Designation: E535 – 14

An American National Standard

Standard Practice for Preparation of Fire-Test-Response Standards[1]

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 (ε) 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*[2], 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.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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,

[1] 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.

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[2] Available on request from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA, 19428-2959.

[3] 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.

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*[2], 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

the result(s) obtained with this standard test method is a function of (1) variations in the test conditions within the tolerances of the standard, (2) variations in the test specimen, and (3) errors in the measurements recorded. Because it is not possible to quantify the effects of (1) and (2), it is not possible to quantify the uncertainty of the result(s) from a test conducted according to this standard."

5.16.5 It is neither appropriate for, nor the responsibility of, the fire-test-response standard to provide explicit values that a user would quote as their estimate of uncertainty. Uncertainty values must be based on data generated by laboratories reporting results using the test method.

5.17 *Keywords:*

5.17.1 All fire-test-response standards shall include a list of descriptive keywords at the end of the standard. The appendix of Terminology E176 contains a list of keywords that are appropriate for use in fire standards.

5.17.2 Keywords shall be taken from the title and body of the standard and shall provide a concise picture of the standard.

5.17.3 Keywords serve two very useful purposes: they provide a very quick identification of the standard, and they are searchable from computerized data bases for retrieval purposes.

5.17.4 Keyword lists shall be confined to 20 words or less.

5.17.5 Keywords shall include familiar words that are commonly identified with the test method, even if they are not used broadly in the standard.

5.18 *Annexes:*

5.18.1 Annexes shall be used to provide one or more of the following: mandatory information that is too extensive for inclusion in other sections of the standard, or provisions on optional uses of the test.

5.18.2 Appropriate information to be incorporated into annexes includes: explanations of symbols and equations, detailed descriptions of the apparatus, directions for cleaning the apparatus, operating instructions for special operations, adjustments for specific types of apparatuses, and descriptions of sections of the apparatus to be used for optional measurements.

5.19 *Appendixes:*

5.19.1 It is recommended that fire-test-response standards include an appendix labeled "Commentary" which provides non-mandatory information with respect to the history and rationale for the development of the standard. The relationship to other standards shall also be included. Factors that potentially influence the performance of a test or affect the results shall also be included. Such information is very helpful to the user as well as to committee members as they consider revisions or reapprovals of the standard.

5.19.2 It is appropriate to include other appendixes to provide: (*1*) additional explanatory material which will aid in judgments about the applicability of the standard, (*2*) explanations of equations used in the standard, (*3*) charts or photographs, or (*4*) details of precision evaluations.

5.19.3 It is recommended to include, if appropriate and known, the relationship between the test method described in the standard and similar standards available from other organizations, including those from other countries and from ISO or IEC. Where this information is included, it shall state whether the international standard is identical, technically equivalent or different from the ASTM standard. The title and numerical designation of the international standard shall be included in the section on referenced documents.

5.20 *Notes*—Appropriate notes shall be used, as specified in *Form and Style for ASTM Standards.*

5.21 *Working Document Caveat*—All draft standards shall include the working document caveat as specified in *Form and Style for ASTM Standards*. This caveat shall be typed or stamped at the top of the first page of the document. The wording of the caveat is as follows:

> This document is not an ASTM standard; it is under consideration within an ASTM technical committee but has not received all approvals required to become an ASTM standard. It shall not be reproduced or circulated or quoted, in whole or in part, outside of ASTM committee activities except with the approval of the chairman of the committee having jurisdiction and the president of the Society. Copyright ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. All Rights Reserved.

5.22 *Summary of Changes*—Each test method shall contain a summary of changes section. After each revision of a test method a summary of the most recently approved changes shall be added to the Summary of Changes section. Each entry into this section shall start as follows: "The following changes(s) has (have) been made to this test method since the last issue, EXXXX.XXXX (approved on xx date)."

6. Keywords

6.1 caveat; checklist; commentary; fire; fire-test-response; fire-test-response characteristic; guidance; implementation; policy; practice; preparation; response; standard; test

ANNEX

(Mandatory Information)

A1. ASTM POLICY ON FIRE STANDARDS

A1.1 The ASTM policy on fire standards is contained in F2.2 of *Form and Style of ASTM Standards*, and is reproduced herein.

A1.2 *Fire Standards*:

A1.2.1 Every fire standard shall state its purpose, specify the known limitations of the standard, and specify the significance of the data that are generated (including relevance to human life and property, where appropriate). Use precise terminology (see Part E, Terminology in ASTM Standards, within *Form and Style of ASTM Standards*), and include the appropriate caveat as listed below. Standards should include, where practical, sufficient background or explanatory material to guide users in properly applying ASTM fire standards..

