



# Standard Test Method for Evaluating the Under-Deck Fire Test Response of Deck Materials<sup>1</sup>

This standard is issued under the fixed designation E2632/E2632M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> NOTE—The units statement and captions for figures were updated editorially in February 2013.

## 1. Scope

1.1 This standard prescribes a method to assess the fire-test response characteristics of deck materials when used as the walking surface of a deck. The prescribed fire exposure is intended, under test conditions, to determine the heat release rate and the thermal decomposition modes of decking materials when exposed to a burner flame simulating combustibles burning beneath a deck.<sup>2</sup>

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems has the potential to result in non-conformance with the standard.

1.3 This standard is used to measure and describe the response of deck materials 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 deck materials under actual fire conditions.

1.4 *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.*

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

1.6 *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 Recom-*

*mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

D2898 Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

E176 Terminology of Fire Standards

E2067 Practice for Full-Scale Oxygen Consumption Calorimetry Fire Tests

2.2 *ISO Standards:*<sup>4</sup>

ISO 13943 Fire Safety – Vocabulary

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology E176 or ISO 13943. When discrepancies exist, the definition in Terminology E176 shall prevail.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *deck surface area, n*—the test specimen area defined by the overall specimen length and width after assembly.

## 4. Summary of Test Method

4.1 The test method described here measures the heat release rate of deck materials subjected to a flame source located beneath a test specimen.

4.2 The test method employs a diffusion flame based fire source from a nominal 305 mm [12 in.] square burner located underneath the test specimen.

4.3 An 80 kW fire exposure shall be applied to the underside of the test specimen for a period of 3 min after which the burner is extinguished.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.14 on External Fire Exposures.

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<sup>2</sup> Appendix X1 provides commentary on the background of this test method as well as its potential use for evaluation of coatings and surface treatments of deck products.

<sup>3</sup> 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.

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

4.4 Fire test response characteristics monitored and recorded shall include heat release of the test specimen utilizing oxygen depletion methodologies as described in Practice E2067. In addition, physical changes of the test specimen during the test shall be recorded.

**5. Significance and Use**

5.1 This test method addresses the suitability of deck materials by assessing their response to fire hazards associated with sources of flame located beneath the deck material.

**6. Deck Test Specimen**

6.1 Test material shall be representative of normal daily production and shall be installed according to the manufacturer’s instructions. Test material for developmental products shall be so identified.

6.2 *Pre-test Conditioning*—Prior to testing, all materials (deck boards and joist material) shall be conditioned to a constant weight or for a minimum of 30 days at  $21 \pm 2 \text{ }^\circ\text{C}$  [ $70 \pm 4 \text{ }^\circ\text{F}$ ] and  $50 \pm 5 \%$  relative humidity, whichever occurs first. Constant weight shall be defined as occurring when the change

in test material weight is less than or equal to 0.1 % in a 24-h period. For those materials whose fire test response is potentially affected by moisture resident within that material, the moisture content of the test material shall be measured prior to conducting the test.

6.3 *Test Specimen Size*—The overall test specimen width (i.e., direction of joists, see Fig. 1) shall be  $710 \pm 51 \text{ mm}$  [ $28 \pm 2.0 \text{ in.}$ ] to accommodate variations in individual deck board width and spacing. The length of individual deck boards shall be  $610 \pm 6 \text{ mm}$  [ $24 \pm 0.25 \text{ in.}$ ]. The deck surface area shall be the overall test specimen length and width after assembly of the test specimen. The front deck board shall be flush with the ends of the joists. The rear deck board shall overhang the end of the joists by  $25 \pm 6 \text{ mm}$  [ $1 \pm 0.25 \text{ in.}$ ] and rest on the ledger board attached to the test apparatus. Deck board profiles shall not be changed from their manufactured dimensions.

6.4 *Joists*—When constructing the test specimen, the deck materials shall be attached to two nominal 2 by 6-in. Douglas-fir joists with a  $406 \pm 5 \text{ mm}$  [ $16 \pm 0.2 \text{ in.}$ ] center-to-center spacing, creating an approximate 90 mm [approx. 3.5 in.] overhang on one side of each joist.

