Natural gas - Calculation of compression factor - Part 1: Introduction and guidelines

EESTI STANDARDIKESKUS
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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN ISO 12213-1:2009 sisaldab Euroopa standardi EN ISO 12213-1:2009 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 12213-1:2009 consists of the English text of the European standard EN ISO 12213-1:2009.
Standard on kinnitatud Eesti Standardikeskuse 30.10.2009 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 30.10.2009 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
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Foreword

The text of ISO 12213-1:2006 has been prepared by Technical Committee ISO/TC 193 “Natural gas” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 12213-1:2009.

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of an identical text or by endorsement, at the latest by March 2010, and conflicting national standards shall be withdrawn at the latest by March 2010.

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Endorsement notice

The text of ISO 12213-1:2006 has been approved by CEN as a EN ISO 12213-1:2009 without any modification.

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1 Scope

ISO 12213 specifies methods for the calculation of compression factors of natural gases, natural gases containing a synthetic admixture and similar mixtures at conditions under which the mixture can exist only as a gas.

It is divided into three parts: this part of ISO 12213 gives an introduction and provides guidelines for the methods of calculation described in ISO 12213-2 and ISO 12213-3.

Part 2 gives a method for use where the detailed molar composition of the gas is known. Part 3 gives a method for use where a less detailed analysis, comprising superior calorific value (volumetric basis), relative density, carbon dioxide content and (if non-zero) hydrogen content, is available.

Both methods are applicable to dry gases of pipeline quality within the range of conditions under which transmission and distribution, including metering for custody transfer or other accounting purposes, are normally carried out. In general, such operations take place at temperatures between about 263 K and 338 K (approximately −10 °C to 65 °C) and pressures not exceeding 12 MPa (120 bar). Within this range, the uncertainty of prediction of both methods is about ± 0,1 % provided that the input data, including the relevant pressure and temperature, have no uncertainty.

NOTE Pipeline quality gas is used in this International Standard as a concise term for gas which has been processed so as to be suitable for use as industrial, commercial or domestic fuel. Although there is no formal international agreement upon the composition and properties of a gas which complies with this concept, some quantitative guidance is provided in 5.1.1. A detailed gas quality specification is usually a matter for contractual arrangements between buyer and seller.

The method given in Part 2 is also applicable (with increased uncertainty) to broader categories of natural gas, including wet or sour gases, within a wider range of temperatures and to higher pressures, for example for reservoir or underground storage conditions or for vehicular (NGV) applications.

The method given in Part 3 is applicable to gases with a higher content of nitrogen, carbon dioxide or ethane than normally found in pipeline quality gas. The method may also be applied over wider ranges of temperature and pressure but with increased uncertainty.

For the calculation methods described to be valid, the gas must be above its water and hydrocarbon dewpoints at the prescribed conditions.

This International Standard gives all of the equations and numerical values needed to implement both methods. It is planned to make verified computer programs available (see Annex B).

2 Normative references

The following referenced documents are indispensable for the application 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 6976, *Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition*

ISO 13443, *Natural gas — Standard reference conditions*

3 Terms and definitions

For the purposes of the various parts of this International Standard, the following terms and definitions apply.

3.1
compression factor
Z
ratio of the volume of an arbitrary mass of gas, at a specified pressure and temperature, to the volume of the same mass of gas under the same conditions as calculated from the ideal-gas law, as follows:

$$Z = V_{\mathrm{m}}(\mathrm{real})/V_{\mathrm{m}}(\mathrm{ideal}) \quad (1)$$

where

$$V_{\mathrm{m}}(\mathrm{ideal}) = RT/p \quad (2)$$

NOTE 1 Thus

$$Z(p, T, y) = pV_{\mathrm{m}}(p, T, y)/(RT) \quad (3)$$

where

p is the absolute pressure;

T is the thermodynamic temperature;

y is a set of parameters which uniquely characterizes the gas (in principle, the latter may be the complete molar composition or a distinctive set of dependent physico-chemical properties, or a mixture of both);

V_{m} is the molar volume of the gas;

R is the molar gas constant, in coherent units.

NOTE 2 The compression factor is a dimensionless quantity usually close to unity.

NOTE 3 The terms “compressibility factor” and “Z-factor” are synonymous with compression factor.

3.2
density
ρ
mass of a given quantity of gas divided by its volume at specified conditions of pressure and temperature

3.3
molar composition
term used when the proportion of each component in a homogeneous mixture is expressed as a mole (or molar) fraction, or mole (molar) percentage, of the whole