INTERNATIONAL STANDARD

ISO 6145-9

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

Part 9: Saturation method

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

Partie 9: Méthode par saturation

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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 3.

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 part of ISO 6145 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 6145-9 was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

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 injection method*

— *Part 5: Capillary calibration devices*

— *Part 6: Critical orifices*

— *Part 7: Thermal mass-flow controllers*

— *Part 9: Saturation method*

— *Part 10: Permeation method*

Diffusion will be the subject of a future part 8 to ISO 6145. Part 3 to ISO 6145, entitled *Periodic injections into a flowing stream*, has been withdrawn.

Annexes A and B form a normative part of this part of ISO 6145.

Introduction

Easily condensable gases and vapours are subject to surface adsorption, and it is difficult to prepare calibration gas mixtures containing these components by means of static methods. Moreover, these calibration gas mixtures cannot be kept under pressure near the saturation limit without condensation taking place. The saturation method can be employed in such cases.

This part of ISO 6145 is one of a series of standards dealing with the various dynamic volumetric methods used for the preparation of calibration gas mixtures.

In contrast to the methods presented in the other parts of ISO 6145, the method described in this part does not call for accurate measurement of flow rates since flow rates do not appear in the equations for calculation of the volume fraction.

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

Part 9:
Saturation method

1 Scope

This part of ISO 6145 specifies a method for the continuous production of calibration gas mixtures with a component which is easily condensable. In most cases the relative expanded uncertainty occurring on the volume fraction is less than 1 %.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 6145. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 6145 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

VDI 3490-3:1980, *Messen von Gasen — Prüfgase — Anforderungen und Maßnahmen für den Transfer* (Measurement of gases — Calibration gas mixtures — Requirements and precautions for the transfer).

3 Principle

The vapour pressure of a pure substance in equilibrium with its condensed phase depends only on temperature. At pressures close to atmospheric, and in the absence of significant gas phase interactions, such as occur with hydrocarbon mixtures, the volume fraction of the constituent can be calculated from knowledge of the temperature and pressure of the system.

If a complementary gas is brought into contact with the condensed phase of a constituent at a certain temperature, the saturation condition is reached more or less slowly. In order to accelerate the process, the complementary gas is passed through the condensed phase at a temperature T_1 and the gas mixture thus obtained is then cooled to a lower temperature T_2 which is below the dew-point. To ensure that saturation is attained, the difference in temperature, $(T_1 - T_2)$, should be at least 5 K.

The volume fraction φ_x of the constituent x is, to a good approximation, equal to the vapour pressure p_x of the constituent at temperature T_2 divided by the total pressure p of the gas mixture at the same temperature in the condenser, as follows:

$$\varphi_x = \frac{p_x}{p} \tag{1}$$

The value of the relevant partial pressure (vapour pressure) of the constituent at temperature T_2 can be found in tables or diagrams in references [1] to [4] of the Bibliography.