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Standard Terminology Relating to Gaseous Fuels¹

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1. Scope

1.1 This standard defines the terms used in standards that are the responsibility of Committee D03 on Gaseous Fuels. These terms are used in:

1.1.1 The sampling of gaseous fuels,

1.1.2 The analysis of gaseous fuels for composition and various other physical properties, and

1.1.3 Other practices related to the processing, transmission, and distribution of gaseous fuels.

1.2 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1142 Test Method for Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperature

D3588 Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels

2.2 *ISO Standards:*³

ISO 7504 Gas Analysis—Vocabulary

ISO 14687 Hydrogen Fuel Quality—Product Specification

2.3 *SAE Standard:*⁴

SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles

¹ This terminology is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.92 on Terminology Classification and Specifications.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.

2.4 *GPA Standard:*⁵

GPA 2145 Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas and Natural Gas Liquids Industries

3. Terminology

absolute pressure, *n*—pressure measured with reference to absolute zero pressure, usually expressed as kPa, mm Hg, bar, or psia.

acid gas, *n*—natural gas containing high concentrations of hydrogen sulfide or carbon dioxide, or both, which is acidic when in contact with water or water vapor.

associated gas, *n*—natural gas, also known as gas-cap gas or dome gas, that overlies and is in immediate contact, but not in solution, with crude oil in a reservoir.

at-line instrument, *n*—instrument requiring operator interaction to sample gas directly from the pipeline.

base conditions, *n*—temperature and pressure conditions at which natural gas volumes are determined for purposes of custody transfer.

DISCUSSION—In natural gas measurements, the properties of interest are temperature, pressure, and composition. Assuming ideal gas properties, for simplicity, tables of pure compounds can be prepared for use in calculating gas properties for any composition at “base conditions.” These “base conditions” are chosen near ambient.

British thermal unit (Btu or BTU), *n*—the amount of energy required to raise the temperature of one pound of water one degree Fahrenheit.

DISCUSSION—One Btu_{IT} (International Table) is equal to 1055.056 J. The defining relationships are:

$$(a) 1 \text{ Btu} \cdot \text{lb}^{-1} = 2.326 \text{ J} \cdot \text{g}^{-1} \text{ (exact)}$$

$$(b) 1 \text{ lb} = 453.592 37 \text{ g (exact)}$$

By these relationships, 1 Btu = 1055.055 852 62 J (exact). For most purposes, the value rounded to 1 Btu = 1055.056 J is adequate.

calibration gas mixture, *n*—a certified gas mixture with known composition used for the calibration of a measuring instrument or for the validation of a measurement or gas analytical method.

⁵ Available from Gas Processors Association (GPA), 66 American Plaza, Suite 700, Tulsa, OK 74135, http://www.gpaglobal.org.

DISCUSSION—Calibration Gas Mixtures are the analogues of measurement standards in physical metrology (reference ISO 7504 paragraph 4.1).

calorimeter, *n*—a device to measure the evolved heat resulting from the combustion of a material.

compressed natural gas (CNG), *n*—natural gas that has been compressed after processing for storage or transportation purposes.

DISCUSSION—CNG is primarily used as a fuel for vehicles, typically compressed up to 24 821 kPa in the gaseous state.

compressibility, *n*—the property of a material that permits it to decrease in volume when subjected to an increase in pressure.

compressibility factor (*z*), *n*—a factor calculated by taking the ratio of the actual volume of a given mass of gas at a specified temperature and pressure to its volume calculated from the ideal gas law at the same conditions.

constituent, *n*—component, compound, or element found within a mixture.

continuous fuel monitor, *n*—instrument that samples gas directly from a source and provides an analytical result on a continuous or semi-continuous basis.

dew point, *n*—the temperature at any given pressure at which liquid initially condenses from a gas or vapor and is specifically applied to the temperature at which water vapor starts to condense from a gas mixture (**water dew point**), or at which hydrocarbons start to condense (**hydrocarbon dew point**).

DISCUSSION—Charts of dewpoints versus pressure and water content are found in Test Method **D1142**.

direct sampling, *n*—sampling where there is a direct connection between the sample source and the analyzer.

dissolved gas, *n*—natural gas held in solution in reservoir liquids at the prevailing temperature and pressure of the reservoir.

dry gas, *n*—natural gas containing little or no water vapor.

dynamic calibration, *n*—calibration of an analytical system using a gaseous standard generated by dilution of the flow of a known quantity of gaseous analyte with a known quantity of diluent gas.

DISCUSSION—The analyte does not have to be from only a compressed gas source; it may be from a permeation system, liquid source, chemically generated, etc.

DISCUSSION—The diluent gas does not necessarily need to be purified. The minimum purity depends on the critical impurities in the final gas mixture.

fuel cell grade hydrogen, *n*—hydrogen satisfying the specifications in SAE J2719 or ISO 14687, Grade D.

gas quality, *n*—quality of gaseous fuel, which is defined by its composition and its physical properties.

gross heating value, *n*—also called **higher heating value**, the amount of energy per volume transferred as heat from the complete, ideal combustion of the gas at standard temperature in which all the water formed by the reaction condenses to liquid.

DISCUSSION—If the gross heating value has a volumetric rather than a mass or molar basis, a base pressure must also be specified.

DISCUSSION—The values for the pure gases appear in GPA Standard 2145. **D3588**

higher heating value, *n*—see **gross heating value**.

hydrate, *n*—a solid, crystalline material composed of water and components of natural gas formed under pressure at temperatures above the freezing point of water.

hydrocarbon dew point, *n*—see **dew point**.

inert components, *n*—those elements or components of natural gas (fuel gas) that do not contribute to the heating value.

in-line instrument, *n*—instrument with an active element installed in the pipeline, measuring pipeline contents or conditions, and measures at pipeline conditions.

interchangeability, *n*—a measure of the degree to which combustion characteristics of one gas are comparable to those of another gas.

DISCUSSION—Two gases are interchangeable when one gas may substitute another directly without interfering with the operation of gas burning appliances or equipment.

lean gas, *n*—natural gas containing little or no hydrocarbons commercially recoverable as liquid products.

DISCUSSION—Water and recoverable hydrocarbons (ethane and heavier hydrocarbons) are customarily removed from natural gas to meet contractual or state statutory requirements.

liquefied natural gas (LNG), *n*—natural gas that has been liquefied, after processing, for storage or transportation purposes.

DISCUSSION—Liquefied natural gas is revaporized and introduced into pipelines for transmission and distribution as natural gas and may be used as a fuel for internal combustion engines.

lower heating value, *n*—see **net heating value**.

methane number (MN), *n*—an experimental determination of a gaseous fuel's resistance to knock based on a Cooperative Fuel Research (CFR) Motor Octane Number (MON) test engine and indicated by the volume of methane in a blend with hydrogen.

DISCUSSION—Methane has a value of MN = 100, and hydrogen has a value of MN = 0.

methane number, calculated (MN_c), *n*—calculation of a rating index, indicating the resistance to knock of a gaseous fuel when compared to a reference methane/hydrogen mixture.

DISCUSSION—Multiple methods have been developed in the past for providing this analytical estimate based on gas composition. A MN_c is determined using volumetric fuel composition. Sometimes MN_c is described as “methane index (MI).”