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Gasanalys – Tillverkning av kalibreringsgaser med dynamiska, volymetriska metoder – Del 10: Permeationsmetod (ISO 6145-10:2002)

Gas analysis – Preparation of calibration gas mixtures using dynamic volumetric methods – Part 10: Permeation method (ISO 6145-10:2002)

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 6145-10

August 2008

ICS 71.040.40

English Version

**Gas analysis - Preparation of calibration gas mixtures using
dynamic volumetric methods - Part 10: Permeation method (ISO
6145-10:2002)**

Analyse des gaz - Préparation des mélanges de gaz pour
étalonnage à l'aide de méthodes volumétriques
dynamiques - Partie 10: Méthode par perméation (ISO
6145-10:2002)

Gasanalyse - Herstellung von Kalibriergasgemischen mit
Hilfe von dynamisch-volumetrischen Verfahren - Teil 10:
Permeationsverfahren (ISO 6145-10:2002)

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SS-EN ISO 6145-10:2008 (E)

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Foreword

The text of ISO 6145-10:2002 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 6145-10:2008 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of an identical text or by endorsement, at the latest by February 2009, and conflicting national standards shall be withdrawn at the latest by February 2009.

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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.

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

Part 10: Permeation method

1 Scope

This part of ISO 6145 specifies a dynamic method using permeation membranes for the preparation of calibration gas mixtures containing component mole fractions ranging from 10^{-9} and 10^{-6} . A relative expanded uncertainty of 2,5 % of the component mole fraction can be achieved using this method. In the mole fraction range considered, it is difficult to maintain some gas mixtures, for example in cylinders, in a stable state. It is therefore desirable to prepare the calibration gas immediately before use, and to transfer it by the shortest possible path to the place where it is to be used. This technique has been successfully applied in generating low content calibration gas mixtures of, for example, sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and benzene (C₆H₆) in air.

If the carrier gas flow is measured as a gas mass-flow, the preparation of calibration gas mixtures using permeation tubes is a dynamic-gravimetric method which gives contents in mole fractions.

2 Normative reference

The following normative document contains 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 edition of the normative document 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 6145-1, *Gas analysis — Preparation of calibration gas mixtures using dynamic volumetric methods — Part 1: Methods of calibration*

3 Principle

The calibration component [for example SO₂, NO₂, ammonia (NH₃), benzene, toluene, xylene] is permeated through an appropriate membrane into the flow of a carrier gas, i.e. the complementary gas of the mixture obtained. The calibration component, of known purity, is contained in a tube, which is itself contained in a temperature-controlled vessel. This vessel is purged at a known and controlled flow rate by the carrier gas. The composition of the mixture is determined from the permeation rate of the calibration component as well as the flow rate of the high quality carrier gas, free from any trace of the calibration component and from any chemical interaction with the material of the permeation tube.

The permeation rate of the calibration component through the membrane depends upon the component itself, the chemical nature and structure of the membrane, its area and thickness, the temperature, and the partial pressure gradient of the calibration component across the membrane. These factors can be kept constant by proper operation of the system.

The permeation rate can be measured directly by mounting the tube on a microbalance and weighing the tube either continuously or periodically.

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4 Reagents and materials

4.1 Permeating substances for calibration, of the highest possible purity so as to avoid any effect of impurities on the permeation rate; if this is not possible, the nature and quantities of the impurities shall be known and allowance made for their effect.

4.2 Carrier gas, of known purity, established by an appropriate analytical technique, for example, gas chromatography (GC) and/or Fourier transform infrared (FTIR) spectrometry.

5 Apparatus

5.1 Permeation apparatus, typically consisting of one of two modes (5.1.1 and 5.1.2) of application of the permeation method.

The materials of the permeation apparatus shall be chosen so as to avoid any effect on the content of the calibration component by sorption (chemical or physical). The smaller the desired final content, the greater the effect of adsorption phenomena. If possible, use glass as the housing of the temperature-controlled permeation tube. Choose flexible and chemically inert tube materials and metals, especially having regard to the transfer of the gas between the permeation apparatus and the analyser. Pay special attention to all junctions so as to keep them free from leaks.

The flow range of the carrier gas is kept constant by a control system and is monitored by a flowmeter. The value of the flow rate can, for example, be controlled by means of a mass flow controller and determined using a mass flowmeter.

