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Gas analysis — Sampling guidelines

Analyse des gaz — Lignes directrices pour le prélèvement des échantillons

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 158, *Analysis of gases*.

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.

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Introduction

The determination of gas composition, impurity concentration and physical properties depend, to a large extent, on sampling technique. The use of correct sampling techniques is an important safety and quality critical step in gas analysis. The design, construction and selection of the sampling equipment to avoid hazardous situations and sampling errors are important and directly influence the results obtained. Any slight carelessness, inexactitude or mistake will seriously influence safety and the results obtained.

Gaseous products are stored and transported in pressure receptacles in the form of compressed or liquefied gas or through gas pipelines. The sampling methods used differ depending upon the package, composition and delivery methods.

This document provides technical guidelines for the sampling of gases in pressure receptacles and pipelines for analytical purposes.

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Gas analysis — Sampling guidelines

WARNING — The use of this document can involve a number of hazards. This document does not specify all the safety issues associated with its use. Users of this document are responsible for establishing measures to ensure safety while gas sampling.

1 Scope

This document specifies the general provisions and gives the basic definitions of terms relating to sampling for gas analysis, including sampling devices, sampling methods, sampling technical considerations, and sampling safety.

This document applies to both direct and indirect sampling of gas in pressure receptacles and pipelines, including pure gases and gas mixtures. Compressed and liquefied gases are both considered.

This document applies to the sampling of processed gases and does not involve gas treatment processes.

The sampling procedures specified are not intended for the sampling of special products which are the subject of other International Standards, such as liquefied petroleum gases (see ISO 4257) and gaseous natural gases (see ISO 10715).

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 3165, *Sampling of chemical products for industrial use — Safety in sampling*

ISO 16664, *Gas analysis — Handling of calibration gases and gas mixture — Guidelines*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

— IEC Electropedia: available at http://www.electropedia.org/

3.1
gas
materials which are present completely in gaseous form at a temperature of 20 °C under the absolute pressure of 0,101 3 MPa

Note 1 to entry: The materials here include single mediums and mixtures.

3.2
compressed gas
gas (3.1) which, when packaged under pressure for transport, is entirely gaseous at all temperatures above −50 °C

Note 1 to entry: This category includes all gases with a critical temperature less than or equal to −50 °C.

[SOURCE: ISO 10286:2015, 705, modified — Modified to include all temperatures above −50 °C.]

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3.3
liquefied gas
gas (3.1) which, when packaged under pressure for transport, is partially liquid at temperatures above −50 °C

[SOURCE: ISO 10286:2015, 706, modified — Modified to specify that gas is packaged under pressure.]

3.4
high pressure liquefied gas
gas (3.1) with a critical temperature between −50 °C and +65 °C

[SOURCE: ISO 10286:2015, 708]

3.5
low pressure liquefied gas
gas (3.1) with a critical temperature above +65 °C

[SOURCE: ISO 10286:2015, 707]

3.6
toxic gas
gas (3.1) which is known to be so toxic or corrosive to humans to pose a health hazard or which is presumed to be toxic or corrosive to humans because it has a *lethal concentration 50* (3.38) value for acute toxicity equal to or less than 5 000 ml/m^3 (ppm)

Note 1 to entry: Other risks, such as tissue corrosiveness, are sometimes associated.

[SOURCE: ISO 10286:2015, 716]

3.7
gas in pressure receptacles
gas stored in closed cylinders, tube, pressure drums, tanks and other pressure receptacles

3.8
gas in pipelines
gas delivered in pipelines during the production process

3.9
sampling device
components that comprise the *sampling system* (3.10) mainly includes *sample lines* (3.26), pressure regulators/reducers, flow controllers, connectors and sample containers

3.10
sampling system
gas transmission and control system constructed by gas storage container or sample point of *gas in pipelines* (3.8) and various *sampling devices* (3.9)

3.11
representative sample
sample assumed to have the same composition as the material sampled when the latter is considered as a homogeneous whole

[SOURCE: ISO 6206:1979, 3.3]

3.12
direct sampling
sampling in situations where there is a direct connection between the gas to be sampled and the analytical unit

[SOURCE: ISO 10715:1997, 2.1, modified — The word "natural" has been omitted from the definition.]

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3.13
indirect sampling
sampling in situations where there is no direct connection between the gas to be sampled and the analytical unit

[SOURCE: ISO 10715:1997, 2.7, modified — The word "natural" has been omitted from the definition.]

