



Designation: E 2187 – 02

Standard Test Method for Measuring the Ignition Strength of Cigarettes¹

This standard is issued under the fixed designation E 2187; 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.

INTRODUCTION

The most common initiating event in a fatal fire in the United States is the dropping of a lit cigarette onto a bed or piece of upholstered furniture. The cigarette coal heats the furnishing materials to the point where smoldering combustion begins, perhaps followed by a transition to flaming combustion. Since limiting the frequency of ignitions is a principal approach to reducing fire loss, it is desirable to establish a test method for the propensity of a cigarette to ignite soft furnishings. This test method uses standard substrates to determine the extent to which, as the substrate draws heat from the cigarette, the cigarette combustion remains strong enough to be capable of initiating a fire.

1. Scope

1.1 This fire-test-response standard provides a standard measure of the capability of a cigarette, positioned on one of three standard substrates, to generate sufficient heat to continue burning and thus potentially cause ignition of bedding or upholstered furniture.

1.2 This method has value as a predictor of the relative propensity of a cigarette to ignite upholstered furnishings.

1.3 This method is applicable to cigarettes that burn along the length of a tobacco column.

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

1.5 This standard measures and describes the response of materials, products, or assemblies to heat 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.

1.6 *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 specific hazard statements, see Section 6.

2. Referenced Documents

2.1 ASTM Standards:

E 176 Terminology of Fire Standards²

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method³

E 1352 Test Method for Cigarette Ignition Resistance of Mock-up Upholstered Furniture Assemblies²

E 1353 Test Method for Cigarette Ignition Resistance of Components of Upholstered Furniture²

2.2 Other Standard:

Standard for the Flammability of Mattresses and Mattress Pads, 16 Code of Federal Regulations, Part 1632

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method refer to Terminology E 176E 176.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *full-length burn, n*—the outcome of a determination in which the cigarette burns at least to the beginning of the tipping paper, which covers the filter and perhaps a short section of the tobacco column in a filter tip cigarette, or to within 5 mm of the end of the tobacco column if the cigarette has no filter.

4. Summary of Test Method

4.1 This test method measures the probability that a cigarette, placed on a substrate, will generate sufficient heat to maintain burning of the tobacco column. Each determination consists of placing a lit cigarette on the horizontal surface consisting of a set number of layers of filter paper. Observation is made of whether or not the cigarette continues to burn to the beginning of the tipping paper. Forty determinations (comprising a test) are performed to obtain the relative probability that the cigarette will continue burning despite heat abstraction by the substrate.

¹ This test method is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.15 on Furnishings and Contents.

Current edition approved Feb. 10, 2002. Published April 2002.

² Annual Book of ASTM Standards, Vol 04.07.

³ Annual Book of ASTM Standards, Vol 14.02.

5. Significance and Use

5.1 The most common initiating event in a fatal fire is the dropping of a cigarette onto a bed or piece of upholstered furniture, causing 20 % of the estimated U.S. fire deaths from 1992–1996 in residential structures, according to statistics provided by the U.S. Consumer Product Safety Commission. Test Methods E 1352E 1352 and E 1353E 1353 have been developed to evaluate the susceptibility of upholstered furniture mock-ups and components to ignition by cigarettes. Federal Standard 16 CFR Part 1632, Standard for the Flammability of Mattresses and Mattress Pads, was promulgated to reduce the likelihood that mattresses and mattress pads would ignite from a lighted cigarette.

5.2 This test method enables comparison of the relative ignition strength of different cigarette designs.

5.3 In this procedure, the specimens are subjected to a set of laboratory conditions. If different conditions are substituted or the end use conditions are changed, it may not be possible, using this test, to predict quantitative changes in the fire test response characteristics measured. Therefore, the quantitative results are valid only for the fire test exposure conditions described in this procedure.

6. Hazards

6.1 This test method involves the use of combustible materials that are exposed to ignition sources. Consequently, the user shall take proper precautions to avoid thermal injuries.

6.1.1 Personnel shall be instructed on general procedures to handle an unwanted fire. Appropriate fire extinguishing equipment shall be provided to suppress any fires that exceed normal controlled limits.

6.2 Personnel shall take proper precautions to avoid inhaling combustion products.

6.2.1 Exhaust systems shall be checked regularly to ensure that they are removing all products of combustion from the workspace.

6.2.2 Respiratory equipment shall be made available for personnel.

6.3 The user shall ensure that all burning has ceased before discarding used test materials. An appropriate closed metal waste container shall be used in each fire test laboratory for safe disposal of specimens and test assemblies after being exposed to heat and fire.

7. Apparatus and Equipment

7.1 *Test and Conditioning Environment*—An environmental conditioning room shall be maintained which provides an area adequate for conditioning both cigarettes and filter paper specimens. This room shall be capable of maintaining a relative humidity of 55 % \pm 5 % and a temperature of 23°C \pm 3°C (73°F \pm 5°F) and shall be continuously monitored. The room in which the tests are conducted, which may also be the conditioning room, shall be maintained within the same temperature and relative humidity ranges.