A1.2.2 ASTM fire standards include fire-test-response standards, fire-hazard assessment standards, and fire-risk assessment standards. Other types of fire standards shall also be permitted, including terminologies, guides, specifications, and practices. The following criteria shall be followed by fire standards:

A1.2.2.1 Fire-test-response standards provide a means for measuring the response of materials, products, or assemblies to heat and flame under controlled conditions of test. ASTM fire-test-response standards shall contain the following caveat:

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.

A1.2.2.2 Fire-hazard assessment standards provide a method for assessing the potential for harm for materials, products, or assemblies that could be anticipated under specified fire conditions. ASTM fire-hazard assessment standards shall contain the following statement:

This standard is used to predict or provide a quantitative measure of the fire hazard from a specified set of fire conditions involving specific materials, products, or assemblies. This assessment does not necessarily predict the hazard of actual fires which involve conditions other than those assumed in the analysis.

A1.2.2.3 Fire-risk assessment standards provide a method for assessing the probability of loss resulting from a given fire situation involving interaction between the material, product, or assembly with its environment. ASTM fire-risk assessment standards shall contain the following statement:

This standard is used to establish a means of combining the potential for harm in fire scenarios with the probabilities of occurrence of those scenarios. Assessment of fire risk using this standard depends upon many factors, including the manner in which the user selects scenarios and uses them to represent all scenarios relevant to the application. This standard cannot be used to assess fire risk if any specifications are different from those contained in the standard.

A1.2.2.4 ASTM develops fire standards other than fire-test-response standards, fire-hazard assessment standards, or fire-risk assessment standards, which provide information on fire issues that are not associated with a quantitative output (where quantitative outputs include a binary pass/fail option or a classification into categories). Such ASTM fire standards shall contain the following statement:

This fire standard cannot be used to provide quantitative measures.

A1.2.2.5 The following generic caveat is appropriate for fire standards that do not describe a fire test but do produce quantitative results that are calculated measures of fire-test-response charcteristics and not by themselves measures of fire hazard or fire risk.

This standard is used to determine certain fire-test responses of materials, products, or assemblies to heat and flame under controlled conditions by using results obtained from fire-test-response standards. The results obtained from using this standard do not by themselves constitute measures of fire hazard or fire risk.

A1.2.2.6 The following caveat is required for fire test methods:

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

A1.2.3 *Titles and Criteria for Fire-Hazard and Fire-Risk Assessment Standards*—All standards developed, approved, or reapproved for the analysis and control of fire hazard or fire risk shall contain the words "FIRE-HAZARD ASSESSMENT" or "FIRE-RISK ASSESSMENT" in the title. The results of all such assessments shall be expressed in terms that relate the item in question to the anticipated fire environment. When appropriate, the standard may also contain acceptance or classification criteria and a statistical sampling plan as a guide to its use.

A1.2.4 ASTM Committee E05 on Fire Standards is available to provide review of fire standards developed by other ASTM committees.

APPENDIXES

(Nonmandatory Information)

X1. COMMENTARY

X1.1 The ASTM policy on fire standards was developed in 1973 (and has since been revised) in response to a concern about the misuse of fire standards. Such misuse could result in unsafe products and practices as well as discrimination against specific products without proper cause. The policy has served ASTM well. The extensive revisions have reflected the responsibilities of Committee E05, of other technical committees and of ASTM staff, as well as new technology, and new approaches to the definitions of terms such as fire hazard and fire risk, which have evolved with the development of fire science.

X2. E05 PRECISION AND BIAS STATEMENT RECOMMENDATIONS

X2.1 *Background Information*:

X2.1.1 For each ASTM standard which includes therein a test method, the manual *Form and Style for ASTM Standards* requires the inclusion (in that standard) of statements which provide the user of the standard with information regarding the precision and the bias of that test method. The manual states that precision statements should show precision under both repeatability conditions and reproducibility conditions, as defined in Terminology E456. Repeatability is precision within a single laboratory. Reproducibility is precision between different laboratories.

X2.1.2 The manual also states that precision should be estimated in accordance with Practice E691, or by an interlaboratory test program that yields equivalent information. Such a directive fails to allow the inclusion of statements about valid estimates of precision that might be obtained by programs of study other than Practice E691.

X2.1.3 The manual does allow for the temporary use of precision statements that are not in full compliance. Such use is limited to 5 years, at which time a more definitive precision statement is required for a properly developed test method.

