



Designation: D7940 – 21

Standard Practice for Analysis of Liquefied Natural Gas (LNG) by Fiber-Coupled Raman Spectroscopy¹

This standard is issued under the fixed designation D7940; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice is for both on-line and laboratory instrument-based determination of composition for liquefied natural gas (LNG) using Raman spectroscopy. Although the procedures in this practice refer specifically to liquids, the basic methodology can also be applied to other light hydrocarbon mixtures in either liquid or gaseous states, provided the data quality objectives and measurement needs are met. From the composition, gas properties such as heating value and the Wobbe index may be calculated. The components commonly determined according to this test method are CH_4 , C_2H_6 , C_3H_8 , $i\text{-C}_4\text{H}_{10}$, $n\text{-C}_4\text{H}_{10}$, $i\text{C}_5\text{H}_{12}$, $n\text{-C}_5\text{H}_{12}$. Components heavier than C5 are not measured as part of this practice.

NOTE 1—Raman spectroscopy does not directly quantify the component percentages of noble gases; however, inert substances can be calculated indirectly by subtracting the sum of the other species from 100 %.

1.2 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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.*

¹ This practice is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.12 on On-Line/At-Line Analysis of Gaseous Fuels.

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2. Referenced Documents

2.1 ASTM Standards:²

D1945 Test Method for Analysis of Natural Gas by Gas Chromatography

D1946 Practice for Analysis of Reformed Gas by Gas Chromatography

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

D4150 Terminology Relating to Gaseous Fuels

D7833 Test Method for Determination of Hydrocarbons and Non-Hydrocarbon Gases in Gaseous Mixtures by Gas Chromatography

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 BS EN Standards:³

BS EN 60079-28 Explosive Atmospheres. Protection of Equipment and Transmission Systems using Optical Radiation

BS EN 60825-1 Safety of Laser Products Part 1: Equipment Classification, Requirements and User's Guide

2.3 ISO Standards:⁴

ISO 6974-5 Natural Gas—Determination of Composition with Defined Uncertainty by Gas Chromatography, Part 5: Determination of Nitrogen, Carbon Dioxide and C1 to C5 and C6+ Hydrocarbons for a Laboratory and On-line Process Application Using Three Columns

ISO 6976:2016(E) Natural Gas—Calculation of Calorific Values, Density, Relative Density and Wobbe Indices from Composition

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 British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, U.K., <http://www.bsigroup.com>.

⁴ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.