SLOVENSKI STANDARD
SIST EN ISO 10715:2000

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Zemeljski plin - Smernice za vzorčenje (ISO 10715:1997)

Natural gas - Sampling guidelines (ISO 10715:1997)

Erdgas - Probenahmerichtlinien (ISO 10715:1997)

Gaz naturel - Lignes directrices pour l'échantillonnage (ISO 10715:1997)

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Natural gas - Sampling guidelines (ISO 10715:1997)

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This European Standard was approved by CEN on 26 November 1999.

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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 Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

The text of the International Standard from Technical Committee ISO/TC 193 "Natural gas" of the International Organization for Standardization (ISO) has been taken over as an European Standard by CEN/CS.

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of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

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

Endorsement notice

The text of the International Standard ISO 10715:2000 has been approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 10715

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1997-06-01

Natural gas — Sampling guidelines

Gaz naturel — Lignes directrices pour l'échantillonnage

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Contents

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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.

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.

International Standard ISO 10715 was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcomittee SC 1, *Analysis of natural gas*.

Annexes A to J of this International Standard are for information only.

Introduction

This International Standard provides guidance on all aspects of the sampling of processed natural gas. Unless otherwise stated, all pressures up to 15 MPa in this International Standard are given as gauge pressures.

The determination of the composition and the properties of the gas is highly dependent on the sampling technique. Also of great importance are the design, construction, installation and maintenance of the sampling system as well as the conditions of sample transfer and transport.

These guidelines cover sampling strategy, details of sampling methods, the choice of sampling method and sampling equipment.

This document is intended for use in those cases where sampling is not described as part of the analytical procedure.

This document concentrates on sampling systems and procedures. Analyses from the samples collected using these systems and procedures may be utilized in many different ways, including calculations to determine the calorific value of the gas stream, identification of contaminants contained in the gas stream, and compositional information to determine whether or not the stream meets contractual specifications.

Natural gas — Sampling guidelines

WARNING — The use of this International Standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability or regulatory limitations prior to use.

All sampling activities shall comply with local safety regulations.

1 Scope

The purpose of this document is to provide concise guidelines for the collection, conditioning and handling of representative samples of processed natural gas streams. It also contains guidelines for sampling strategy, probe location and the handling and design of sampling equipment.

It considers spot, composite (incremental) and continuous sampling systems.

This document gives consideration to constituents such as oxygen, hydrogen sulfide, air, nitrogen and carbon dioxide in the gas stream.

This document does not include sampling of liquid streams or streams with multiphase flow.

Traces of liquid, such as glycol and compressor oil, if present, are assumed to be intrusive and not a part of the gas to be sampled. Their removal is desirable to protect the sampling and analytical equipment from contamination.

This document can be used for custody transfer measurement systems and allocation measurement systems.

2 Definitions

For the purposes of this International Standard, the following definitions apply:

2.1 direct sampling:
Sampling in situations where there is a direct connection between the natural gas to be sampled and the analytical unit.

2.2 floating-piston cylinder:
A container which has a moving piston separating the sample from a buffer gas. The pressures are in balance on both sides of the piston.

2.3 flow-proportional incremental sampler:
A sampler which collects gas over a period of time and at a rate that is proportional to the flow rate in the sampled pipeline.

2.4 high-pressure natural gas:
Natural gas with a pressure exceeding 0,2 MPa.

NOTE — The maximum for this International Standard is 15 MPa.

2.5 hydrocarbon dew point:
The temperature, at a given pressure, at which hydrocarbon vapour condensation begins.

2.6 incremental sampler:
A sampler which accumulates a series of spot samples into one composite sample.

2.7 indirect sampling:
Sampling in situations where there is no direct connection between the natural gas to be sampled and the analytical unit.

2.8 liquid separator:
A unit, in the sample line, used to collect liquid fall-out.

2.9 low-pressure natural gas:
Natural gas having a pressure between 0 and 0,2 MPa.

2.10 purging time:
The period of time during which a sample purges a piece of equipment.

