



Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 °C¹

This standard is issued under the fixed designation E2652; 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 fire-test-response test method covers the determination under specified laboratory conditions of the combustibility of building materials. Under certain conditions, with the appropriate pass/fail criteria, the results from this test are used to classify materials as noncombustible materials.

1.2 Limitations of this fire-test response test method are shown below.

1.2.1 This test method does not apply to laminated or coated materials.

1.2.2 This test method is not suitable or satisfactory for materials that soften, flow, melt, intumesce or otherwise separate from the measuring thermocouple.

1.2.3 This test method does not provide a measure of an intrinsic property.

1.2.4 This test method does not provide a quantitative measure of heat generation or combustibility; it simply serves as a test method with selected (end point) measures of combustibility.

1.2.5 This test method does not measure the self-heating tendencies of materials.

1.2.6 In this test method materials are not being tested in the nature and form used in building applications. The test specimen consists of a small, specified volume that is either (1) cut from a thick sheet; (2) assembled from multiple thicknesses of thin sheets; or (3) placed in a container if composed of granular powder or loose fiber materials.

1.2.7 Results from this test method apply to the specific test apparatus and test conditions and are likely to vary when changes are made to one or more of the following: (1) the size, shape, and arrangement of the specimen; (2) the distribution of organic content; (3) the exposure temperature; (4) the air supply; (5) the location of thermocouples.

1.3 This test method references notes and footnotes that provide explanatory information. These notes and footnotes,

excluding those in tables and figures, shall not be considered as requirements of this test method.

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

1.5 This test method is technically equivalent to ISO 1182:2010 (see also [Annex A2](#) and [6.4.5](#)).

NOTE 1—While developed as technically equivalent to ISO 1182:2010, a change implemented in ISO 1182:2020 added a second furnace thermocouple to that standard, while this test method continues to use one furnace thermocouple.

1.6 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire-hazard or fire-risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.7 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

1.8 *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.*

1.9 *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

E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C

¹ This test method is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.23 on Combustibility.

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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.

*A Summary of Changes section appears at the end of this standard

E176 Terminology of Fire Standards

2.2 ISO Standards:³

ISO 1182:2010 Reaction to Fire Tests for Building Products
– Non-combustibility Test

ISO 1182:2020 Reaction to Fire Tests for Building Products
– Non-combustibility Test

ISO 13943 Fire Safety — Vocabulary

ISO 5725-2:1994 Accuracy (trueness and precision) of Measured Methods and Results – Part 2: Basic Method for the Determination of Repeatability and Reproducibility of a Standard Measurement Method

2.3 Other Standards:⁴

IMO Fire Test Procedures Code

3. Terminology

3.1 *Definitions*—For definitions of terms found in this test method, refer to Terminology E176 and ISO 13943. In case of conflict, the definitions given in Terminology E176 shall prevail.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *homogeneous product, n*—a product with nominally uniform density and composition.

3.2.2 *non-homogeneous product, n*—a product that does not satisfy the requirements of a homogeneous product.

3.2.2.1 *Discussion*—Non-homogeneous products are often composed of more than one component.

3.2.3 *sustained flaming (for testing at 750 °C), n*—sustained flaming for testing at 750 °C (1382 °F) is the persistence of a flame on or over any part of the visible part of the test specimen lasting 5 s or longer.

4. Summary of Test Method

4.1 This test method uses a furnace to expose building materials for at least 30 min to a temperature of 750 °C (1382 °F).

4.2 The furnace consists of an enclosed refractory tube surrounded by a heating coil with a cone-shaped airflow stabilizer.

4.3 Thermocouples are used to assess the temperature increases resulting from combustion of the product.

4.4 Weight loss and flaming combustion of the product is also assessed.

5. Significance and Use

5.1 While actual building fire exposure conditions are not duplicated, this test method will assist in indicating those materials which do not act to aid combustion or add appreciable heat to an ambient fire.