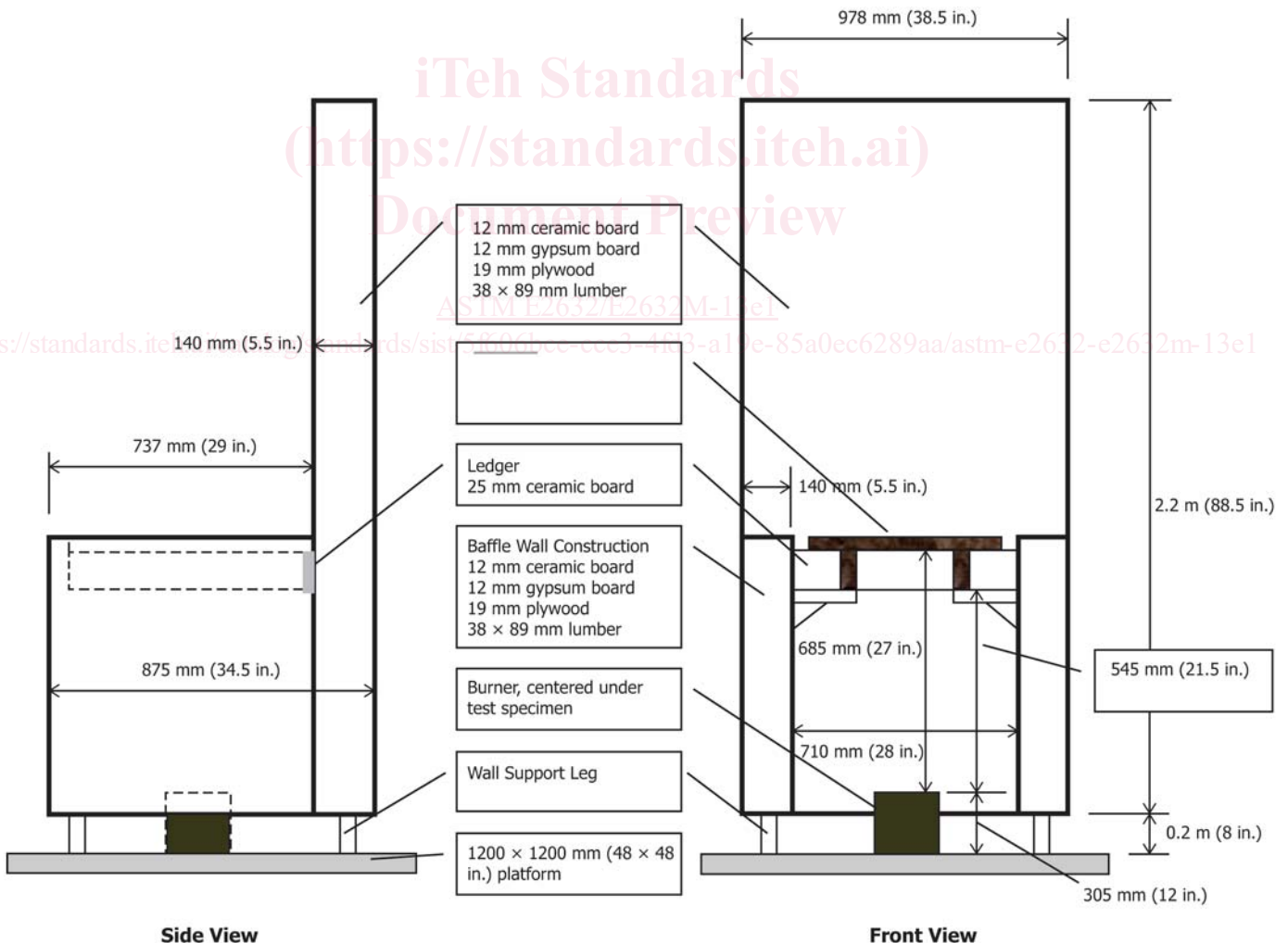


FIG. 1 Schematic Representation of the Under-Deck Test Apparatus

**7. Under-Deck Test Apparatus (See Fig. 1 and Fig. 2)**

**7.1 Burner**—The ignition source for the test shall be a gas burner with a nominal 305 by 305 mm [12 by 12 in.] porous top surface of a refractory material. The refractory material shall be a minimum 102-mm [4-in.] layer of white Ottawa sand used to provide the horizontal surface through which the gas is supplied. The gas supply to the burner shall provide an output of  $80 \pm 4$  kW using a regulated CP propane gas source, and shall be metered throughout the test, with an accuracy of at least  $\pm 3$  %. Heat release rates shall be calculated using propane’s net heat of combustion, which is 50.0 MJ/kg.

**7.2 Oxygen Depletion Calorimeter**—The system includes a hood, associated ducting, and instrumentation to provide heat release rate data by oxygen consumption calorimetry, and is described in Sections 6.4 and 7 of Practice E2067.

**7.3** The facility where the test is conducted shall be draft-protected and equipped with a system for exhausting smoke or noxious gases, or both, produced by testing. Air velocity in the vicinity of the test deck surface shall not exceed 0.5 m/s [1.64 ft/s]. This facility shall be maintained at  $20 \pm 10$  °C [ $68 \pm 18$  °F] and at a relative humidity less than 75 % at the time the test begins. Initiation of flammability testing shall begin within 20 min after removal of the test specimen from the pre-test conditioning environment.

**7.4 Baffle Walls**—Ceramic fiber board or other non-combustible panel product shall be used for the interior surface of the baffle walls. The baffle wall shall extend  $0.2 \text{ m} \pm 6 \text{ mm}$  [ $8 \pm 0.25 \text{ in.}$ ] above the floor to a total height of  $0.9 \text{ m} \pm 6 \text{ mm}$  [ $37 \pm 0.25 \text{ in.}$ ] and be supported to allow unrestricted airflow.