3.14
sampling plan
planned procedure of selection, withdrawal and preparation of a sample or samples from a lot to yield the required knowledge of the characteristic(s) from the final sample so that a decision can be made regarding the lot

[SOURCE: ISO 6206:1979, 3.1.5]

3.15
spot sampling
indirect sampling (3.13) from a specific part of the stream of material with a certain volume at a specific time

3.16
incremental sampling
indirect sampling (3.13) by collecting a series of spot samples into a combined sample

3.17
continuous sampling
direct sampling (3.12) taken continuously from a stream of material with a constant flow rate in a certain period of time

3.18
intermittent sampling
direct sampling (3.12) from a stream of material with predetermined intervals

3.19
ullage
outage
space in the container not occupied by the material, or the distance between the material surface and a fixed reference point at the top of the container

Note 1 to entry: This volume allows room for expansion.

[SOURCE: ISO 6206:1979, 3.3.14]

3.20
sampling error
part of the total estimation error of a characteristic due to known and acceptable deficiencies in the *sampling plan* (3.14)

[SOURCE: ISO 6206:1979, 3.4.10]

3.21
incremental sampler
sampler which accumulates a series of spot samples into one composite sample

[SOURCE: ISO 10715:1997, 2.6]

3.22
low-pressure gas
gases with a pressure between 0 MPa and 0,2 MPa at sampling temperature

Note 1 to entry: Except for special provisions, all pressures mentioned in this standard are gauge pressures.

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3.23
high-pressure gas
gases with a pressure exceeding 0,2 MPa at sampling temperature

3.24
lag time
time taken for a *representative sample* (3.11) to enter the instrument

[SOURCE: ISO 11042-2:1996, 3.5.1.1]

3.25
sample container
container for collecting the gas sample when *indirect sampling* (3.13) is necessary

[SOURCE: ISO 10715:1997, 2.14]

3.26
sample line
conduit to transfer a sample of gas from the sample place to the analytical unit or *sample container* (3.25)

Note 1 to entry: Another word used for sample line is transfer line.

[SOURCE: ISO 14532:2014, 2.3.2.5]

3.27
sample probe
device inserted into the gas pipelines so that a *representative sample* (3.11) of the flowing gas can be taken

Note 1 to entry: The sample probe will have a conduit to convey the sample from the flowing gas to a point external to the pipeline.

[SOURCE: ISO 14532:2014, 2.3.2.6, modified — The second sentence has been formatted as a note to entry.]

3.28
sampling point
point in the gas stream where a *representative sample* (3.11) can be collected

[SOURCE: ISO 10715:1997, 2.17]

3.29
filling ratio
ratio of the mass of gas to the mass of water at 15 °C that would fill completely a pressure receptacle fitted ready for use

Note 1 to entry: Synonyms are filling factor and filling degree, often expressed in kg/l or similar.

[SOURCE: ISO 10286:2015, 747]

3.30
continuous purging method
purging method by continually purging the *sampling system* (3.10) with sample gases

3.31
fill-empty cycle purging method
purging method by sequentially filling and emptying the *sampling system* (3.10) repeatedly with the gas to be taken

3.32
evacuation-gas purging cycles
purging method by sequentially evacuating and pressurizing the *sampling system* (3.10) with the sample to be taken

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3.33
sampling from the gaseous phase
process that takes a sample from the gaseous phase of the *liquefied gases* (3.3)

3.34
sampling from the liquid phase
process that takes a sample from the liquid phase of the *liquefied gases* (3.3)

3.35
sampling in liquid form
process that takes a sample in liquid form directly from the liquid phase of the *liquefied gas* (3.3)

3.36
sampling after evaporation
process that takes a sample in gaseous form by vaporizing the sample from the liquid phase of the *liquefied gas* (3.3)

3.37
liquid valve
device with an internal fixed sample loop, fitted to an analyser for the *direct sampling* (3.12) of *liquefied gas* (3.3) in liquid form, which can keep the liquefied gas to be collected completely in the liquid phase

3.38
lethal concentration 50
LC_{50}
concentration of a substance in air exposure to which, for a specified length of time, it is expected to cause the death of 50 % of the entire defined experimental animal population after a defined time period

[SOURCE: ISO 10298:2018, 3.1]

3.39
corrosive gas
gas (3.1) which, when dissolved in water or other liquid, causes corrosion of metal

[SOURCE: ISO 13703:2000, 3.1.4]

3.40
floating piston cylinder
sample container (3.25) that has a moving piston separating the sample from a precharge gas

Note 1 to entry: The pressures are in balance on both sides of the piston.

[SOURCE: ISO 14532:2014, 2.3.2.1, modified — The container has been specified as a "sample container" and the second sentence was formatted as a note to entry.]

4 Sampling plan

A feasible and complete sampling plan should be developed before sampling as shown in Figure 1.

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