Designation: ~~F1052 – 14~~ F1052 – 20

Standard Test Method for Pressure Testing Vapor Protective Suits[1]

This standard is issued under the fixed designation F1052; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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. 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 F2588 for evaluating chemical vapor inward leakage, Test Method ~~F1359~~F1359/F1359M for evaluating splash resistance using a shower test, and ~~Practice~~Practices F1154 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 F739 for continuous contact and F1383 for intermittent contact (that is, splash), or by Test Method F1407 according to the permeation cup method. Resistance of protective clothing materials to liquid penetration should be determined by Test Method F903.

Physical properties of materials used in the construction of protective clothing can be determined using a variety of test methods, including Test Methods D751 (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), D2582 (puncture propagation tear), D4157 (abrasion resistance), ~~F392~~F392/F392M (flexural fatigue), F1358 (flammability), as well as many others.

1. Scope

1.1 This test method measures the ability of a vapor protective ~~suits,~~suit, including ~~seams,~~seams and closures, to maintain a fixed, positive ~~pressure.~~pressure over a specified period of time.

1.2 This test method does not measure vapor protection of suits. This test method measures the integrity of the suit, glove, foot

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protection, and visor materials, as well as the ~~seams,~~seams and closures of a vapor protective suit. Exhaust valves fitted in the vapor protective suit must be sealed or blocked for this test and therefore are not functionally tested.

1.2.1 The measurement of vapor protection of suits is measured using a different test method, Test Method F2588.

1.3 The values as stated in in.-H_2O (mm-H_2O) units are to be regarded as the standard.

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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 7.

1.5 *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]

D751 Test Methods for Coated Fabrics
D2582 Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting
D4157 Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)
~~F392~~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
F1154 Practices for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components
F1358 Test Method for Effects of Flame Impingement on Materials Used in Protective Clothing Not Designated Primarily for Flame Resistance
~~F1359~~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
F2588 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 *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.~~

3.1.1 *protective clothing, n*—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.

3.1.2 *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.

3.1.3 *protective suit, n*—an item of protective clothing that at a minimum covers the wearer's torso, head, arms, and legs.

3.1.3.1 *Discussion*—

For purposes of this test method, the protective suit is also equipped with a visor, and tightly attached glove and foot protection and exhaust valves. These suits are designed to cover the wearer's respiratory equipment and provide protection from vapors.

[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.

4. Summary of Test Method

4.1 The vapor protective suit is visually inspected and modified for the test. A test apparatus is attached to the vapor protective suit (Fig. 1) to permit inflation to the pre-test expansion pressure for removal of wrinkles and creases, and to equalize/stabilize the air temperatures internal and external to the vapor protective suit. The pressure is lowered to the test pressure and monitored for 4 min. If the pressure drop is excessive, the vapor protective suit fails the test and is removed from service. The test is repeated after leak location and repair.

4.2 Pressure testing of vapor protective suits should be conducted at a frequency recommended by the manufacturer but no less often than upon receipt of the garment, after each wearing if the suit is to be reused, and at least annually thereafter.

5. Significance and Use

~~5.1 Workers involved in the production, use, and transportation of liquid and gaseous chemicals can be exposed to numerous compounds 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 that resists permeation, penetration, and degradation.~~

5.1 This test method is only appropriate for evaluating the integrity of totally encapsulating protective ~~suits,~~suits that are designed and manufactured to prevent the inward leakage of gases and vapors. ~~The~~ However, this test method does not evaluate the exhaust(s) which permit the release of exhalation air from the wearer's self-contained breathing apparatus or supplied air respirator, or the effects of use on the suit's ability to protect against inward leakage of gases or vapors. Suit vapor protection should be tested in accordance with Test Method F2588. Garments designed to protect from liquid chemicals should be tested in accordance with Test Method ~~F1359~~F1359/F1359M.

5.2 It is possible to apply this test method to suits that do not fully encapsulate the wearer by providing fixtures or other means of blocking off those portions of the suit that are open, such as hood face openings or sleeve ends.

5.3 This ~~non-destructive~~nondestructive test method is useful as a quality control tool for ~~manufactures~~manufacturers and as a field method for end users to determine changes in garment integrity following use.

