



# Standard Practice for Preparation of Fire-Test-Response Standards<sup>1</sup>

This standard is issued under the fixed designation E535; 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.

## INTRODUCTION

This standard has been developed to assist ASTM Committees in the writing of fire-test-response standards that comply with the ASTM policy on fire standards (see [Annex A1](#)).

The policy on fire standards describes the types of ASTM fire standards and their required caveats. Committee E05 has the responsibility of helping other committees developing fire standards by providing the information and assistance required by all committees for writing standards which contain testing procedures for the response of materials, products, or assemblies to fire.

Fire-test-response standards are standards for, or based on, one or more fire-test-response characteristics. A fire-test-response characteristic provides a means of measuring the response of materials, products, or assemblies to a prescribed source of heat alone or to one of heat and flame under controlled test conditions.

## 1. Scope

1.1 This practice is a supplement to *Form and Style for ASTM Standards*<sup>2</sup>, which shall be consulted in writing all ASTM standards.

1.2 This practice contains, directly or by reference, all of the information required to comply with the policy on fire standards and the additional guidelines recommended by Committee E05.

1.3 This practice, intended to assist ASTM Committees, establishes guidelines and criteria for the preparation of fire-test-response standards (that is, standards for response to heat or flame under prescribed 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 and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 This fire standard cannot be used to provide quantitative measures.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.31 on Terminology and Services / Functions.

Current edition approved March 1, 2012. Published April 2012. Originally approved in 1975. Last previous edition approved in 2009 as E535 – 09. DOI: 10.1520/E0535-12.

<sup>2</sup> Available on request from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA, 19428-2959.

## 2. Referenced Documents

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

E176 Terminology of Fire Standards

E456 Terminology Relating to Quality and Statistics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E2536 Guide for Assessment of Measurement Uncertainty in Fire Tests

E2655 Guide for Reporting Uncertainty of Test Results and Use of the Term Measurement Uncertainty in ASTM Test Methods

## 3. Terminology

3.1 *Definitions*:

3.1.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology E176.

3.1.2 *fire-test-response characteristic, n*—a response characteristic of a material, product, or assembly, to a prescribed source of heat or flame, under controlled fire conditions; such response characteristics may include but are not limited to ease of ignition, flame spread, mass loss, smoke generation, fire resistance, and toxic potency of smoke.

3.1.2.1 *Discussion*—A fire-test-response characteristic can be influenced by variable characteristics of the heat source,

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

such as its intensity, or of the burning environment, such as ventilation, geometry of item or enclosure, humidity or oxygen concentration. It is not an intrinsic property such as specific heat, thermal conductivity, or heat of combustion, where the value is independent of test variables. A fire-test-response characteristic may be described in one of several terms. Smoke generation, for example, may be described as smoke opacity, change of opacity with time, or smoke weight. No quantitative correlation need exist between values of a fire-test-response characteristic for different materials, products, or assemblies, as measured by different methods or tested under different sets of conditions for a given method.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *measurand, n*—quantity subject to measurement.

3.2.2 *uncertainty of measurement, n*—parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.

## 4. Significance and Use

4.1 This standard is to be used by those concerned with the development of fire-test-response standards.

4.2 The resultant fire-test-response standards are intended to be useful in one or more of the following areas, among others: product development, quality control, product comparisons, screening, information to be used as part of a fire hazard or a fire risk assessment, and regulatory purposes.

4.3 This practice is intended to be useful to users of fire-test-response standards because it provides much of the general rationale for the development and use of such standards.

4.4 This practice is not intended to provide guidance for the preparation of fire hazard assessment standards or fire risk assessment standards.

4.5 This practice is not intended to provide guidance for the preparation of standards not related to fire-test responses of materials, products or assemblies.

## 5. Preparation of Fire-Test-Response Standards

5.1 The writer of fire-test-response standards shall be able to refer to *Form and Style of ASTM Standards*<sup>2</sup>, to obtain assistance in ensuring that the standards being written will conform with the requirements of Section A and other appropriate sections, as specified in this practice.

