps*

— *Part 4: Continuous syringe injection method*

— *Part 5: Capillary calibration devices*

— *Part 6: Critical orifices*

— *Part 7: Thermal mass-flow controllers*

— *Part 8: Diffusion method*

— *Part 9: Saturation method*

— *Part 10: Permeation method*

— *Part 11: Electrochemical generation*

ISO 6145-3, entitled *Periodic injections into a flowing gas stream*, has been withdrawn.

Gas analysis — Preparation of calibration gas mixtures using dynamic volumetric methods —

Part 7: Thermal mass-flow controllers

1 Scope

This part of ISO 6145 is one of a series of International Standards dealing with dynamic volumetric methods used for the preparation of calibration gas mixtures. This part specifies a method for continuous production of calibration gas mixtures, containing two or more components, from pure gases or other gas mixtures by use of commercially available thermal mass-flow controllers.

If this method is employed for the preparation of calibration gas mixtures, the optimum performance is as follows: the relative expanded uncertainty of measurement, U, obtained by multiplying the combined standard uncertainty by a coverage factor $k = 2$, is not greater than 2 %.

If pre-mixed gases are used instead of pure gases, mole fractions below 10^{-6} can be obtained. The measurement of mass flow is not absolute and the flow controller requires independent calibration.

The merits of the method are that a large quantity of the gas mixture can be prepared on a continuous basis and that multicomponent mixtures can be prepared as readily as binary mixtures if the appropriate number of thermal mass-flow controllers is utilized.

NOTE Gas-blending systems based upon thermal mass-flow controllers, some including the facility of computerization and automatic control, are commercially available.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6143, *Gas analysis — Comparison methods for determining and checking the composition of calibration gas mixtures*

ISO 6145-1:2003, *Gas analysis — Preparation of calibration gas mixtures using dynamic volumetric methods — Part 1: Methods of calibration*

ISO 7504, *Gas analysis — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7504 apply.