



Standard Test Method for Ethylene, Other Hydrocarbons, and Carbon Dioxide in High-Purity Ethylene by Gas Chromatography¹

This standard is issued under the fixed designation D2505; 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 test method covers the determination of carbon dioxide, methane, ethane, acetylene, and other hydrocarbons in high-purity ethylene. Hydrogen, nitrogen, oxygen, and carbon monoxide are determined in accordance with Test Method [D2504](#). The percent ethylene is obtained by subtracting the sum of the percentages of the hydrocarbon and nonhydrocarbon impurities from 100. The method is applicable over the range of impurities from 1 to 500 parts per million volume (ppmV).

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.* For some specific hazard statements, see Section 6.

1.3 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*²

[D2504](#) Test Method for Noncondensable Gases in C₂ and Lighter Hydrocarbon Products by Gas Chromatography
[D4051](#) Practice for Preparation of Low-Pressure Gas Blends
[E260](#) Practice for Packed Column Gas Chromatography
[F307](#) Practice for Sampling Pressurized Gas for Gas Analysis

3. Summary of Test Method

3.1 The sample is separated in a gas chromatograph system utilizing four different packed chromatographic columns with

¹ This test method is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.D0.02](#) on Ethylene.

Current edition approved June 1, 2015. Published July 2015. Originally approved in 1966. Last previous edition approved in 2010 as D2505 – 88 (2010). DOI: 10.1520/D2505-88R15.

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.

helium as the carrier gas. Methane and ethane are determined by using a silica gel column. Propylene and heavier hydrocarbons are determined using a hexamethylphosphoramide (HMPA) column. Acetylene is determined by using, in series, a hexadecane column and a squalane column. Carbon dioxide is determined using a column packed with activated charcoal impregnated with a solution of silver nitrate in β,β' -oxydipropionitrile. Columns other than those mentioned above may be satisfactory (see [5.3](#)). Calibration data are obtained using standard samples containing the impurities, carbon dioxide, methane, and ethane in the range expected to be encountered. Calibration data for acetylene are obtained assuming that acetylene has the same peak area response on a weight basis as methane. The acetylene content in a sample is calculated on the basis of the ratio of peak area of the acetylene peak to the peak area of a known amount of methane. Calculations for carbon dioxide, methane, and ethane are carried out by the peak-height measurement method.

4. Significance and Use

4.1 High-purity ethylene is required as a feedstock for some manufacturing processes, and the presence of trace amounts of carbon dioxide and some hydrocarbons can have deleterious effects. This method is suitable for setting specifications, for use as an internal quality control tool and for use in development or research work.

5. Apparatus

5.1 Any chromatographic instrument with an overall sensitivity sufficient to detect 2 ppmV or less of the compounds listed with a peak height of at least 2 mm without loss of resolution.

5.2 *Detectors—Thermal Conductivity*—If a methanation reactor is used, a flame ionization detector is also required. To determine carbon dioxide with a flame ionization detector, a methanation reactor must be inserted between the column and the detector and hydrogen added as a reduction gas (see Test Method [D2504](#), Appendix X1, Preparation of Methanation Reactor).