5.1.1 Fire-test-response standards shall not use conditional language.

5.2 Fire-test-response standards shall, as applicable, contain the sections described in 5.3-5.21 of this practice.

### 5.3 Title:

5.3.1 The title of the test method shall specify the intended specific application, clearly and as concisely as is practicable.

5.3.2 The title of the test method shall not contain the phrases “fire hazard” or “fire risk”.

### 5.4 Scope:

5.4.1 The scope shall clearly:

5.4.1.1 Identify the standard as a “fire-test-response standard,”

5.4.1.2 State the purpose of the standard,

5.4.1.3 Specify the known limitations of the standard,

5.4.1.4 Specify the significance of the data that are generated (including relevance to human life and property, where appropriate),

5.4.1.5 Specify what the standard is and is not intended to accomplish,

5.4.1.6 Identify the class of materials, products or assemblies to which it is to be applied,

5.4.1.7 Identify the heat flux or other test input characteristics involved,

5.4.1.8 Identify the fire-test-response characteristic(s) to be measured, and

5.4.1.9 Identify the system of units of measurement applied within the standard and to be used in referee decisions; parenthetical measures in a different system of units are permitted when identified to be for information only.

5.4.2 The scope shall include the caveat for fire-test-response standards required by the ASTM policy on fire standards, and contained in F2.2 of *Form and Style for ASTM Standards*. This is referred to as the fire-test-response standards caveat. No alterations are to be made to the caveat as follows:

*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.*

5.4.3 The scope shall contain the standard safety hazards caveat specified in F2.1.1 of *Form and Style for ASTM Standards*. No alterations are to be made to the caveat as follows:

*This standard does not purport to address all of the safety problems, 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.*

5.4.4 The scope of all fire test methods shall contain the following safety caveat:

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

5.4.5 The scope shall contain information with respect to any known limitations of the test method with respect to its application, and inappropriate uses of the standard.

5.4.6 It is appropriate to include reference to alternative, companion or related standards in the scope. The title and designation of such standards shall be included in the referenced documents section.

### 5.5 Referenced Documents:

5.5.1 The list of referenced documents shall include:

5.5.1.1 All ASTM standards, proposals, and adjuncts that are cited in the text,

5.5.1.2 **E176**, Terminology Relating to Fire Standards,

5.5.1.3 Alternate, companion, or related ASTM standards, mentioned in the scope.

5.5.2 The list of referenced documents shall also include all standards and codes of other organizations which are useful to the user of the standard and are cited in the text of the standard.

### 5.6 Terminology:

5.6.1 The standard shall use precise and accurate terminology. Inappropriate, misleading or deprecated terms such as “slow burning” or “self extinguishing” shall not be used.

5.6.2 Terminology **E176** shall be used for selecting terminology as well as definitions for terms used in the standard.

5.6.3 Where applicable, reference shall be made to other existing ASTM terminology standards having specific application to the subject of the test method.

5.6.4 When applicable, reference shall be made to the appropriate international terminology standards, such as those by the International Organization for Standardization (ISO) or the International Electrotechnical Commission (IEC). The title and numerical designation of the ISO or IEC standard shall be included in a separate subsection of the section on referenced documents.

5.6.4.1 In case of conflict between the international terminology standards and Terminology **E176**, the ASTM standard shall prevail.

5.6.5 Part E of *Form and Style for ASTM Standards* shall be used as a source for additional guidance on terminology in ASTM standards.

5.6.6 The standard shall not describe or define terms that are inconsistent with those given in Terminology **E176** or other ASTM terminology standards, unless the difference is described in the terminology section, and is justified as being unique to the specific test method. Terms that are specific (or applicable) only to the standard shall be described in the terminology section. Such terms shall be included in a subsection entitled “Definitions of Terms Specific to this Standard.” Any terms so described which appear in ASTM terminology standards shall include a notation explaining the difference in use or meaning.

5.6.7 It is acceptable for definitions of terms critical to the use of the standard to be reproduced, in precisely the form in which they appear in the corresponding terminology standard. In such cases, reference to the terminology standard shall be made in the section on terminology and the standard shall be listed in the section on referenced documents.