2.11 representative sample:
A sample having the same composition as the natural gas sampled when the latter is considered as a homogeneous whole.

2.12 residence time:
The time it takes for a sample to flow through a piece of equipment.

2.13 retrograde condensation:
Retrograde behaviour describes the non-ideal phase properties of hydrocarbon gas mixtures, such as natural gas. Retrograde condensation is the production of a liquid phase of heavy hydrocarbons at a particular pressure and temperature where, at that same temperature, the gas stays in a single phase at a higher pressure as well as at a lower pressure.

NOTE — See also 5.2.

2.14 sample container:
A container for collecting the gas sample when indirect sampling is necessary.

2.15 sample line:
A line provided to transfer a sample of the gas to the sampling point. It may include devices which are necessary to prepare the sample for transportation and analysis.

2.16 sample probe:
A device inserted into the gas line to be sampled and to which a sample line is connected.

2.17 sampling point:
A point in the gas stream where a representative sample can be collected.

2.18 spot sample:
A sample of specified volume taken at a specified place at a specified time from a stream of gas.

2.19 transfer line:
A line provided to carry the sample to be analysed from the sample point to the analytical unit.

2.20 water dew point:
The temperature, at a given pressure, at which water vapour condensation begins.

3 Principles of sampling

3.1 Sampling methods

The main function of sampling is to take an adequate sample that is representative of the gas.

The main distinction in sampling is between direct and indirect sampling methods.

In the direct sampling method, the sample is drawn from a stream and directly transferred to the analytical unit.

In the indirect sampling method, the sample is stored before it is transferred to the analytical unit.

The main classifications of the indirect sampling method are spot sampling and incremental sampling.

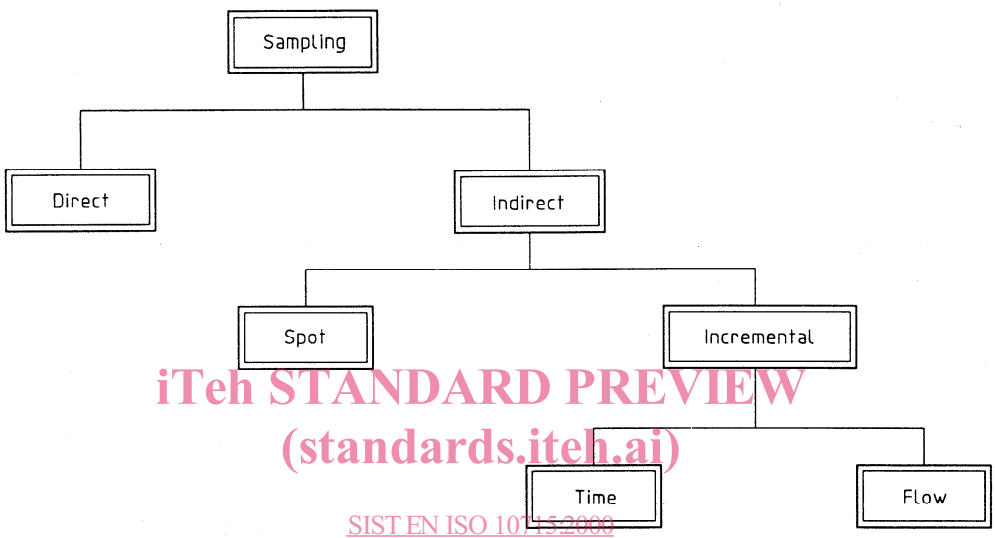

Figure 1 — Survey of direct and indirect sampling methods

The information needed from the analysis of natural gas falls into two basic categories: averaged and limit values.

3.1.1 Averaged values

A typical example is the calorific value. Custody transfer requires the time- or flow-averaged calorific value. Commercial agreements determine the period and method of averaging.

3.1.2 Limit values

Most gas custody transfer contracts contain specification limits on composition or on gas properties. Direct sampling can be applied, but often the requirements are such that also indirect sampling has to be applied.