**7.5 Joist Support**—Horizontal metal plates shall be provided to support the joists along their full length, and also to confine burner flames to the underside of the deck boards located

between the support joists. The support surface of the joist support shall be  $545 \text{ mm} \pm 6 \text{ mm}$  [ $21.5 \pm 0.25 \text{ in.}$ ] above the top of the burner. If gaps exist between the joists and joist support, the user shall be permitted to insert ceramic wool, of joist width and no more than 6 mm [0.25 in.] thick, along the bottom of each joist to confine burner flames to the underside of the deck boards.

**7.6 Back Wall**—Ceramic fiber board or other non-combustible panel product shall be used for the interior surface of the back wall. The back wall shall extend  $0.2 \text{ m} \pm 6 \text{ mm}$  [ $8 \pm 0.25 \text{ in.}$ ] above the floor and be supported to allow unrestricted airflow. Total height of the back wall shall be  $2.4 \text{ m} \pm 12 \text{ mm}$  [ $8 \text{ ft} \pm 0.5 \text{ in.}$ ].

**7.7 Ledger Board**—A  $0.71 \text{ m} \pm 5 \text{ mm}$  [ $28 \pm 0.25 \text{ in.}$ ] long simulated 38 by 140 mm [nominal 2 by 6-in.] ledger board shall be constructed of layers of ceramic fiber board (or other non-combustible panel product) and attached to the back wall, between the baffle walls, at a height slightly below the overhang of the rear deck board of the test specimen.

**7.8 Burner Location**—The burner shall be centered directly under the test specimen, midway between the support joists. The distance from the top of the burner to the lowest portion of the deck material shall be  $690 \pm 5 \text{ mm}$  [ $27 \pm 0.2 \text{ in.}$ ].

**7.9 Burner Output Verification**—Without a test specimen in the apparatus, the burner output shall be set to  $80 \pm 4$  kW. At least one, 3 min verification run shall be conducted to ensure the burner heat release rate.

**8. Under-Deck Test Procedure**

**8.1** The test shall be conducted on a minimum of two test specimens. If the difference between the peak heat release rates, determined in 10.3, for these two test specimens is greater than 20 %, a third replicate shall be required. The percent difference shall be calculated using the larger value of the two peak heat release rates in the denominator.

**8.2** Ignite the burner, controlling for a constant  $80 \pm 4$  kW output.

**8.3** Continue the exposure for a 3 min [+2 s, -0 s] period. Extinguish the burner.

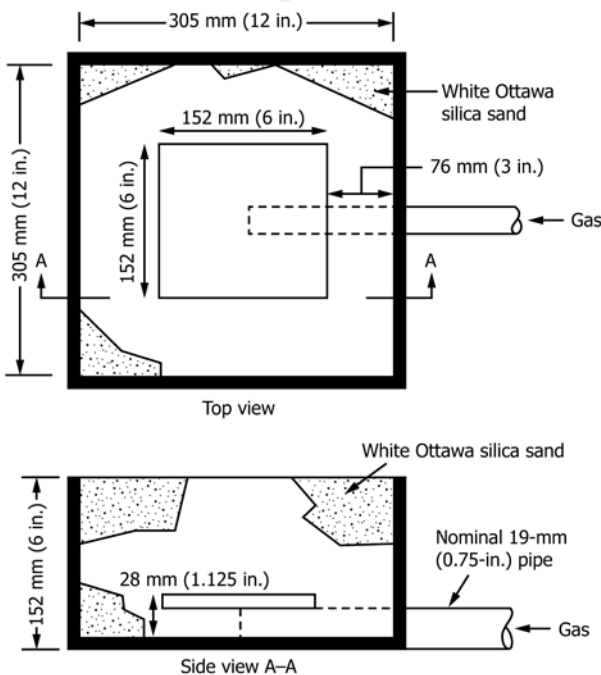
**8.4** Continue observation for an additional 40 min or until all combustion has ceased, whichever occurs first. The test shall be terminated immediately if flaming combustion accelerates uncontrollably (runaway combustion).

**8.5** Note physical changes of the deck materials during the test, including structural failure of any deck board, location of flaming and glowing ignition, and loss of material (i.e., flaming drops or particles falling from the deck). A video or photographic record of the test shall be obtained.

**8.6 Measurement of Heat Release Rate**—Heat release rate is measured during the tests using an oxygen depletion calorimeter (per 10.3). The heat release rate shall be measured throughout the test duration at a maximum of 6 s intervals.

**9. Accelerated Aging/Weathering**

**9.1** When it is anticipated that a regulatory or other agency will require pre-test accelerated aging/weathering of the



**FIG. 2 Schematic Representation of the Gas Burner**