



Standard Test Method for Concentration Limits of Flammability of Chemicals (Vapors and Gases)¹

This standard is issued under the fixed designation E681; 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 the lower and upper concentration limits of flammability of chemicals having sufficient vapor pressure to form flammable mixtures in air at atmospheric pressure at the test temperature. This test method may be used to determine these limits in the presence of inert dilution gases. No oxidant stronger than air should be used.

NOTE 1—The lower flammability limit (LFL) and upper flammability limit (UFL) are sometimes referred to as the lower explosive limit (LEL) and the upper explosive limit (UEL), respectively. However, since the terms LEL and UEL are also used to denote concentrations other than the limits defined in this test method, one must examine the definitions closely when LEL and UEL values are reported or used.

1.2 This test method is based on electrical ignition and visual observations of flame propagation. Users may experience problems if the flames are difficult to observe (for example, irregular propagation or insufficient luminescence in the visible spectrum), if the test material requires large ignition energy, or if the material has large quenching distances.

1.3 **Annex A1** provides a modified test method for materials (such as certain amines, halogenated materials, and the like) with large quenching distances which may be difficult to ignite.

1.4 In other situations where strong ignition sources (such as direct flame ignition) is considered credible, the use of a test method employing higher energy ignition source in a sufficiently large pressure chamber (analogous, for example, to the methods in Test Method **E2079** for measuring limiting oxygen concentration) may be more appropriate. In this case, expert advice may be necessary.

1.5 The flammability limits depend on the test temperature and pressure. This test method is limited to an initial pressure of the local ambient or less, with a practical lower pressure limit of approximately 13 kPa (100 mm Hg). The maximum practical operating temperature of this equipment is approximately 150°C.

¹ This test method is under the jurisdiction of ASTM Committee **E27** on Hazard Potential of Chemicals and is the direct responsibility of Subcommittee **E27.04** on Flammability and Ignitability of Chemicals.

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1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 This test method should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test method may be used as elements of a fire risk assessment that takes into account all of the factors pertinent to an assessment of the fire hazard of a particular end use.

1.8 This standard may involve hazardous materials, operations, and equipment. *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.* Specific precautionary statements are given in Section 8

2. Referenced Documents

2.1 ASTM Standards:²

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

E582 Test Method for Minimum Ignition Energy and Quenching Distance in Gaseous Mixtures

E1445 Terminology Relating to Hazard Potential of Chemicals

E1515 Test Method for Minimum Explosible Concentration of Combustible Dusts

E2079 Test Methods for Limiting Oxygen (Oxidant) Concentration in Gases and Vapors

2.2 NFPA Standard:³

NFPA 69 Standard on Explosion Prevention Systems

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 National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.