7.2 *Constant Humidity Box*—Alternatively, cigarettes and filter paper shall be stored in a box of sufficient size to hold the needed quantities of filter paper and cigarettes. The interior of the box shall be maintained at a relative humidity of 55 % \pm

5 % and a temperature of 23°C \pm 3°C (73°F \pm 5°F) and shall be continuously monitored. A tray containing a saturated solution of sodium bromide (NaBr) in water will provide the appropriate relative humidity when the box temperature is as prescribed. The box shall be located convenient to the test chamber such that test materials shall not be exposed to a non-conditioned environment for more than 5 min between their removal from the box and the beginning of a test.

7.3 *Test Chamber*—A test chamber of the design photographed in Fig. 1 shall be constructed of clear plastic such as PMMA, nominally 6 mm (0.25 in.) in thickness. The inside dimensions shall be: height: 340 mm \pm 2 mm (15.5 in. \pm 0.1 in.), width: 292 mm \pm 2 mm (11.5 in. \pm 0.1 in.), depth: 395 mm \pm 2 mm (15.5 in. \pm 0.1 in.). The full front panel of the chamber shall be hinged, with a latch to effect positive closure. The top of the chamber shall have a flattop cylindrical chimney of height 178 mm \pm 2 mm (6.00 in. \pm 0.1 in.) and inside diameter 150 mm \pm 2 mm (6.00 in. \pm 0.1 in.). The chimney shall be centered on the chamber top and sealed to the chamber top panel.

7.4 *Filter Paper Holder*—A cylindrical support for the layers of filter paper, shown in Fig. 2, shall be made of PMMA or similarly rigid material, dimensioned as follows. The outer diameter shall be 165 mm \pm 1 mm (6.50 in. \pm 0.04 in.), the inner diameter shall be 127 mm \pm 1 mm (5.00 in. \pm 0.04 in.), and the height shall be 50 mm \pm 1 mm (1.97 in. \pm 0.04 in.). A recess in the top, 8 mm \pm 1 mm (0.31 in. \pm 0.04 in.) deep, shall expand the inner diameter to 152 mm \pm 1 mm (6.00 in. \pm 0.04 in.). Three or four legs shall raise the bottom of the holder approximately 20 mm (0.8 in.) above the chamber floor.

7.5 *Metal Rim*—A circular brass or other dense metal rim, shown in Fig. 2, shall be used to hold the sheets of filter paper flat against each other. The outside diameter of the rim shall be 150 mm \pm 2 mm (5.90 in. \pm 0.08 in.). The inner diameter shall be 130 mm \pm 2 mm (5.1 in. \pm 0.08 in.). The thickness shall be 3 mm \pm 1 mm (0.12 in. \pm 0.04 in.). The rim surface shall be flat and smooth. A pair of parallel metal pins, each approximately 1 mm in diameter and 8.1 mm \pm 0.05 mm (0.32 in. \pm 0.02 in.) apart, shall protrude 20 mm \pm 2 mm (0.8 in. \pm 0.1 in.) toward the center of the rim. The pins are to be spaced to keep the non-ignited end of a conventional 25 mm circumference cigarette from rolling, but without pressuring the cigarette. If cigarettes of significantly different diameter are to be tested, other pairs of pins, appropriately spaced, shall be inserted into the rim.

7.6 *Cigarette Holder*—A holder shall be used to support the lit cigarette in a horizontal position in the test chamber prior to placement of the cigarette onto the filter paper substrate. The holder shall not clamp the cigarette nor stress it in any other manner, nor shall it contact the cigarette within 30 mm of its lit end.

7.7 *Cigarette Ignition System*—A system consisting of an air draw component and an ignition source shall be used to ignite the test cigarettes. The cigarette shall be supported in a horizontal position. A butane gas lighter capable of producing a stable luminous flame for 15 mm \pm 3 mm (0.6 in. \pm 0.1 in.) in length or a hot coil igniter shall be used for lighting the cigarette. The airflow and the draw time through the lit



FIG. 1 Photograph of Test Chamber and Filter Paper Holder

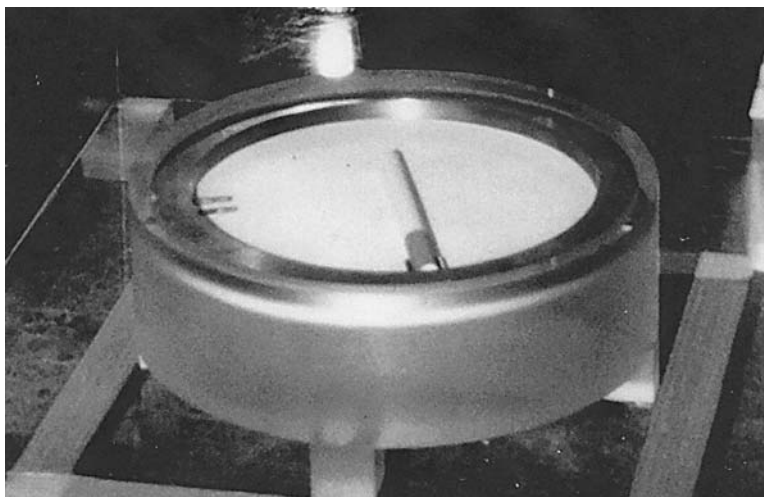


FIG. 2 Close-up of Test Cigarette, Filter Paper Holder, Metal Pins and Metal Rim