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

Part 2:  
**Volumetric pumps**

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

*Partie 2: Pompes volumétriques*



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Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749-09-47  
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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 6145-2 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 Part 3 to ISO 6145, entitled *Periodic injections into a flowing gas*, has been withdrawn.

Annexes A and B of this part of ISO 6145 are for information only.

## Introduction

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

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

## Part 2:

## Volumetric pumps

### 1 Scope

This part of ISO 6145 specifies a method for the continuous production of calibration gas mixtures, containing two or more components, from pure gases or other gas mixtures by use of commercially available multi-piston, volumetric pumps. Pumps of this type may be employed to prepare gas mixtures in which the volume fractions of the gaseous components in the complementary gas range from 0,1 % upwards; the relative expanded uncertainty of measurement,  $U$ , obtained by multiplying the relative combined standard uncertainty by a coverage factor  $k = 2$  is not greater than 0,5 %.

Lower concentrations may be obtained by cascading volumetric pumps, and the lowest volume fraction achievable by means of a two-pump cascade is  $10^{-6}$ . Moreover, if pre-mixed gases are used instead of pure gases, much lower concentrations can be obtained.

The merits of this method are that a large quantity of the gas mixture can be prepared on a continuous basis, and that multicomponent mixtures can also be readily prepared.

### 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*

ISO 6145-1:1986, *Gas analysis — Preparation of calibration gas mixtures — Dynamic volumetric methods — Part 1: Methods of calibration*

### 3 Principle

A binary mixture of two gases, A and B, is prepared by passing each gas through one of a pair of single action piston pumps, each pump of which is driven by a synchronous motor. The volume fraction,  $\varphi_A$ , of component A, in the gas mixture is given by:

$$\varphi_A = q_A / (q_A + q_B) \quad (1)$$

in which  $q_A$  and  $q_B$  are the volumetric flow rates of the calibration component A and the complementary gas B respectively.