



Designation: F 2302 – 03

Standard Performance Specification for Labeling Protective Clothing as Heat and Flame Resistant¹

This standard is issued under the fixed designation F 2302; 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 This specification provides minimum requirements for labeling protective clothing as heat and flame resistant for applications where the potential for flame contact or high heat exposure exist.

1.1.1 This specification includes requirements that define heat and flame resistance of materials used in protective clothing in a manner to limit the contribution of the clothing for causing injury to the wearer when exposed to high heat or flame.

1.1.2 This specification does not provide requirements that establish the level of protection provided by the clothing.

1.1.3 This specification does not include testing for the evaluation of the entire clothing item.

1.2 This specification does not pertain to materials and clothing that are addressed in other standards. See **Appendix X1** for a list of standards for heat and flame resistant protective clothing.

1.3 This specification does not pertain to applications where the conditions of potential flame contact or heat exposure are of an extended duration and/or are of a high intensity.

NOTE 1—Examples include fire fighting applications, exposure to high energy electrical arcs and exposures in flash fires.

1.4 The values stated in SI units or in other units shall be regarded separately as standard. The values stated in each system must be used independently of the other, without combining values in any way.

1.5 This standard measures and describes 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.

1.6 The following precautionary caveat pertains only to the test methods portion, Section 8, of this specification: *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 This specification is under the jurisdiction of ASTM Committee F23 on Protective Clothing and is the direct responsibility of Subcommittee F23.80 on Flame and Thermal.

Current edition approved June 10, 2003. Published August 2003.

2. Referenced Documents

2.1 ASTM Standards:²

D 123 Terminology Related to Textiles

D 4391 Terminology Relating to the Burning Behavior of Textiles

D 6413 Test Method for Flame Resistance of Textiles (Vertical Test)

E 171 Specification for Standard Atmospheres for Conditioning and Testing Materials

F 1358 Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance

F 1494 Terminology Relating to Protective Clothing

2.2 AATCC Standards:³

AATCC 132 Colorfastness to Drycleaning

AATCC 135 Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics

2.3 ISO Standards:

ISO 17493 Clothing for protection against heat and flame—Test method for convective heat resistance using a hot air circulating oven⁴

3. Terminology

3.1 **Definitions**—For definitions of terms used in this specification, related to the combustion of textiles, refer to the terminology contained in Terminology **D 4391**. For definitions of terms used in this test method, related to protective clothing, refer to the terminology contained in Terminology **F 1494**. For definitions of terms used in this test method, related to textile issues, refer to the terminology contained in Terminology **D 123**.

3.2 **afterflame, n**—persistent flaming of a material after the ignition source has been removed.

3.3 **afterflame time, n**—the length of time for which a material continued to flame after the ignition source has been removed.

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.

³ Available from American Association of Textile Chemists and Colorists (AATCC), One Davis Dr., P.O. Box 12215, Research Triangle Park, NC 27709-2215.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

3.4 *afterglow, n*—a glow in a material after the removal of an external ignition source and after the cessation (natural or induced) of flaming of the material (see also *glow*)

3.5 *burning behavior, n*—all the changes that take place when materials or products are exposed to a specified ignition source.

3.6 *burn distance, n*—the measurement from the bottom edge of the specimen to the farthest point that shows evidence of damage due to combustion.

3.6.1 *Discussion*—In this specification, burn distance is used when testing is performed in accordance with Test Method F 1358.

3.7 *char length, n*—in measuring flame resistance of textiles, the distance from the fabric edge, which is directly exposed to the flame to the furthest point of visible fabric damage after a specified tearing force has been applied.

3.7.1 *Discussion*—In this specification, char length is reported when testing is performed in accordance with Test Method D 6413.

3.8 *charring, n*—the formation of carbonaceous residue as the result of pyrolysis or incomplete combustion.

3.9 *combustion, n*—a chemical process of oxidation that occurs at a rate fast enough to produce heat and usually light either as glow or flames.

