Designation: G125 – 00 (Reapproved 2023)

Standard Test Method for Measuring Liquid and Solid Material Fire Limits in Gaseous Oxidants[1]

This standard is issued under the fixed designation G125; 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 a procedure for measuring the threshold-limit conditions to allow equilibrium of combustion of materials in various oxidant gases under specific test conditions of pressure, temperature, flow condition, fire-propagation directions, and various other geometrical features of common systems.

1.2 This test method is patterned after Test Method D2863-95 and incorporates its procedure for measuring the limit as a function of oxidant concentration for the most commonly used test conditions. Sections 8, 9, 10, 11, 13, and for the basic oxidant limit (oxygen index) procedure are quoted directly from Test Method D2863-95. Oxygen index data reported in accordance with Test Method D2863-95 are acceptable substitutes for data collected with this standard under similar conditions.

1.3 This test method has been found applicable to testing and ranking various forms of materials. It has also found limited usefulness for surmising the prospect that materials will prove "oxygen compatible" in actual systems. However, its results do not necessarily apply to any condition that does not faithfully reproduce the conditions during test. The fire limit is a measurement of a behavioral property and not a physical property. Uses of these data are addressed in Guides G63 and G94.

NOTE 1—Although this test method has been found applicable for testing a range of materials in a range of oxidants with a range of diluents, the accuracy has not been determined for many of these combinations and conditions of specimen geometry, outside those of the basic procedure as applied to plastics.

NOTE 2—Test Method D2863-95 has been revised and the revised Test Method has been issued as D2863-97. The major changes involve sample dimensions, burning criteria and the method for determining the oxygen index. The aim of the revisions was to align Test Method D2863 with ISO 4589-2. Six laboratories conducted comparison round robin testing on self-supporting plastics and cellular materials using D2863-95 and D2863-97. The results indicate that there is no difference between the means provided y the two methods at the 95 % confidence level. No comparison tests were conducted on thin films. The majority of ASTM Committee G4 favors maintaining the D2863-95 as the backbone of G125 until comprehensive comparison data become available.

1.4 One very specific set of test conditions for measuring the fire limits of metals in oxygen has been codified in Test Method G124. Test Method G124 measures the minimum pressure limit in oxygen for its own set of test conditions. Its details are not reproduced in this standard. A substantial database is available for this procedure, although it is much smaller than the database for Test Method D2863-95. (**Warning—**During the course of combustion, gases, vapors, aerosols, fumes or any combination of these are evolved which may be hazardous.) (**Warning—**Adequate precautions should be taken to protect the operator.)

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

1.6 *This basic standard 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 directly describe or appraise the fire hazard or fire risk of materials, products or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use. The standard has more applicability in this regard at predicting the fire behavior of materials and components that are close in size to the test condition, than for systems that are much different (for example: comparing a test rod to a valve seat rather than comparing a test rod to a house or a particle).*

1.7 *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.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

[1] This test method is under the jurisdiction of ASTM Committee G04 on Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres and is the direct responsibility of Subcommittee G04.01 on Test Methods. Portions have been adopted from Test Method D2863-95, which is under the jurisdiction of ASTM Committee D20 on Plastics.

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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]

D618 Practice for Conditioning Plastics for Testing

D1071 Test Methods for Volumetric Measurement of Gaseous Fuel Samples

D2444 Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

D2863-95 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

D2863-97 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

G63 Guide for Evaluating Nonmetallic Materials for Oxygen Service

G94 Guide for Evaluating Metals for Oxygen Service

G124 Test Method for Determining the Combustion Behavior of Metallic Materials in Oxygen-Enriched Atmospheres

G128 Guide for Control of Hazards and Risks in Oxygen Enriched Systems

2.2 *Other Standards:*

ISO 4589-2 Plastics—Determination of burning behavior by oxygen index—Part 2: Ambient temperature test[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *oxygen compatibility, n*—the ability of a substance to coexist with both oxygen and a potential source(s) of ignition within the acceptable risk parameter of the user (at an expected pressure and temperature). (See Guide G128.)

3.1.2 *oxygen index, n*—the minimum concentration of oxygen, expressed as a volume percent, in a mixture of oxygen and nitrogen that will just support flaming combustion of a material initially at room temperature under the conditions of Test Method D2863. (See Test Method D2863.)

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *fire limit, n*—the threshold limit conditions that will just support sustained combustion of a material under a combination of specified conditions and at least one variable parameter (typically oxidant concentration, diluent nature, pressure, temperature, geometry, flow or flame parameters, etc.).

3.2.2 *oxidant compatibility, n*—the ability of a substance to coexist with both an oxidant and a potential source(s) of ignition within the acceptable risk parameter of the user (at an expected pressure and temperature).

3.2.3 *oxidant index, n*—the minimum concentration of an oxidant such as oxygen, nitrous oxide, fluorine, etc., expressed as a volume percent, in a mixture of the oxidant with a diluent such as nitrogen, helium, carbon dioxide, etc., that will just support sustained combustion of a material initially at given conditions of temperature, pressure, flow conditions, propagation direction, etc. (See also, *oxygen index.*)

3.2.3.1 *Discussion*—The oxidant index may be more specifically identified by naming the oxidant: oxygen limit (or index), nitrous oxide limit (or index), fluorine limit (or index), etc. Unless specified otherwise, the typical oxidant is taken to be oxygen, the typical diluent is taken to be nitrogen, and the typical temperature is taken as room temperature.

3.2.4 *pressure limit*—the minimum pressure of an oxidant (or mixture) that will just support sustained combustion of a material initially at given conditions of oxidant concentration, temperature, flow condition, propagation direction, etc.

3.2.4.1 *Discussion*—The pressure limit may be more specifically identified by naming the oxidant: oxygen pressure limit, nitrous oxide pressure limit, fluorine pressure limit, etc.

3.2.5 *temperature limit*—the minimum temperature of an oxidant (or mixture) that will just support sustained combustion of a material initially at given conditions of oxidant concentration, temperature, flow condition, propagation direction, etc.

3.2.5.1 *Discussion*—The temperature limit may be more specifically identified by naming the oxidant: oxygen temperature limit, nitrous oxide temperature limit, fluorine temperature limit, etc.

4. Summary of Test Method

4.1 The threshold limit condition (minimum oxidant concentration, minimum pressure, minimum temperature, etc.) that will just support sustained combustion under equilibrium conditions is measured in a test apparatus. The equilibrium is established by the relation between the heat generated from the combustion of the specimen (that may be augmented by the heat of decomposition of some oxidants) and the heat lost to the surroundings as measured by one or the other of two arbitrary criteria, namely, a time of burning or a length of specimen burned. This point is approached from both sides of the critical threshold condition in order to establish the fire limit.

5. Significance and Use

5.1 This test method provides for measuring of the minimum conditions of a range of parameters (concentration of oxidant in a flowing mixture of oxidant and diluent, pressure, temperature) that will just support sustained propagation of combustion. For materials that exhibit flaming combustion, this is a flammability limit similar to the lower flammability limit, upper flammability limit, and minimum oxidant for

[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] ISO 4589-2 First edition 1996-07-15, International Organization for Standardization, Geneve, Switzerland, 1996.