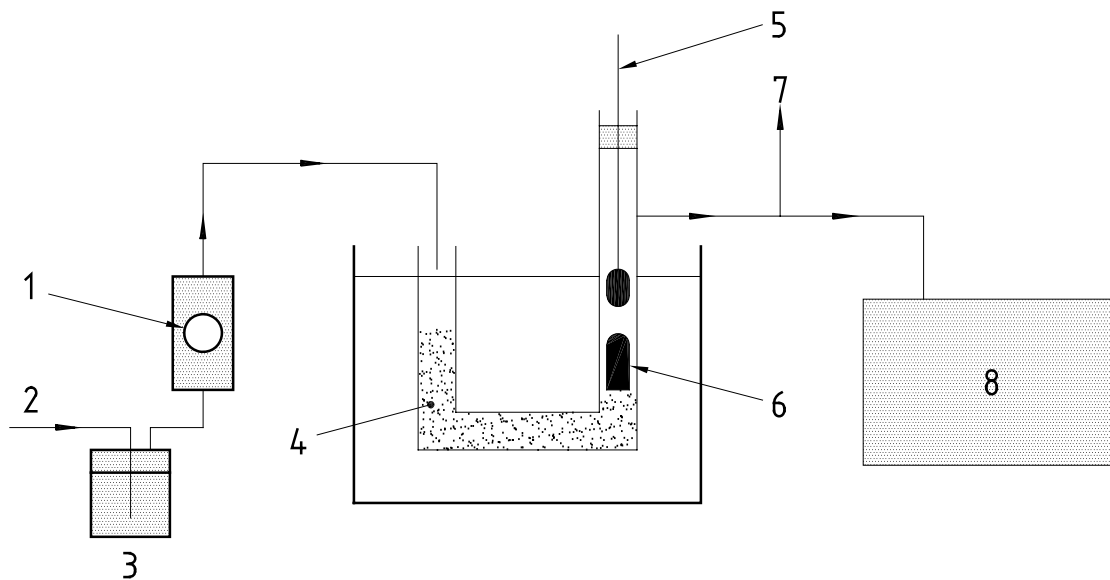
The existence of an outlet for surplus gas enables the analyser under calibration to take the gas flow rate necessary for its proper operation, the remainder of the flow of gas being vented to atmosphere.

5.1.1 Periodic-weighing-mode permeation apparatus, consisting of a permeation tube kept in a temperature-controlled enclosure, swept by carrier gas. The permeation tube is periodically removed from the enclosure to be weighed.

Typical examples are given in Figures 1 and 2.

5.1.2 Continuous-weighing-mode permeation apparatus, consisting of a permeation tube kept in a temperature-controlled enclosure, swept by carrier gas. The permeation tube is suspended from a weighing device and weighed continuously.

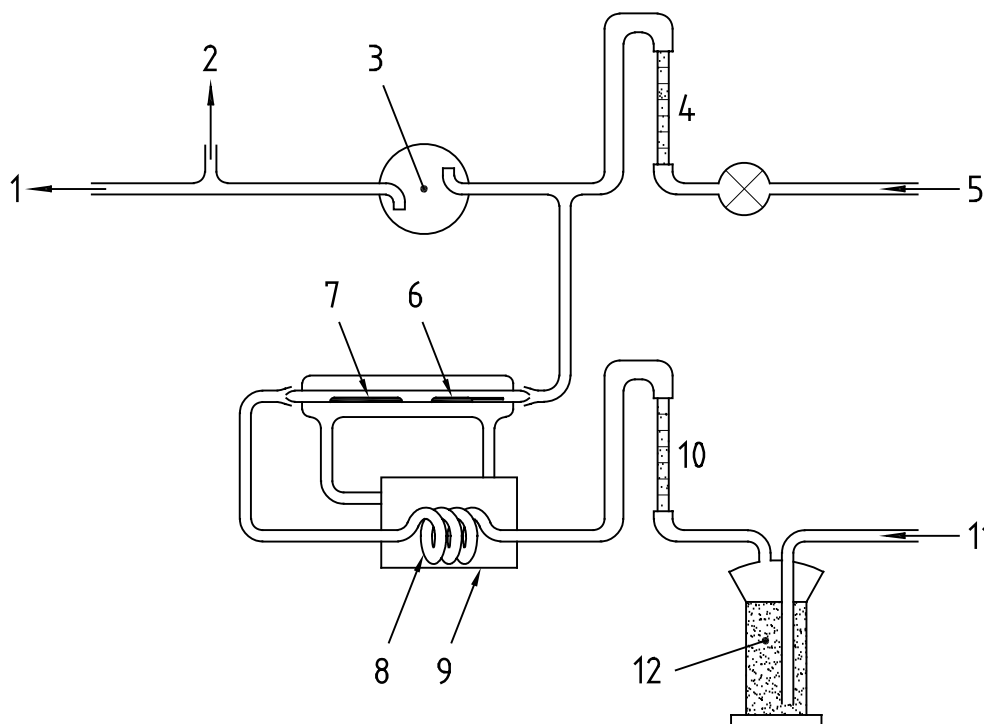
A typical example is given in Figure 3.



Key

- | | |
|---------------|--------------------------|
| 1 Flowmeter | 5 Thermometer |
| 2 Carrier gas | 6 Permeation tube |
| 3 Drier | 7 Outlet for surplus gas |
| 4 Filter | 8 Analyser |

Figure 1 — Example 1 of a periodic-weighing-mode permeation apparatus



Key

- | | | |
|--------------------------|-------------------|----------------|
| 1 Outlet for surplus gas | 5 Diluent gas | 9 Water bath |
| 2 Sampling system | 6 Thermometer | 10 Flowmeter 1 |
| 3 Mixing bulb | 7 Permeation tube | 11 Carrier gas |
| 4 Flowmeter 2 | 8 Copper tubing | 12 Drier |

Figure 2 — Example 2 of a periodic-weighing-mode permeation apparatus