



**SLOVENSKI STANDARD**  
**SIST EN ISO 6145-1:2008**

01-oktober-2008

---

5 bU]nUd`]bcj `!`Df]dfUj U\_ U]VfUW]g\_Yd`]bg\_Y`na Yg]`ni dcfUvc`X]bUa ] b]`  
j c`i a Yff] b]`a YrcX`!`%rXY.`?U]VfUW]g\_Ya YrcXY`fIGC`\*%( ) !%&\$\$' Ł

Gas analysis - Preparation of calibration gas mixtures using dynamic volumetric methods  
- Part 1: Methods of calibration (ISO 6145-1:2003)

Gasanalyse - Herstellung von Kalibriergasgemischen mit Hilfe von dynamisch-  
volumetrischen Verfahren - Teil 1: Kalibrierverfahren (ISO 6145-1:2003)

Analyse des gaz - Préparation des mélanges de gaz pour étalonnage à l'aide de  
méthodes volumétriques dynamiques - Partie 1: Méthodes d'étalonnage (ISO 6145-  
1:2003)

**Ta slovenski standard je istoveten z: EN ISO 6145-1:2008**

---

**ICS:**

71.040.40      Kemijska analiza      Chemical analysis

**SIST EN ISO 6145-1:2008**      en

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN ISO 6145-1:2008](https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN ISO 6145-1**

August 2008

ICS 71.040.40

English Version

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

Analyse des gaz - Préparation des mélanges de gaz pour  
étalonnage à l'aide de méthodes volumétriques  
dynamiques - Partie 1: Méthodes d'étalonnage (ISO 6145-  
1:2003)

Gasanalyse - Herstellung von Kalibriergasgemischen mit  
Hilfe von dynamisch-volumetrischen Verfahren - Teil 1:  
Kalibrierverfahren (ISO 6145-1:2003)

This European Standard was approved by CEN on 30 July 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

**Contents**

Page

Foreword.....3

**iTeh STANDARD PREVIEW  
(standards.iteh.ai)**

[SIST EN ISO 6145-1:2008](https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

## Foreword

The text of ISO 6145-1:2003 has been prepared by Technical Committee ISO/TC 158 "Analysis of gases" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 6145-1:2008 by Technical Committee CEN/SS N21 "Gaseous fuels and combustible gas" the secretariat of which is held by CMC.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2009, and conflicting national standards shall be withdrawn at the latest by February 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**iTeh STANDARD PREVIEW**  
Endorsement notice  
(standards.iteh.ai)

The text of ISO 6145-1:2003 has been approved by CEN as a EN ISO 6145-1:2008 without any modification.

[SIST EN ISO 6145-1:2008](https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN ISO 6145-1:2008](#)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

# INTERNATIONAL STANDARD

**ISO**  
**6145-1**

Second edition  
2003-11-15

---

---

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

### Part 1: Methods of calibration

iTeh STANDARD PREVIEW

(standards.iteh.ai)

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

*Partie 1: Méthodes d'étalonnage*

SIST EN ISO 6145-1:2008

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>



Reference number  
ISO 6145-1:2003(E)

© ISO 2003

**ISO 6145-1:2003(E)****PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 6145-1:2008](https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland



## Contents

Page

Foreword .....	iv
Introduction .....	v
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Calibration methods</b> .....	<b>2</b>
4.1 General .....	2
4.2 Description of primary or potentially primary measuring devices .....	4
4.3 Measurements on the final mixture .....	12
<b>5 Techniques for preparation of gas mixtures calibrated by the methods described in Clause 4</b> .....	<b>13</b>
5.1 General .....	13
5.2 Volumetric pumps (see ISO 6145-2 <sup>[3]</sup> ) .....	15
5.3 Continuous injection (see ISO 6145-4 <sup>[4]</sup> ) .....	15
5.4 Capillary (see ISO 6145-5 <sup>[5]</sup> ) .....	15
5.5 Critical orifices (see ISO 6145-6 <sup>[6]</sup> ) .....	16
5.6 Thermal mass flow controllers (see ISO 6145-7 <sup>[7]</sup> ) .....	16
5.7 Diffusion (see ISO 6145-8 <sup>[8]</sup> ) .....	16
5.8 Saturation (see ISO 6145-9 <sup>[9]</sup> ) .....	17
5.9 Permeation (see ISO 6145-10 <sup>[10]</sup> ) .....	17
<b>Annex A (normative) Volume measurement by weighing the water content</b> .....	<b>19</b>
<b>Annex B (informative) Description of secondary devices which need calibration against primary devices</b> .....	<b>23</b>
<b>Bibliography</b> .....	<b>32</b>

## ISO 6145-1:2003(E)

## 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 6145-1 was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

This second edition cancels and replaces the first edition (ISO 6145-1:1986), in which the estimated uncertainties in the calibration methods and techniques have now been combined in a square-root sum-of-squares manner to form the relative combined standard uncertainty. In comparison with the previous edition the periodic injection has been deleted (limited application).

