Natural gas - Calculation of thermodynamic properties - Part 5: Calculation of viscosity, Joule-Thomson coefficient, and isentropic exponent (ISO 20765-5:2022)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 20765-5:2022 sisaldab Euroopa standardi EN ISO 20765-5:2022 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 20765-5:2022 consists of the English text of the European standard EN ISO 20765-5:2022.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 04.05.2022.	Date of Availability of the European standard is 04.05.2022.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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English Version

Natural gas - Calculation of thermodynamic properties - Part 5: Calculation of viscosity, Joule-Thomson coefficient, and isentropic exponent (ISO 20765-5:2022)

Gaz naturel - Calcul des propriétés thermodynamiques - Partie 5: Calcul de la viscosité, du coefficient de Joule-Thomson et de l'exposant isentropique (ISO 20765-5:2022)

Erdgas - Berechnung der thermodynamischen Eigenschaften - Teil 5: Berechnung der Viskosität, Joule-Thomson-Koeffizient und Isentropenexponent (ISO 20765-5:2022)

This European Standard was approved by CEN on 3 April 2022.

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

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European foreword

This document (EN ISO 20765-5:2022) has been prepared by Technical Committee ISO/TC 193 "Natural gas" in collaboration with Technical Committee CEN/TC 238 “Test gases, test pressures, appliance categories and gas appliance types” the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by November 2022, and conflicting national standards shall be withdrawn at the latest by November 2022.

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Endorsement notice

The text of ISO 20765-5:2022 has been approved by CEN as EN ISO 20765-5:2022 without any modification.

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Foreword

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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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This document was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcommittee SC 1, *Analysis of natural gas*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 238, *Test gases, test pressures and categories of appliances*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 20765 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 gives simplified methods for the calculation of (dynamic) viscosity, Joule-Thomson coefficient, and isentropic exponent for use in natural gas calculations in the temperature range –20 °C to 40 °C, with absolute pressures up to 10 MPa, and only within the gas phase. For the Joule-Thomson coefficient and isentropic exponent, the uncertainty of the formulae provided is greater than that obtained from a complete equation of state such as GERG-2008[1] (see ISO 20765-2) but is considered to be fit for purpose. The formulae given here are very simple.

Natural gas — Calculation of thermodynamic properties —

Part 5: Calculation of viscosity, Joule-Thomson coefficient, and isentropic exponent

1 Scope

This document specifies methods to calculate (dynamic) viscosity, Joule-Thomson coefficient, isentropic exponent, and speed of sound, excluding density, for use in the metering of natural gas flow.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

4 Background

The main motivation for this document is to provide simplified methods for the calculations required, according to ISO 5167, to measure flow of high-pressure natural gas with an orifice plate meter.

Useful references for the work herein are given below:

a) ISO 5167-1:1991, *Measurement of fluid flow in closed conduits — Part 1: Pressure differential devices*

b) EN 5167-1:1997, *Measurement of fluid flow by means of pressure differential devices — Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full*

c) ISO 5167-1:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

d) ISO 5167-2:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 2: Orifice plates*

The basic mass flowrate, q, formula is:

$$q = \frac{C}{\sqrt{1-\beta^4}} \varepsilon \frac{\pi}{4} d^2 \sqrt{2 \cdot \Delta P \cdot D} \tag{1}$$

where

C is a function of β, Re, and the type of orifice pressure tappings;

ε is a function of β, P, ΔP, and κ.

The symbols are defined in Annex A. The standards above differ in the functions for C and ε. Although q is given by Formula (1), iteration is required since C is a function of Re, and Re is a function of q. Similarly, given q in Formula (1) does not directly give ΔP since ε is a function of ΔP.