X2.1.4 Members of ASTM Committee E05 are aware that some test methods under the jurisdiction of Committee E05 have not been subjected to the requirements of a round robin interlaboratory evaluation in accordance with Practice E691. It is likely that attempts to conduct such round robin programs for older fire test methods would not be financially supported by sufficient numbers of E05 members. Moreover, when new test methods are being developed, the combination of manufacture and test cost considerations can take the conduction of round robin evaluations out of the committee's reach.

X2.1.5 It is a technical fact that every test method which produces a quantitative test result will have a value of precision. That precision can be estimated by testing materials, products, or assemblies, from a finite population, at several different times using both a single operator in one laboratory using a specific apparatus, and multiple operators in different laboratories using similar apparatuses.

X2.1.6 This appendix serves ASTM committees, subcommittees, and individuals developing or managing fire-test-response standards, as a guide to wording of both useful and acceptable precision and bias statements for such standards. This will include those standards that have been in widespread use for many years but lack precision and bias data appropriately generated. In this way, both new and existing fire-test-response standards should be written in conformance with the form and style manual requirements and incorporate one of the statements for precision and one of the statements for bias included in this section.

X2.2 *Precision Statements*, for cases where precision has not been assessed directly:

X2.2.1 *PA*—The precision of this test method is under consideration and is awaiting evaluation.

X2.2.1.1 Use this format only where definite plans for evaluation of precision are in progress, with some expectation of a foreseeable completion date.

X2.2.2 *PB*—The precision of this test method has not been determined by the committee. Operators familiar with this method estimate that the coefficient of variation of the test results within a single laboratory by a single operator is approximately _____ % and that the coefficient of variation between laboratories is approximately ____ %.

X2.2.2.1 Use this format where work will be indefinitely postponed but there are estimates of precision that can be suggested in the interim.

X2.2.3 *PC*—The precision of this test method for measuring ... is essentially as specified in Test Method X 0000.

X2.2.3.1 Use this format only if it can be demonstrated that the precision is the same as that of the referenced test method. Do not refer to test methods containing multiple tests using this format.

X2.2.4 *PD*—This test method has been in use for many years, but no information has been presented to ASTM upon which to base a statement on precision. No activity has been planned to develop such information.

X2.2.4.1 Use this format only for old test methods in which there has been no recent or current technical development, for which no round robin is being contemplated, and when it is unlikely that any significant voluntary participation in such a test program could be organized.

X2.2.5 *PE*—No activity has been planned to develop information to assess the precision of this test method. The

techniques used and the properties measured in this test method are similar to those for Test Method X 0000 and it is expected that the precision will also be similar.

X2.2.5.1 This format is a variant on format PD. Use this format only for old test methods and when all the following conditions apply: *(a)* there has been no recent or current technical development, *(b)* no round robin is being contemplated, *(c)* it is unlikely that any significant voluntary participation in a round robin test program could be organized, and *(d)* information based on other test methods measuring similar properties with comparable techniques can be used to roughly estimate precision. Do not refer to test methods containing multiple tests using this format.

X2.2.6 *PF*—No information is presented about the precision of Test Method X 00000 for measuring .... because the test result is non quantitative.

X2.2.6.1 Use this format when the test result is of a pass/fail nature or when the test results classify specimens in various classes through non numerical reports of success or failure. This format should not be used in applying this format in cases where the criterion is the achievement or non-achievement of a numerical test value.

X2.3 *Bias Statements*, for cases where bias has not been assessed directly:

X2.3.1 *BA*—This test method has no bias because the value for _____ is determined solely in terms of this test method itself.

X2.3.1.1 Use this format if the test method assesses an arbitrary property or if there is no other test method generally accepted as standard that can be used to measure the exact property of interest, for example against a reference material.

X2.3.2 *BB*—No information is presented about the bias of this test method for measuring .... because the test result is non quantitative.

X2.3.2.1 Use this format, combined with precision format PF above, where there is no information that bias does not exist, if the test method generates non numerical reports of success or failure. If it is known that there is no bias, use bias format BA with precision format PF.

X2.3.3 *BC*—The bias of this test method for measuring .... is essentially the same as the bias for Test Method X 0000.

X2.3.3.1 Use this format with precision format PC above, with the same limitations as to use, if it can be shown that the bias is the same as that for another test method.

X2.3.4 *BD*—Some materials appear to perform differently in this test method than they would be expected to perform in an actual application. This test method has a distinct bias with reference to materials that respond in the following fashion in the test method: .....

X2.3.4.1 Use this format for cases where the test method misrepresents, either favorably or unfavorably, the performance of certain materials, when compared to others, due to certain characteristics of the material, which are not associated with the properties being measured in the test method.