3.10 *dripping, n*—in testing thermal protective clothing, a material response as evidenced by flowing of the polymer.

3.10.1 *Discussion*—In evaluating the effects of flame contact or heat exposure of materials used in protective clothing, dripping may be the formation of liquid droplets from melted surface or substrate material during flame impingement or high heat exposure.

3.11 *embrittlement, n*—the formation of a brittle residue as the result of pyrolysis or incomplete combustion.

3.12 *flame, n*—as related to ignition of textiles, a controlled hot luminous zone of gas or matter in gaseous suspension, or both, of constant size and shape that is undergoing combustion as evidenced by a low-intensity, heat source of less than 1 kW, such as a candle flame or match flame.

3.12.1 *Discussion*—Examples are flames from a match, candle, or bunsen burner. The burner flame in this test method produces relatively low heat flux and should be constant in size and shape.

3.13 *flame application time, n*—the time interval for which the ignition flame is applied to a material.

3.14 *flame resistance, n*—the property of a material whereby flaming combustion is prevented, terminated, or inhibited following application of a flaming or nonflaming source of ignition, with or without the subsequent removal of the ignition source.

3.14.1 *Discussion*—In this specification, flame resistance is demonstrated by testing to Test Method D 6413 or Test Method F 1358 and meeting specific performance criteria.

3.15 *flammability, n*—those characteristics of a material that pertain to its ignition and support of combustion.

3.16 *glow, n*—visible, flameless combustion of the solid phase of a material.

3.16.1 *Discussion*—Although a solid may glow, it can also produce combustible discharge that will cause a flame. These two phenomena are not necessarily interdependent.

3.17 *heat resistance, n*—the extent to which a material retains useful properties as measured after exposure of the material to a specified temperature and environment for a specified time.

3.17.1 *Discussion*—In this specification, heat resistance or the heat stability of the material is demonstrated by testing in accordance with ISO 14793 at a temperature of 260°C [500°F] for five minutes without ignition, melting, dripping, or separation of the material and without material shrinkage greater than 10 %.

3.18 *ignition, n*—the initiation of combustion.

3.18.1 *Discussion*—In evaluating the effects of flame contact or heat exposure of materials used in protective clothing, ignition is determined by the presence of afterflame after the removal of the burner flame or when observing the condition of the specimen(s) inside the oven after opening the oven door.

3.19 *melting, n*—in testing thermal protective clothing, a response to heat by a material resulting in evidence of flowing or dripping.

3.19.1 *Discussion*—In evaluating the effects of flame contact or heat exposure of materials used in protective clothing, melting may occur at surface layers or in combination with the substrate fabric(s) or other polymer layers. Melting may be observed for protective clothing materials that involve a polymer coating or laminate combined with a flame-resistant fabric or substrate.

3.20 *protective clothing, n*—a product which is specifically designed and constructed for the intended purpose of isolating parts of the body from a potential hazard; or as a barrier to prevent the body from being a source of contamination.

3.21 *separation, n*—in testing thermal protective clothing, the partial or full detachment of one or more layers comprising a material

3.21.1 *Discussion*—In evaluating the effects of heat exposure, separation occurs when the face cloth detaches from the batting for quilted material or if a film or coating lifts from a substrate fabric.

3.22 *shrinkage, n*—a decrease in one or more dimensions of an object or material.

3.22.1 *Discussion*—In evaluating the effects of flame contact or heat exposure, these changes in dimensions are caused by heat from the flame source or convection within the oven.

4. Significance and Use

4.1 This specification is used to establish the minimum requirements for labeling protective clothing as heat and flame resistant. Testing is performed on the product in both an “as received” condition and after ten laundering or dry cleaning cycles using standardized procedures. Users of this specification are also permitted to use laundering or dry cleaning procedures for conditioning samples as specified in the manufacturer’s care instructions for a minimum of ten cycles.

4.2 This specification is not intended to replace standards that have already been developed for specific types of flame and heat resistant protective clothing, including clothing for protection from flash fire, clothing for protection against