5.6.8 In the terminology section, reference sources shall be provided for each keyword in the title of the standard, unless the terms are well known and widely used.

5.7 *Summary of Test Method*—This section shall contain a brief summary of the test method, which describes the heat source, the type of specimen, the exposure conditions, the types of measurements made, and the type of results reported.

#### 5.8 *Significance and Use:*

5.8.1 This section shall provide information with respect to the usefulness of the test method.

5.8.1.1 It shall include information that indicates the appropriate uses of the test method, such as product development, quality control, screening, product comparisons, input for a fire model or a fire hazard assessment, basis for regulation.

5.8.1.2 This section shall include information with respect to the need for the standard. Possible explanations of need are: (1) that no other test method exists, (2) that this test method supersedes older test methods, or (3) that this test method offers useful or improved alternatives.

5.8.2 Known potential inappropriate uses shall be stated along with reasons why use of the test method is inappropriate in such cases. Examples of inappropriateness include: (1) a test method provides results that are too imprecise for use in a particular application, (2) the inter-laboratory evaluation test data indicates that the use of the test method for regulatory purposes is inappropriate because of large variability of test results among laboratories, (3) the data generated by using the test method do not adequately describe one particular fire-test-response characteristic for use in regulation, or (4) some materials, products or assemblies perform differently in the test method from the way in which they are expected to perform in an actual application.

5.8.3 The significance and use section shall include all known limitations of the test method.

5.8.4 The significance and use section shall include a statement addressing the effect of changing test conditions on the results and their subsequent use. An example statement follows:

In this procedure, the specimens are subjected to one or more specific sets of laboratory test conditions. If different test conditions are substituted or the end-use conditions are changed, it is not always possible by or from this test method to predict changes in the fire-test-response characteristics measured. Therefore, the results are valid only for the fire test exposure conditions described in this procedure.

5.8.5 The significance of the data generated through the use of the test method shall be described, including relevance to human life or property, where appropriate.

5.8.6 Any warning needed in the interpretation of the results shall be included in this section.

#### 5.9 *Hazards:*

5.9.1 A statement shall be included to warn the operator of specific safety hazards involved when using the test method. Hazards to be considered include, but are not restricted to, explosion, generation of vision obscuring smoke or of toxic products of combustion, and rapid fire growth. (See *Form and Style for ASTM Standards*.)

5.9.2 A precautionary statement shall be included to inform the operator of precautions to be taken to avoid or minimize particular hazards. (See *Form and Style for ASTM Standards*.)

5.9.3 A statement addressing remediation of the hazards is not required to be included in detail in the standard. However, it is appropriate to cite a reference, for example by way of a footnote, which describes a means for treating a situation resulting from an uncontrolled hazard. (See *Form and Style for ASTM Standards*.)

#### 5.10 *Test Equipment:*

5.10.1 The test equipment shall be specified and described.

5.10.2 It is desirable to provide the source for commercially available equipment when only a single source of the equipment is known.

5.10.3 Equipment that is not commercially available shall be described in sufficient detail to enable the user to construct the equipment. If complete descriptions and specifications are readily available, they shall be cited instead of providing the complete description and drawings in the standard.

#### 5.11 *Calibration and Standardization:*



5.11.1 Calibration information shall be included in the test method.

5.11.2 Complete details for the calibration and standardization of the equipment shall be included in the fire-test-response standard, under the following circumstances:

5.11.2.1 The equipment is simple and ordinary, however, its calibration is not obvious. For example, if a Bunsen burner is used with natural gas as a fuel and the flame height is specified, further details are required. Such details include a specification of the setting of the air inlet, as well as the conditions for measuring the flame height (such as the ambient lighting level and the point to be considered as the top of the flame). A desirable alternative in this case is to provide a specification of fuel heat content and mass flow rate.

5.11.2.2 The equipment is used in a manner other than that specified by the manufacturer, so that calibration instructions supplied with the equipment are not valid.