3.2 Sampling frequency

This subclause gives guidelines for the establishment of the sampling frequency. Mostly the sampling frequency is a matter of common sense. Information on the properties of the gas stream in the past and about expected (systematic) future changes determines the sampling frequency.

Generally, pipeline gas composition will have daily, weekly, monthly, semi-annual and seasonal variations. Compositional variations will also occur because of gas treatment equipment and reservoir changes. All of these environmental and operational considerations shall be taken into account when selecting a sampling interval.

The statistical approach in this paragraph is only intended to support the common-sense approach.

In this context, the required sampling frequency is the number of samples to be taken in a certain period of time in order to obtain meaningful results.

The formula for calculating the number of samples is:

$$n^{\frac{1}{2}} = t \times \frac{s}{d}$$

where

d is the error margin required;

n is the number of samples;

s is the standard deviation;

t is Student's t-factor (see table H.1 in annex H).

This equation shall be solved by iteration: an initial value of t is estimated, and used to calculate a revised value of n, which is used, in turn, to give a new value of t. The error margin, the number of samples and the standard deviation shall be taken over the same period of time.

3.2.1 Error margin

There are two different cases of error margins. One case is related to the determination of averaged values. In most custody transfer contracts, these values are given as an indication of the accuracy.

The other is related to the determination of limit values. Custody transfer contracts specify the limits but rarely give an indication of the accuracy. In these cases, the difference between the last measured value, or the last year's average, and the limit value is the error margin.

3.2.2 Number of samples

The number of samples is the number of samples to be taken in a defined period. It is equivalent to the number of partial samples in incremental sampling.

3.2.3 Student's t-factor

Student's t-factor allows for the finite sample size, and is to be found in standard statistical tables. The value depends on the claimed certainty (typically 95 %) and the "degrees of freedom", here to be taken as the number of measurements minus one (n-1).

EXAMPLE 1

Determination of the monthly average caloric value

d = 0,4 % (error margin required from custody transfer contract for monthly averaged value)

s = 0,6 % (estimated variation over a one-month period)

First estimate, taking n = 7:

t = 2,45 for 6 degrees of freedom and a certainty of 0,975 single-sided (equals 0,95 double-sided)

$$n^{\frac{1}{2}} = 2{,}45 \times \frac{0{,}6}{0{,}4}$$

$n = 14$

First iteration, taking n = 14:

recalculate for

$t = 2{,}16$ for 13 degrees of freedom, and a certainty of 0,975 single-sided (equals 0,95 double-sided)

$$n^{\frac{1}{2}} = 2{,}16 \times \frac{0{,}6}{0{,}4}$$

$$n = 11$$

Second iteration, taking $n = 11$:

recalculate for

$t = 2{,}23$ for 10 degrees of freedom, and a certainty of 0,975 single-sided (equals 0,95 double-sided)

$$n^{\frac{1}{2}} = 2{,}23 \times \frac{0{,}6}{0{,}4}$$

$$n = 11$$

EXAMPLE 2

Total sulfur determination

Last measured concentration 20 mg/m^3 and the contract limit value 50 mg/m^3.

$d = 30$ mg/m^3 (difference between limit value from custody transfer contract and last measured value)

$s = 10$ mg/m^3 [standard deviation in spot sample results (in the past year)]

$t = 4{,}30$ $n - 1$ taken as 2, level of certainty 95%

$$n^{\frac{1}{2}} = 4{,}3 \times \frac{10}{30}$$

$$n = 2$$

Three samples are enough. Recalculation indicates that two samples are not enough.

4 Safety precautions

4.1 General

Sampling and sample handling shall follow all relevant national and company-related safety regulations.

In the case of inadequate regulations, those responsible for sampling shall establish detailed procedures. Specifications for equipment shall also be established.

Personnel involved shall be properly trained and educated to a level such that they are able to take necessary responsibility.

4.2 Personnel

The person responsible for the department/section which is to perform the sampling shall be satisfied that the sampling can be performed within relevant safety regulations.