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Standard Guide for Evaluating Chemical Protective Clothing¹

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INTRODUCTION

ASTM Committee F-23 was established in 1976 for the purpose of producing standards for use in the evaluation of protective clothing; in particular, clothing that is used for protection from potentially hazardous chemicals. Such clothing ranges from aprons and gloves to totally encapsulating ensembles. The clothing is widely used throughout industry, agriculture, government, and academia in, for example, chemical research, pesticide application, hazardous waste cleanup, and chemical production.

Committee F-23 is also concerned with clothing for protection from molten metals, but that aspect of the committee's activities is not addressed in this guide.

The effective development and selection of chemical protective clothing requires information on several aspects of the clothing, including chemical resistance, physical integrity, comfort, and fit. Some of these characteristics can be evaluated using swatches of the materials from which the clothing is fabricated; other characteristics require testing of the finished items of clothing. Both types of test methods have been addressed by Committee F-23.

The successful use of Committee F-23's standards requires an awareness and understanding of each standard as well as the interrelationship of the standards.

The successful application of chemical protective clothing requires the careful matching of the proper level of protection and performance characteristics of clothing with the potential hazard and the functional requirements of the tasks to be performed while wearing the clothing.

1. Scope

1.1 This guide is intended to promote the use of standards in the development, specification, and selection of chemical protective clothing with the ultimate goal of improving the safety and health of workers who come into contact with hazardous chemicals.

1.2 *Proposed standards under development by ASTM Committee F-23:*

1.2.1 Test Methods for Measuring the Performance Characteristics of Exhaust Valves Used in Chemical Protective Suits

1.2.2 Test Method for Measuring the Thermal and Evaporative Resistance of Textile Materials Using a Sweating Hot Plate

1.2.3 Test Method for Testing Protective Clothing Materials for Particle Penetration and Air Flow Resistance

1.2.4 Practice for Protective Clothing Maintenance Instructions

1.3 Standards relevant to the work of Committee F-23 are described along with their key reporting elements and limitations.

1.4 Proposed standards of Committee F-23 are also described to provide insight into possible future products of the committee.

1.5 The standards and proposed standards are organized under the following headings: Physical Properties, Chemical Resistance, Classification, Chemical Protective Suits, and General.

1.6 Appendix X1 is an example of how the standards can be combined into a protocol for selection of the most suitable protective clothing for a given application. Briefly, the process is one of defining the requirements of the application and then (by testing) eliminating those candidates that are unsuitable. No protocol can ensure the selection of protective clothing that *guarantees* worker protection. The purpose of testing is to generate data and information that will allow the selection of the most appropriate clothing. Ultimately, clothing selection is based on technical evaluation of available information and professional assessment of risk.

1.7 The values stated in inch-pound units are to be regarded as standard. The SI units given in parentheses are for information only.

1.8 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and*

¹ This guide is under the jurisdiction of ASTM Committee F-23 on Protective Clothing and is the direct responsibility of Subcommittee F23.70 on Use.

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

2. Referenced Documents

2.1 ASTM Standards:

- F 739 Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact²
- F 903 Test Method for Resistance of Materials Used In Protective Clothing to Penetration by Liquids²
- F 1001 Guide for Selection of Chemicals to Evaluate Protective Clothing Materials²
- F 1052 Test Method for Pressure Testing Vapor Protective Ensembles²
- F 1154 Practices for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical-Protective Suit Ensembles²
- F 1186 Classification System for Chemicals According to Functional Groups²
- F 1194 Guide for Documenting the Results of Chemical Permeation Testing on Materials Used in Protective Clothing²
- F 1291 Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin²
- F 1301 Practice for Labeling Chemical Protective Clothing²
- F 1342 Test Method for Protective Clothing Material Resistance to Puncture²
- F 1358 Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance²
- F 1359 Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Mannequin²
- F 1383 Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Intermittent Contact²
- F 1407 Test Method for Resistance of Chemical Protective Clothing Materials to Liquid Permeation—Permeation Cup Method²
- F 1461 Practice for Chemical Protective Clothing Program²
- F 1494 Terminology Relating to Protective Clothing²
- F 1790 Test Method for Measuring Cut Resistance of Materials Used in Protective Clothing²
- F 1818 Specification for Foot Protection for Chain Saw Users²
- F 1819 Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Synthetic Blood Using a Mechanical Pressure Technique²

3. Significance and Use

3.1 The standards under the jurisdiction of Committee F-23 can be used individually or as part of an integrated protocol in the development, selection, specification, and application of chemical protective clothing.

3.2 The standards are intended as a means by which information can be requested, generated, and reported in a consistent, comparable manner.

3.3 The information on clothing performance must be combined, by means of professional judgment, with a clear understanding of the clothing application to provide the best protection to the worker.

4. Physical Properties of Clothing Materials

4.1 Standards:

4.1.1 *F 1358 Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance*—This test method is intended to determine the ignition resistance and burning characteristics of materials used in protective clothing, where flame resistance is not the primary form of protection designated. A test specimen is exposed to a flame for 3 s. If the material ignites, the after-flame time, afterglow time, and burn distance are measured. If the material does not ignite, the test is repeated using a flame exposure period of 12 s.

4.1.1.1 When flame resistance is the primary protection offered by the protective clothing, alternative test methods should be used.

4.1.2 *F 1342 Test Method for Protective Clothing Material Resistance to Puncture*—This test method evaluates puncture resistance of protective clothing materials that may include plastics or elastomeric films, coated fabrics, flexible materials, laminates, or textile materials.

4.1.2.1 It is not intended to measure puncture resistance of all types of punctures encountered using protective clothing materials. This test method involves a procedure where a puncture probe of specified dimensions is used for puncturing specimens.

4.1.2.2 The method evaluates puncture resistance of protective clothing materials, specifically for puncture forced on specimens perpendicular to material surface. There is no supporting structure under the material specimen.

4.1.3 *F 1790 Test Method for Measuring Cut Resistance of Materials Used in Protective Clothing*—This test method assesses the cut resistance of a material when exposed to a cutting edge under specified loads. Data obtained using this test method can be used to compare the cut resistance of different materials.

4.1.3.1 This test method only addresses that range of cutting hazards that are related to a cutting action across the surface of the material. It is not representative of any other cutting hazard to which the material may be exposed.

4.2 Proposed Standards:

4.2.1 *Test Method for Testing Protective Clothing Materials for Particle Penetration and Air Flow Resistance*—The purpose of this test method is to provide a means to compare a fabric's particulate penetration behavior. An aerosol generator is used to generate a uniform aerosol. The generator is coupled to a laser particle counter that counts and records the number of aerosol particles before and after the test fabric at specified air flows.

5. Chemical Resistance of Clothing Materials

5.1 Standards:

² Annual Book of ASTM Standards, Vol 11.03.