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 methods*
- *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.

## Introduction

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

In dynamic volumetric methods a gas, A, is introduced at volume or mass flow rate  $q_A$  into a constant flow rate  $q_B$  of a complementary gas B. Gas A can be either a pure calibration component,  $i$ , or a mixture of  $i$  in A.

The volume fraction,  $\varphi_{i,M}$  of  $i$  in the final calibration gas mixture is given in the following equation:

$$\varphi_{i,M} = \varphi_{i,A} \left( \frac{q_A}{q_A + q_B} \right)$$

where  $\varphi_{i,A}$  is the volume or mass fraction of component,  $i$ , in the pre-mixed gas A, and is already known from its method of preparation. It is assumed that in this equation,  $\varphi_{i,B}$ , the concentration of component,  $i$ , in gas B, is zero.

The introduction of gas A can be continuous (e.g. permeation tube) or pseudo-continuous (e.g. volumetric pump). A mixing chamber should be inserted in the system before the analyser and is particularly essential in the case of pseudo-continuous introduction. The flow rate of component A is measured either directly in terms of volume or mass, or indirectly by measuring the variation of a physical property.

The dynamic volumetric preparation techniques produce a continuous flow rate of calibration gas mixtures into the analyser but do not generally allow the build-up of a reserve by storage under pressure.

The main techniques used for the preparation of the mixtures are:

- a) volumetric pumps;
- b) continuous injection;
- c) capillary;
- d) critical orifices;
- e) thermal mass-flow controllers;
- f) diffusion;
- g) saturation;
- h) permeation;
- i) electrochemical generation.

In all cases, and most particularly if very dilute mixtures are concerned, the materials used for the apparatus are chosen as a function of their resistance to corrosion and low absorption capacity (usually glass, PTFE or stainless steel). It should, however, be pointed out that the phenomena are less important for dynamic volumetric methods than for static methods.

Numerous variants or combinations of the main techniques can be considered and mixtures of several constituents can also be prepared by successive operations.

**ISO 6145-1:2003(E)**

Some of these techniques allow calculation of the final concentration of the gas mixture from basic physical information (e.g. mass rates of diffusion, flow through capillaries). However, since all techniques are dynamic and rely on stable flow rates, this part of ISO 6145 emphasizes calibration of the techniques by measurement of the individual flow rates or their ratios, or by determination of the composition of the final mixture.

The uncertainty of the composition of the calibration gas mixture is best determined by comparison with a gas mixture traceable to international standards. Certain of the techniques which may be used to prepare a range of calibration gas mixtures may require several such traceable gas mixtures to verify their performance over that range. The dynamic volumetric technique used has a level of uncertainty associated with it. Information on the final mixture composition depends both on the calibration method and on the preparation technique.

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

[SIST EN ISO 6145-1:2008](https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008)

<https://standards.iteh.ai/catalog/standards/sist/1ce293f4-6570-4faa-93fa-d04a894f8483/sist-en-iso-6145-1-2008>

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

## Part 1: Methods of calibration

### 1 Scope

This part of ISO 6145 specifies the calibration methods involved in the preparation of gas mixtures by dynamic volumetric techniques. It also gives a brief presentation of a non-exhaustive list of examples of dynamic volumetric techniques which are described in more detail in other parts of ISO 6145.

### 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 6142, *Gas analysis — Preparation of calibration gas mixtures — Gravimetric method*

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

ISO 7504, *Gas analysis — Vocabulary*

### 3 Terms and definitions

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

#### 3.1

##### **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 Values of the individual statistical uncertainties found in some methods and techniques in this part of ISO 6145 are combined with the values of systematic uncertainties that also occur in a square-root sum-of-squares manner to provide a relative combined uncertainty, or in some cases as a relative expanded uncertainty by application of the coverage factor “2”.

NOTE 2 In keeping with Reference [1] of the Bibliography, the uncertainty of the composition of a mixture is expressed as a relative expanded uncertainty.