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

**Part 1:
General aspects**

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

Partie 1: Aspects généraux





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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 158, *Gas analysis*.

This third edition cancels and replaces the second edition (ISO 6145-1:2003), which has been technically revised. The main changes compared to the previous edition are as follows.

- The techniques for the preparation of gas mixtures are described in an abbreviated manner since there is no need to repeat the text and formulae from each of the different parts of the ISO 6145 series. However, a summary table ([Table 1](#)) presenting the advantages and limitations of each method has been introduced.
- Recommendations regarding the handling of the dynamic mixing systems and quality considerations have been added.
- The methods and instruments to calibrate a dynamic system have changed and are better described.
- The calculations to obtain composition and uncertainties are more detailed, and the different ways of mixing gases (volume flow rates or mass flow rates) have been taken into account.
- Clauses on certificates ([7.4](#)) and verification ([Clause 10](#)) have been added.

A list of all parts in the ISO 6145 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is one of a series of standards which describes the various dynamic methods for the preparation of calibration gas mixtures.

Several techniques are available and the choice between them is decided based on the desired gas composition range, the consistency of equipment with the application and the required level of uncertainty. This document aids with making an informed choice by listing all the advantages and limitations of the methods.

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

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

In dynamic methods, a gas A is introduced at a known constant volume or mass flow rate into a known constant flow rate of a complementary gas B. Gases A and B can be either pure gases or gas mixtures. The preparation process can be continuous (such as mass flow controllers, permeation tube) or pseudo-continuous (such as piston pump).

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

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

Part 1: General aspects

1 Scope

This document gives a brief overview of each of the dynamic techniques which are described in detail in the subsequent parts of ISO 6145. This document provides basic information to support an informed choice for one or another method for the preparation of calibration gas mixtures. It also describes how these methods can be linked to national measurement standards to establish metrological traceability for the composition of the prepared gas mixtures.

Since all techniques are dynamic and rely on flow rates, this document describes the calibration process by measurement of each individual flow rate generated by the device.

Methods are also provided for assessing the composition of the generated gas mixtures by comparison with an already validated calibration gas mixture.

This document provides general requirements for the use and operation of dynamic methods for gas mixture preparation. It also includes the necessary expressions for calculating the calibration gas composition and its associated uncertainty.

Gas mixtures obtained by these dynamic methods can be used to calibrate or control gas analysers.

The storage of dynamically prepared gas mixtures into bags or cylinders is beyond the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7504, *Gas analysis — Vocabulary*

ISO 12963, *Gas analysis — Comparison methods for the determination of the composition of gas mixtures based on one- and two-point calibration*

ISO 14912, *Gas analysis — Conversion of gas mixture composition data*

ISO 19229, *Gas analysis — Purity analysis and the treatment of purity data*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>