5.2 This test method does not apply to laminated or coated materials.

5.3 This test method is technically equivalent to ISO 1182.

5.4 When appropriate pass/fail criteria are applied, materials that are reported as passing this test by complying with those criteria (such as the ones in Appendix X2) are typically classified as noncombustible materials.

6. Test Apparatus

6.1 General:

6.1.1 The apparatus shall consist of a refractory tube furnace insulated and surrounded by a heating coil. A cone-shaped airflow stabilizer shall be attached to the base of the furnace and a draft shield to its top. Details are shown in Fig. 1.

6.1.2 Thermocouples shall be provided for measuring the furnace temperature and the furnace wall temperature. Optional additional thermocouples shall be used if the specimen surface temperature and the specimen center temperature are required.

6.1.3 A thermal sensor shall be used to measure the furnace temperature along its central axis.

6.1.4 Unless stated otherwise, all dimensions shall have a 5 % tolerance.

6.2 Test Furnace:

6.2.1 The test furnace shall consist primarily of the following.

6.2.2 The furnace tube shall be constructed of a refractory material, as specified in Table 1, of density $2800 \text{ kg/m}^3 \pm 300 \text{ kg/m}^3$ ($175 \text{ lb/ft}^3 \pm 19 \text{ lb/ft}^3$).

6.2.3 The furnace shall be $150 \text{ mm} \pm 1 \text{ mm}$ (5.9 in. ± 0.04 in.) high with an internal diameter of $75 \text{ mm} \pm 1 \text{ mm}$ (2.9 in. ± 0.04 in.) and a wall thickness of $10 \text{ mm} \pm 1 \text{ mm}$ (0.4 in. ± 0.04 in.).

6.2.4 The furnace tube shall be surrounded by an annular space of the following dimensions: 150 mm (5.9 in. ± 0.04 in.) high and of 10 mm (0.4 in. ± 0.04 in.) wall thickness.

6.2.4.1 The annular space shall be fitted with top and bottom plates, recessed internally to locate the ends of the furnace tube.

6.2.4.2 The annular space shall be insulated with a 25 mm (1 in.) mm layer of an insulating material having a thermal conductivity of $0.04 \text{ W/(m K)} \pm 0.01 \text{ W/(m K)}$ ($0.00077 \pm 0.00019 \text{ BTU in./(s ft}^2 \text{ °F)}$) at a mean temperature of 20 °C (68 °F). Magnesium oxide powder of a nominal bulk density of $170 \text{ kg/m}^3 \pm 30 \text{ kg/m}^3$ ($10.6 \text{ lb/ft}^3 \pm 1.9 \text{ lb/ft}^3$) is a suitable material for this use.

6.2.5 The furnace tube shall be provided with a single winding of 80/20 nickel/chromium electrical resistance tape, $3 \text{ mm} \pm 0.1 \text{ mm}$ (0.12 in. $\pm 4/1000$ in.) wide and $0.2 \text{ mm} \pm 0.01 \text{ mm}$ (8/1000 in. $\pm 0.4/1000$ in.) thick.

6.2.5.1 Wind the electrical resistance tape as specified in Fig. 2.

6.2.5.2 Cut grooves into the furnace tube so as to allow accurate winding of the electrical tape.

6.2.6 An open-ended cone-shaped air-flow stabilizer shall be attached to the underside of the furnace.

6.2.6.1 The air-flow stabilizer shall be 500 mm (19.7 in.) long and shall be reduced uniformly from an internal diameter of $75 \text{ mm} \pm 1 \text{ mm}$ (2.9 in. ± 0.04 in.) at the top to an internal diameter of $10.0 \text{ mm} \pm 0.5 \text{ mm}$ (0.4 in. ± 0.4 in.) at the bottom.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Maritime Organization, 55 Victoria St., London, SW1H0EU, United Kingdom, <http://www.imo.org>.