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Gas analysis — Sampling guidelines

Analyse des gaz — Lignes directrices pour le prélèvement des échantillons

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Contents

Foreword

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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.

Introduction

The determination of gas composition, impurity concentration and physical properties depends 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, in exactitude 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.

Gas Analysis— Sampling Guidelines

1 Scope

This document gives the basic definitions of terms and general provisions 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 (ISO 4257) and gaseous natural gases (ISO 10715).

Warning — The use of this document may involve a number of hazards. This document does not specify all the safety issues associated with the use of the standard. Users of this document are responsible for establishing measures to ensure safety whilst gas sampling. All sampling activities should comply with national and local safety regulations.

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
all materials which are present completely in gaseous form at a temperature of 20 ° C under the absolute pressure of 0,1013 MPa

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

3.2
compressed gas
gas 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]

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

[SOURCE: ISO 10286:2015, 706]

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

[SOURCE: ISO 10286:2015, 708]

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

[SOURCE: ISO 10286:2015, 707]

3.6
toxic gas
gas 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 LC_{50} value for acute toxicity equal to or less than 5000 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 cylinders, tube, pressure drums, tanks and other pressure receptacles, and no fresh gas replenished into the receptacles

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

3.9
sampling device
components that comprise the sampling system mainly include sample lines, 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 and various sampling devices

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

[SOURCE: ISO 6206:1979, 3.1.4]

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]

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

[SOURCE: ISO 10715:1997, 2.7]

3.14
sampling plan
the 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 from a specific part of the stream of material with a certain volume at a specific time

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

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

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

3.19
ullage/outage
the 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
that part of the total estimation error of a characteristic due to known and acceptable deficiencies in the sampling plan

[SOURCE: ISO 6206:1979, 3.4.10]

3.21
incremental sampler
a 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 and 0,2 MPa at sampling temperature

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

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 to enter the instrument

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

3.25
sample container
a container for collecting the gas sample when indirect sampling 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

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 of the flowing gas can be taken. 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]

3.28
sampling point
a point in the gas stream where a representative sample 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 with sample gases

3.31
fill-empty cycle purging method
purging method by sequentially filling and emptying the sampling system repeatedly with the gas to be sampled

3.32
evacuation-gas purging cycles
purging method by evacuating the sampling system

3.33
sampling from the gaseous phase
sampling from the gaseous phase of the liquefied gas

3.34
sampling from the liquid phase
sampling from the liquid phase of the liquefied gas

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

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

3.37
liquid valve
a device fitted to an analyser for the direct sampling of liquefied gas in liquid form, which can keep the liquefied gas to be collected in completely liquid phase

4 Sampling plan

A feasible and complete sampling plan should be developed before sampling.

For a sampling plan, first determine the sampling type (clause 5), then consider techniques of sampling (clause 6), to determine the appropriate sampling process (clause 9) and sampling devices (clause 8) and sampling safety (clause 7), and then sampling (clause 9).

The scheme for sampling plan is shown in Figure 1.

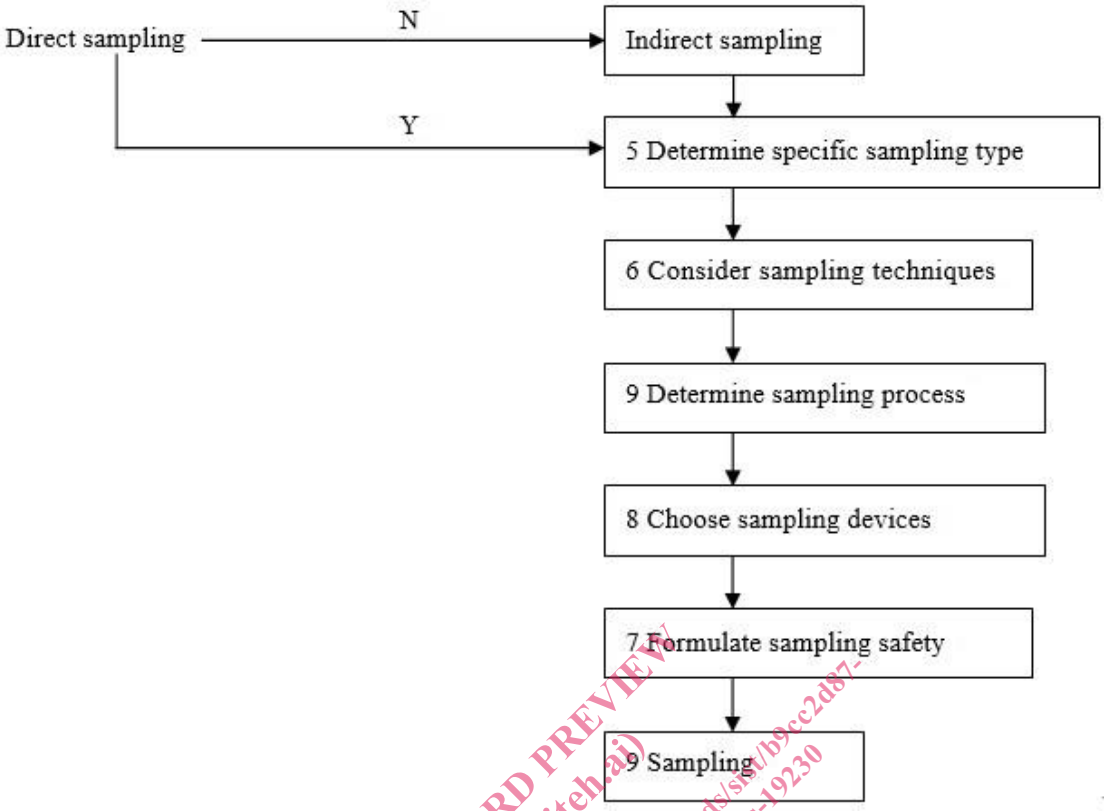

Figure 1 —Scheme of sampling plan

5 Sampling classification

5.1 Sampling classification of gases

In this document, the sampling classification is based on whether the gas is connected to the analyser. In addition, the sampling methods vary among different gas packaging, storage methods and sampling purposes.

Direct sampling, if possible, is strongly recommended. In the case of indirect sampling, the potential loss of component during the time between sampling and analysis should be studied and incorporated in the uncertainty budget.

In general, for gas in pressure receptacles the internal composition is relatively uniform and constant.

For gases in pipelines the purpose and controls required dictate the type of sampling used. The design of a sampling plan should consider whether the objectives of sampling are to:

- Determine the instantaneous gaseous composition
- Determine an average composition over a specified time interval
- Establish changes in concentration by repeated sampling over a specified time
- Pass continuous samples into the analyser to measure both limit and average composition

A flow chart detailing the gas sampling classification is shown in Figure 2.

