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Standard Test Method for Pressure Testing Vapor Protective Ensembles¹

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INTRODUCTION

Personnel in industry and emergency response can be exposed to numerous chemicals capable of causing harm upon contact with the human body. The deleterious effects of these chemicals can range from acute trauma such as skin irritation and burn, to chronic degenerative disease such as cancer. Since engineering controls may not eliminate all possible exposures, attention is often placed on reducing the potential for direct skin contact through the use of protective clothing.

~~Protective clothing is available in a variety of constructions, configurations and materials, and is designed to provide various levels of protection against many hazards. Chemical protective ensembles offering the highest level of chemical protection are constructed to prevent contact of solid, liquid, or gaseous chemicals with the wearer. This test method evaluates the integrity and construction of vapor protective ensembles by way of an internal pressure test. Other related whole suit tests include Test Method F1359 for evaluating splash resistance using a Shower test, and Practice F1154 for evaluating the overall form, fit, and function of a garment using a simulated wear test.~~

Protective clothing is available in a variety of constructions, configurations and materials, and is designed to provide various levels of protection against many hazards. Vapor protective suits generally offer the highest level of chemical protection being constructed to prevent contact of solid, liquid, or gaseous chemicals with the wearer. This test method evaluates the integrity and construction of vapor protective suits by way of an internal pressure test. This test method does not measure the protection of the suit. Other tests measure the protective aspects of the ensembles that are based on these suits, including Test Method F 2588 for evaluating chemical vapor inward leakage, Test Method F 1359 for evaluating splash resistance using a shower test, and Practice F 1154 for evaluating the overall form, fit, and function of a protective ensemble using a simulated wear test.

Resistance to chemical permeation of materials used in protective clothing should be evaluated by Test Methods F 739 for continuous contact and F 1383 for intermittent contact (that is, splash), or by Test Method F 1407 according to the permeation cup method. Resistance of protective clothing materials to liquid penetration should be determined by Test Method F 903.

Physical properties of materials used in the construction of protective clothing can be determined using a variety of test methods, including Test Methods D 751 (dimensions, weight, breaking strength, elongation, burst, tear resistance, hydrostatic resistance, coating adhesion, tack-tear, low temperature impact and bend, accelerated aging, blocking, and crush resistance), D 2582 (puncture propagation tear), D 4157 (abrasion resistance), F 392 (flexural fatigue), F 1358 (flammability), as well as many others.

1. Scope

1.1 This test method measures the ability of a vapor protective ensemble (VPE), suits, including seams, and closures to maintain a fixed, positive pressure.

1.2 This test method does not measure vapor protection of suits. This test method measures the integrity of the suit, glove, boot/bootie, foot protection, and visor materials, as well as the seams, and closures of a VPE-vapor protective suit. Exhaust valves fitted in the VPE-vapor protective suit must be sealed or blocked for this test and therefore are not functionally tested.

1.3 The values as stated in in.-H₂O (mm-H₂O) units are to be regarded as the standard.

¹ This test method 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 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. For specific hazard statements, see Section 7.

2. Referenced Documents

2.1 ASTM Standards:²

- D 751 Test Methods for Coated Fabrics
- D 2582 Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting
- D 4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
- F 392 Test Method for Flex and Durability of Flexible Barrier Materials
- F 739 ~~Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases under Conditions of Continuous Contact~~ Test Method for Permeation of Liquids and Gases through Protective Clothing Materials under Conditions of Continuous Contact
- F 903 Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids
- F 1154 Practices for Qualitatively Evaluating the Comfort, Fit, Function, and Integrity of Chemical Protective Suit Ensembles
- F 1358 Test Method for the Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance
- F 1359 ~~Test Method for Determining the Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray Wheel/While on a Mannequin~~
- F 1383 ~~Test Method for Resistance of Clothing Materials to Permeation by Liquids or Gases Under Conditions of Intermittent Contact~~ Test Method for Permeation of Liquids and Gases through Protective Clothing Materials under Conditions of Intermittent Contact
- F 1407 ~~Test Method for Resistance of Chemical Protective Clothing Materials to Liquid Permeation—Permeation Cup Method~~ Test Method for Resistance of Chemical Protective Clothing Materials to Liquid Permeation Permeation Cup Method
- F 2588 Test Method for Man-In-Simulant Test (MIST) for Protective Ensembles

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 ~~chemical protective ensemble~~ protective ensemble, *n*—a combination of a chemical protective suit, gloves, boots, respiratory protective equipment, and any other clothing and equipment worn to provide the wearer with integrity against exposure to hazardous chemicals. —the combination of protective clothing with respiratory protective equipment, hoods, helmets, gloves, boots, communications systems, cooling devices, and other accessories intended to protect the wearer from a potential hazard when worn together.

3.1.2 ~~chemical protective suit~~ protective clothing, *n*—an item of protective clothing which is designed and configured to provide the wearer's torso, head, arms, and legs with integrity against exposure to hazardous chemicals either by itself or in conjunction with other protective clothing. —item of clothing that is specifically designed and constructed for the intended purpose of isolating all or part of the body from a potential hazard; or, isolating the external environment from contamination by the wearer of the clothing.

3.1.3 ~~integrity~~ protective suit, *n*—the ability of protective clothing or a protective ensemble to prevent inward leakage of hazardous substances from the outside environment. —an item of protective clothing that at a minimum covers the wearer's torso, head, arms, and legs.

3.1.3.1 ~~Discussion~~—For evaluating air-tight integrity, the ability of vapor protective ensembles to prevent inward leakage of gases is determined by the amount of leakage following the inflation of a vapor protective ensemble to a specified pressure over a specified period of time. Exhaust valves and other components and interfaces may not be functionally evaluated depending on the technique used to fill the protective suit or ensemble.

3.1.4 ~~protective ensemble~~, *n*—the combination of protective clothing with respiratory protective equipment, hoods, helmets, gloves, boots, communications systems, cooling devices, and other accessories intended to protect the wearer from a potential hazard when worn together.

3.1.5 ~~protective clothing~~, *n*—apparel used for the purpose of protecting parts of the body from a potential hazard.

3.1.6 ~~liquid splash protective ensemble~~, *n*—a chemical protective ensemble used to protect the wearer from liquid splashes.

3.1.7 ~~liquid splash protective suit~~, *n*—a chemical protective suit used to protect the wearer from liquid splashes of chemicals.

3.1.8 ~~vapor protective ensemble, (VPE)~~, *n*—a chemical protective ensemble used to protect the wearer from chemical liquids, vapors, and gases.

3.1.8.1 ~~Discussion~~—In this test method, the vapor protective ensemble will only include those protective clothing items or accessories that are necessary for providing air-tight integrity.

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.