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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 30491.5-2026

**Natural gas - Calculation of thermodynamic properties - Part 5:
Calculation of viscosity, Joule-Thomson coefficient, and
isentropic exponent**

天然气 热力学性质计算 第5部分：黏度、焦耳-汤姆逊系数和等熵指数的计算
(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

This document is Part 5 of GB/T 30491 "Calculation of Thermodynamic Properties of Natural Gas". GB/T 30491 has been published as follows.

part.

---Part 1: Gas Phase Properties in Gas Distribution;

---Part 2: Properties of Single-Phase (Gas, Liquid, and Dense Phase) Fluids with Expanded Application Range;

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

This document is modified to adopt ISO 20765-5:2022 "Calculation of thermodynamic properties of natural gas - Part 5: Viscosity, Joule-Thomson coefficient".

Calculation of isentropic exponent.

Compared with ISO 20765-5:2022, this document has undergone the following structural adjustments.

---The content of Chapter 8 "Conclusion" of the international standard has been deleted, and the content on the scope of application of the standard in that section has been moved to Chapter 1 "Scope".

"Enclosure", Chapter 8 corresponds to Chapter 9 of ISO 20765-5:2022.

The technical differences between this document and ISO 20765-5:2022, and the reasons therefor, are as follows.

---Added references to normative documents GB/T 3102.3, GB/T 3102.4, GB/T 14850, and GB/T 20604.

GB/T 30491.1, GB/T 30491.2, and ISO 80000-5 (see Chapter 3) are used to improve the application of these standards in practical scenarios in my country.

The feasibility of operation.

The following editorial changes have been made to this document.

---Added informative reference documents GB/T 30491.1-2014 (see Introduction) and GB/T 30491.2-2024 (see Introduction, 5.1,...).

6.1, 6.4), GB/T 2624.2 (see Chapter 4);

---Added labels and titles to the tables in Appendix A (see Appendix A), as well as terms referring to Appendix A (see Chapter 3), to clarify this...

A detailed list of symbols and units for the physical quantities used in this document is provided in Appendix A;

---Notes have been added (see 5.2, 6.2, 6.3) to better explain that formulas (19), (22), and (24) are empirical formulas, and the calculation results are...

The result is only the numerical form of a physical quantity, not a physical quantity containing units;

---The uppercase "T" in Tables 2-6 and Tables D.1-D.3 should be changed to lowercase "t" to conform to the description of symbols and units in Appendix A;

---The symbols and units of all physical quantities in the formulas have been added to Appendix A for ease of use.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Natural Gas (SAC/TC244).

Introduction

GB/T 30491 provides methods for calculating the thermodynamic properties of natural gas, mainly involving single-phase (gas phase, liquid phase, and dense phase) natural gas gathering and transportation.

Calculations of the thermodynamic properties of natural gas (both gas and liquid phases), the two-phase thermodynamic properties of natural gas, and migration properties such as viscosity. (Compare with GB/T 30491.1-) the calculation of natural gas, including artificially blended natural gas, using physical property parameters, thermodynamic equations, and equations of state as specified in GB/T 30491.2-2024 [1,2] is based on these standards.

Compared to methods for measuring the viscosity, Joule-Thomson coefficient, and isentropic index of natural gas and other similar mixtures, this document presents (dynamic) A simplified formula for (force) viscosity, Joule-Thomson coefficient, and isentropic exponent is applicable to a temperature range of -20°C to 40°C and a pressure not exceeding [a certain value].

Calculation of thermodynamic properties of gaseous natural gas at 10 MPa. Although the simplified formula has large uncertainties in calculating the Joule-Thomson coefficient and isentropic index.

While the equations of state are based on equations of state, simplified formulas are often derived through fitting, resulting in simpler forms and applicability to specific situations. This document will be used to further explore these formulas.

The simplified formula provides crucial physical property data for the accurate measurement of high-pressure natural gas flow using orifice plate flowmeters, which is essential for ensuring the safe flow of high-pressure natural gas.

It plays a positive role in promoting efficient development, fair and just gathering, transmission, and metering, as well as the rapid and healthy development of the natural gas industry.

Currently, Parts 1, 2, and 5 of the ISO 20765 series of standards have been published.

Parts 3 and 4 are still under preparation.

Therefore, GB/T 30491 is proposed to consist of the following 5 parts.

---Part 1: Gas Phase Properties in Gas Transmission and Distribution. The purpose is to define the properties of natural gas, natural gas containing artificial additives, and other similar substances.

Methods for calculating the volumetric and thermal properties of mixtures when they exist only in a gaseous state.

---Part 2: Properties of Single-Phase (Gas, Liquid, and Dense Phase) Fluids with Expanded Applications. The aim is to specify the properties of natural gas, synthetic fluids...

Calculation of volumetric and thermal properties of fuel gases and similar mixtures in single-phase states (homogeneous gas, liquid, and dense states).

method.

---Part 3: Two-Phase Properties (Gas-Liquid Equilibrium). The purpose is to define the properties of natural gas, synthetic fuel gases, and similar mixtures in...

A method for calculating the properties of two phases under gas-liquid equilibrium conditions.

---Part 4: Calculation of Physical Properties of Natural Gas. The purpose is to specify the methods for obtaining physical property values of natural gas using parameters such as calorific value and relative density.

Methods for calculating physical property parameters.

---Part 5: Calculation of Viscosity, Joule-Thomson Coefficient, and Isentropic Index. The purpose is to define the viscosity, Joule-Thomson coefficient, and isentropic index of natural gas (power).

Simplified algorithms for the Joule-Thomson coefficient and isentropic exponent.

Calculation of thermodynamic properties of natural gas Part 5: Viscosity, Joule-Thomson Coefficient Calculation of isentropic exponent

1 Scope

This document specifies the (dynamic) viscosity and joule-tonne viscosity used in the process of calculating natural gas flow rate and metering using natural gas composition, temperature, and pressure data.

A simple method using the Merson coefficient, isentropic exponent, and sound velocity (excluding density) for measuring natural gas flow rate.

This document applies to specific scenarios (especially for high-pressure orifice plate