



Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components¹

This standard is issued under the fixed designation E1725; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 These test methods cover fire-test-response.

1.2 These fire-test-response test methods provide information on the temperatures recorded on the electrical system component within a fire-resistive barrier system during the period of exposure.

1.3 *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.*

1.4 Potentially important factors and fire characteristics not addressed by these test methods include, but are not limited to:

1.4.1 The performance of the fire-resistive barrier system constructed with components other than those tested.

1.4.2 An evaluation of the functionality of the electrical system within the fire-resistive barrier system.

1.4.3 An evaluation of the ampacity of the electrical system within the fire-resistive barrier system.

1.4.4 An evaluation of the smoke, toxic gases, corrosivity, or other products of heating.

1.4.5 A measurement of the flame spread characteristics over the surface of the fire-resistive barrier system.

1.4.6 An evaluation of through-penetration sealing methods.

NOTE 1—Refer to Test Method E814 for testing of firestop systems.

1.4.7 Combustibility of materials in the fire-resistive barrier system or of the electrical system components.

1.4.8 The need for supports beyond those normally required.

1.4.9 Environmental conditions in the area of service.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical

conversions to SI units that are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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

1.8 *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

E119 Test Methods for Fire Tests of Building Construction and Materials

E814 Test Method for Fire Tests of Penetration Firestop Systems

E1529 Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies

3. Terminology

3.1 *Definitions:*

3.1.1 *air drop*—lengths of open run conductors or cables supported only at each end.

3.1.2 *electrical system components*—cable trays, conduits and other raceways, open run cables and conductors, cables, conductors, cabinets, and other components, as defined or used in the National Electrical Code, and air drops as defined in 3.1.1.

¹ These test methods are under the jurisdiction of ASTM Committee E05 on Fire Standards and are the direct responsibility of Subcommittee E05.11 on Fire Resistance.

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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

3.1.3 *fire-resistive barrier system*—a specific construction of devices, materials, or coatings installed around, or applied to, the electrical system components.

3.1.4 *specimen*—a construction consisting of electrical system components and a fire-resistive barrier system.

3.1.5 *test assembly*—horizontal or vertical construction on which test specimens are to be mounted together with associated instrumentation.

4. Significance and Use

4.1 These fire-test-response test methods evaluate, under the specified test conditions, the ability of a fire-resistive barrier system to inhibit thermal transmission to the electrical system component within.

4.2 In these procedures, 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 these test methods to predict changes in the fire test response characteristics measured. Therefore, the results are valid only for the fire test exposure conditions described in these procedures.

4.3 These test methods provide a measurement of the transmission of heat to the electrical system components within the barrier system.

4.4 These test methods provide qualification of a fire-resistive barrier system as one element of an electrical system designed to maintain continuous operation of critical functions and processes for a specific fire resistance rating.

4.4.1 In addition to the temperature data provided by these test methods, numerous other factors, such as referenced in 1.4 shall be considered in specifying such a system.

5. Control of Fire Test

5.1 Fire Test Exposure Conditions:

5.1.1 *Time-Temperature Curve*—Maintain the fire environment within the furnace in accordance with the standard time-temperature curve shown in Test Method E119 or the rapid temperature rise curve shown in Test Method E1529.

5.2 Furnace Temperatures:

5.2.1 The temperature fixed by the curve shall be the average temperature obtained from readings of thermocouples distributed within the test furnace. Disperse the thermocouples as symmetrically as possible within the furnace to measure the temperature near all exterior surfaces of the specimen. Do not place the thermocouples at locations where temperature readings would be effected by drafts within the furnace.

5.2.2 Measure and report the temperatures at intervals not exceeding 1 min.

5.3 Furnace Thermocouples:

5.3.1 Test Method E119:

5.3.1.1 Enclose the thermocouples in sealed protection tubes of such materials and dimensions that the time constant of the protected thermocouple assembly lies within the range

from 300 s to 400 s.³ The exposed length of the pyrometer tube and thermocouple in the furnace chamber shall be not less than 12 in. (305 mm).

5.3.2 Test Methods E1529:

5.3.2.1 Measure the temperature of the gases adjacent to and impinging on the test specimens using factory manufactured 0.25 in. (6 mm) outside diameter (OD), Inconel-sheathed, Type K, chromel-alumel thermocouples. The time constant, in air, of the thermocouple assemblies shall be less than 60 s. Use standard calibration thermocouples with an accuracy of $\pm 0.75\%$. A minimum length of 20 diameters (125 mm) of the sheathed junction end of the thermocouple shall be mounted parallel to the surface of the test specimen.

5.4 *Furnace Thermocouple Locations*—Position the furnace control thermocouples before the start of the fire exposure test. It shall be permitted to move the thermocouple to avoid touching the specimen as a result of its deflection during the test.

5.4.1 Place the junction of each thermocouple 12 in. $\pm$ 1 in. (305 mm $\pm$ 25 mm) from the surface of horizontal constructions or 12 in. $\pm$ 1 in. from the surface of specimens mounted in horizontal constructions.

5.4.2 Place the junction of each thermocouple 6 in. $\pm$ 1 in. (152 mm $\pm$ 25 mm) from the surface of vertical constructions or 6 in. $\pm$ 1 in. from the surface of specimens mounted in vertical constructions.

5.4.3 Use a minimum of three thermocouples.

5.4.3.1 For specimens mounted in horizontal constructions, there shall be no less than five thermocouples per 100 ft² (9 m²) of exposed area. Calculate the exposed area to be the sum of the exterior surface area of the fire-resistive barrier system plus the area of the horizontal construction exposed to the furnace fire.

5.4.3.2 For specimens mounted in vertical constructions, there shall be no less than nine thermocouples per 100 ft² (9 m²) of exposed area. Calculate the exposed area to be the sum of the exterior surface area of the fire resistive barrier system plus the area of the vertical construction exposed to the furnace fire.

5.5 Furnace Control:

5.5.1 Test Method E119 Time-Temperature Curve:

5.5.1.1 The control of the furnace control shall be such that the area under the time-temperature curve, obtained by averaging the results from the furnace thermocouple readings, is within 10 % of the corresponding area under the standard time-temperature curve for fire tests of 1 h or less duration, within 7.5 % for those over 1 h and not more than 2 h, and within 5 % for tests exceeding 2 h in duration.

³ A typical thermocouple meeting these time-constant requirements may be fabricated by fusion-welding the twisted ends of No. 18 B&S gage, 0.040 in. (1.02 mm), chromel-alumel wires, mounting the leads in porcelain insulators and inserting the assembly so the thermocouple bead is 0.50 in. (13 mm) from the sealed end of a standard weight, nominal 1/2 in. iron, steel, or Inconel (a registered trademark of INCO Alloys Inc., 3800 Riverside Dr., P.O. Box 1958, Huntingdon, WV 25720) pipe. The time constant for this and for several other thermocouple assemblies was measured in 1976. The time constant may also be calculated from knowledge of its physical and thermal properties. See Research Report RR:E05-1001, available from ASTM Headquarters.