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Standard Guide for Evaluating Chemical Protective Clothing¹

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INTRODUCTION

ASTM Committee F23 was established in 1976 for the purpose of producing standards for use in the evaluation of protective clothing. A significant number of these standards have applied to protection against chemicals. Chemical protective clothing ranges from aprons and gloves to totally encapsulating ensembles. Chemical protective clothing is widely used throughout in several different applications including the general industry, the chemical process industry, oil refining, agriculture, hazardous materials remediation, and emergency response.

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. Committee F23 has developed test methods for both types of evaluations.

The successful use of Committee F23'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 aid in the application of standards for the development, specification, and selection of chemical protective clothing with the ultimate goal of maintaining the safety and health of workers who come into contact with hazardous chemicals.

1.2 This guide provides a short description of each referenced standard and then makes specific recommendations for the use of these standards. The referenced standards are organized under the following headings: Material Chemical Resistance, Material Physical Properties, Seam and Closure Performance, and Overall Clothing Performance.

1.3 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 This guide is under the jurisdiction of ASTM Committee F23 on Personal Protective Clothing and Equipment and is the direct responsibility of Subcommittee F23.30 on Chemicals.

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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 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.*

1.6 *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

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.

D747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam (Withdrawn 2019)³
D751 Test Methods for Coated Fabrics
D1630 Test Method for Rubber Property—Abrasion Resistance (Footwear Abrader)
D2582 Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting
D3389 Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
D4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
D4966 Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method)
D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
D5151 Test Method for Detection of Holes in Medical Gloves
D5587 Test Method for Tearing Strength of Fabrics by Trapezoid Procedure
D6413/D6413M Test Method for Flame Resistance of Textiles (Vertical Test)
F392/F392M Practice for Conditioning Flexible Barrier Materials for Flex Durability
F739 Test Method for Permeation of Liquids and Gases Through Protective Clothing Materials Under Conditions of Continuous Contact
F903 Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids
F1001 Guide for Selection of Chemicals to Evaluate Protective Clothing Materials
F1052 Test Method for Pressure Testing Vapor Protective Suits
F1154 Practices for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components
F1186 Classification System for Chemicals According to Functional Groups
F1194 Guide for Documenting the Results of Chemical Permeation Testing of Materials Used in Protective Clothing
F1291 Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin
F1301 Practice for Labeling Chemical Protective Clothing
F1342/F1342M Test Method for Protective Clothing Material Resistance to Puncture
F1358/F1358M Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance
F1359/F1359M Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin
F1383 Test Method for Permeation of Liquids and Gases Through Protective Clothing Materials Under Conditions of Intermittent Contact
F1407 Test Method for Resistance of Chemical Protective

Clothing Materials to Liquid Permeation—Permeation Cup Method

F1461 Practice for Chemical Protective Clothing Program
F1494 Terminology Relating to Protective Clothing
F1790/F1790M Test Method for Measuring Cut Resistance of Materials Used in Protective Clothing with CPP Test Equipment
F2061 Practice for Chemical Protective Clothing: Wearing, Care, and Maintenance Instructions
F2130 Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials

2.2 *ANSI Standard:*⁴

ANSI Z41 American National Standard for Personal Protection—Protective Footwear

2.3 *ANSI/ISEA Standard:*⁵

ANSI/ISEA 105 American National Standard for Hand Protection Selection Criteria

2.4 *NFPA Standards:*⁶

NFPA 1991 Standard on Vapor-Protective Ensemble for Hazardous Materials Emergencies

NFPA 1992 Standard on Liquid Splash-Protective Ensemble and Clothing for Hazardous Materials Emergencies

NFPA 1994 Standard on Protective Ensemble for Chemical/Biological Terrorism Incidents

2.5 *Federal Regulations:*⁷

29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response: Final Rule, *Federal Register*, Vol 54, Mar. 6, 1989, p. 9317, as amended in *Federal Register*, Vol 55, Apr. 13, 1990, p. 14073; *Federal Register*, Vol 56, Apr. 18, 1991, p. 15382 and *Federal Register*, Vol 59, Aug. 22, 1994, p. 43270

29 CFR Part 1910.132 General Requirements of Subpart I—Personal Protective Equipment, *Federal Register*, Vol 39, Jun. 27, 1974, p. 23502, as amended in *Federal Register*, Vol 59, Apr. 6, 1994, p. 16334 and *Federal Register*, Vol 59, July 1, 1994, p. 33910

29 CFR Part 1910.1000 Air Contaminants, *Federal Register*, Vol. 39, June 27, 1974

2.6 *American Conference of Governmental Industrial Hygienists:*⁸

TLVs® and BEIs®: Threshold Limit Values for Chemical Substances and Physical Agents; Biological Exposure Indices

3. Terminology

3.1 *Definitions:*

⁴ Available from National Safety Council (NSC), 1121 Spring Lake Dr., Itasca, IL 60143-3201, <http://www.nsc.org>.

⁵ Available from Industrial Safety Equipment Association, 1901 North Moore Street, Suite 808, Arlington, VA 22209.

⁶ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

⁷ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

⁸ Available from American Conference of Governmental Industrial Hygienists, Inc. (ACGIH), 1330 Kemper Meadow Dr., Suite 600, Cincinnati, OH 45240, <http://www.acgih.org>.

³ The last approved version of this historical standard is referenced on www.astm.org.