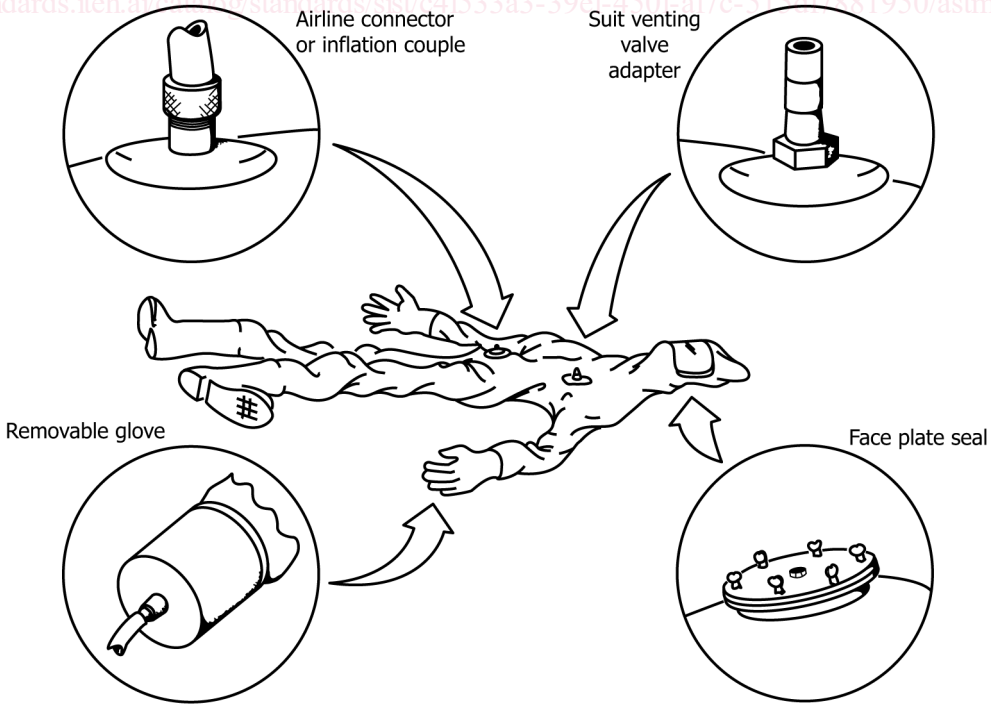

FIG. 1 Typical Examples of Suit Modification to Permit Inflation

5.4 This test method is useful to end users for determining the integrity of vapor protective suits upon receipt from the manufacturer, prior to use, following use and decontamination, following repairs, and as a periodic maintenance test.

6. Required Materials Apparatus

6.1 *Source of Compressed ~~Air:~~Air.*

6.2 *Test Apparatus for Suit ~~Testing—~~Testing* (Fig. 2), including a pressure measurement device with the capability of indicating ¼-in. (6.35-mm) water gauge pressure change.

6.3 *Vent Valve Closure Plugs,* or sealing tape.

6.4 *Soapy Water Solution and Soft Brush.*

6.5 *~~Stop Watch,~~ Stopwatch,* or appropriate timing device.

6.6 *Thermometer,* or appropriate temperature measuring device.

7. Hazards

7.1 Take care to provide the correct pressure safety devices required for the source of compressed air used.

7.2 Visually inspect all parts of the vapor protective suit to be sure that they are positioned correctly and secured tightly before putting the suit back into service. Take special care to examine each exhaust valve to make sure it is not blocked and that any re-assembly has been performed correctly.

7.3 Exercise care to ensure that the inside and outside of the vapor protective suit are completely dry before it is put into storage.

8. Procedure

8.1 Select an area for pressure testing that is away from direct sunlight, open doors, drafts, and HVAC registers. Temperature

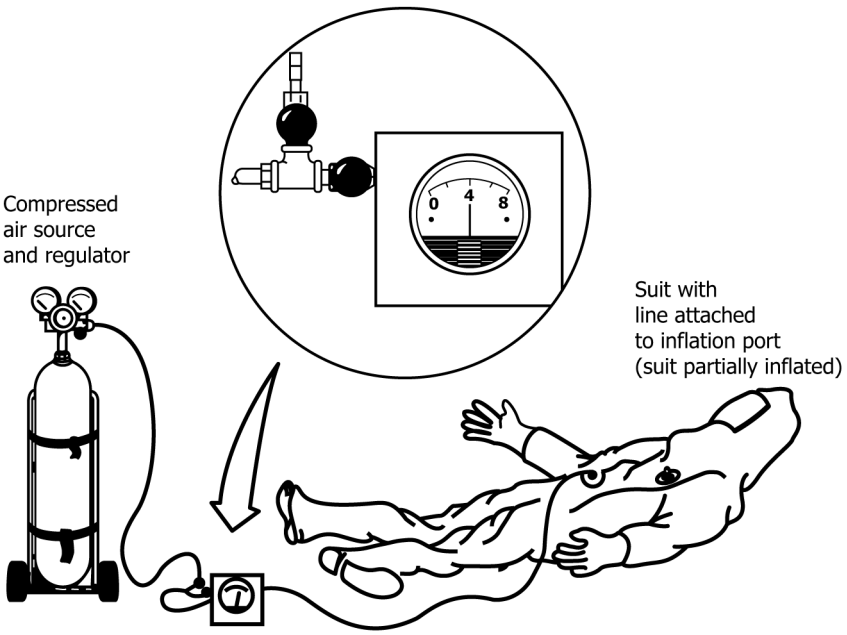

FIG. 2 Recommended Pressure Test Apparatus and Typical Test Configuration