5.11.2.3 The equipment is complex and calibration and standardization information is not supplied with the equipment. In this instance it is possible for the calibration and standardization information required to be quite extensive. An effort shall be made to avoid a lengthy section if the necessary information is available readily elsewhere; in such a case, a reference shall be supplied in the standard. If the additional information is considered necessary its appropriate location is an Annex.

5.11.3 The frequency of calibration and standardization shall be described.

#### 5.12 *Sampling, Test Specimens, and Test Units:*

5.12.1 The procedure for selecting samples (one or more specimens) shall be described. If this involves a statistical sampling plan, it shall be described in sufficient detail to enable the operator to comply with the intent of the plan.

5.12.2 The number and selection of specimens shall be specified. A procedure shall be included for determining the location from which specimens are to be taken.

5.12.3 The preparation of the specimens shall be specified. This shall include descriptions of specimen dimensions and any specialized preparation procedures.

5.12.4 The fire-test-response characteristics of many materials depend on the moisture content and temperature of the material, product, or assembly being tested. Consequently, a conditioning procedure shall be specified unless it is deemed that conditioning is not necessary, in which case the basis for the lack of need for conditioning shall be given.

5.12.5 Any special sample storage conditions or requirements shall be specified in this section.

#### 5.13 *Procedure:*

5.13.1 The procedure shall specify the following, where applicable:

5.13.1.1 The size and number of specimens to be used as a sample,

5.13.1.2 A precise specification of the source of flame or heat,

5.13.1.3 The test equipment to be used,

5.13.1.4 All other required materials or auxiliary equipment,

5.13.1.5 The handling and mounting of specimens,

5.13.1.6 All other procedural details, such as the fuel flow rate, exposure time, atmospheric conditions in the test chamber or room, and timing of measurements,

5.13.1.7 All details of measurements, and

5.13.1.8 The manner in which data shall be recorded and reported.

5.13.2 Critical parameters of the test and allowable limits for them shall be established and specified.

5.13.3 Results shall be expressed in quantitative numerical terms, except when the results are inherently qualitative in form (for example, whether the sample will or will not ignite under specified test conditions).

#### 5.14 *Calculations and Interpretation of Results:*

5.14.1 Procedures and equations for calculation of the test result(s) from the test data shall be given.

5.14.1.1 The procedures shall be given in sufficient detail to enable an operator to perform the calculations on the basis of the information provided. Sources of other necessary information required for the calculations shall be cited.

5.14.2 Procedures for interpretation and application of the results shall be specified clearly.

5.14.2.1 All necessary information for the completion of the interpretation or application of results shall be included, or sources of such information shall be cited.

#### 5.15 *Precision and Bias:*

5.15.1 A statement on precision and bias shall be included.

5.15.1.1 *Form and Style for ASTM Standards* describes the recommended statements for precision and bias.

5.15.2 An inter-laboratory round robin evaluation is the best means for developing a satisfactory precision and bias statement. Furthermore, an inter-laboratory round robin evaluation is valuable for establishing the credibility of a test which is to be used for other than research and development.

5.15.2.1 **Appendix X2** includes other suggested statements for precision and bias, in cases where inter-laboratory round robin evaluations have not been conducted.

#### 5.16 *Measurement Uncertainty:*

5.16.1 Measurement uncertainty is an estimate of the magnitude of systematic and random measurement errors that are associated with the measurement result. An uncertainty statement relates to a particular result obtained in a laboratory carrying out the test method, in accordance with the fire-test-response standard, as opposed to a precision and bias statement which is normally derived from an interlaboratory study.

5.16.2 Each fire-test-response standard issued by Committee E05 shall include a statement on measurement uncertainty, which shall provide guidance for laboratories regarding uncertainty statements to include with test reports providing results of a test conducted using the standard.

5.16.3 Guides **E2536** and **E2655** provide detailed guidance on uncertainty of measurements in fire tests, the relationship of measurement uncertainty to the uncertainty of fire test results, and reporting of uncertainty of test results.

5.16.4 If an uncertainty statement cannot be prepared for a particular E05 fire test standard so as to comply with Guides **E2536** and **E2655**, then the required statement on measurement uncertainty shall have the following form: "The uncertainty of