



Standard Test Methods for Water Vapor Diffusion Resistance and Air Flow Resistance of Clothing Materials Using the Dynamic Moisture Permeation Cell¹

This standard is issued under the fixed designation F 2298; 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.

1. Scope

1.1 This test method covers the measurement of the moisture vapor transport and gas flow properties of fabrics, membranes, and membrane laminates used for protective materials.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *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.*

2. Referenced Documents

2.1 ASTM Standards:

D 737 Test Method for Air Permeability of Textile Fabrics²

E 96 Test Methods for Water Vapor Transmission of Materials³

F 778 Methods for Gas Flow Resistance Testing of Filtration⁴

F 1868 Test Method for Thermal Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate⁴

2.2 Other Standards:

ISO 11092 Textiles—Physiological Effects—Measurement of Thermal and Water-Vapour Resistance Under Steady-State Conditions (Sweating Guarded-Hotplate Test)⁵

JIS L 1099 Testing Methods for Water Vapour Permeability of Clothes⁵

3. Terminology

3.1 Definitions:

3.1.1 *water vapor diffusion, n*—the process by which water vapor molecules move from a region of high concentration to a region of low concentration.

3.1.2 *water vapor transmission rate, n*—the steady water vapor flow in unit time through unit area of a material, under specific conditions of temperature and humidity at each surface.

4. Summary of Test Methods

4.1 The testing outlined in this standard consists of measuring the amount of water vapor transport across a specimen. The water vapor transport properties can be measured in a pure diffusion mode and in a diffusion/convection mode.

4.2 Two test methods are presented in this standard:

4.2.1 *Part A (Diffusion Test)*—The test is done under the maximum difference in relative humidity and zero pressure gradient across the specimen so that only the water vapor diffusion transport through the specimen is measured (Fig. 1).

4.2.2 *Part B (Combined Convection/Diffusion Test)*—A series of pressure gradients is applied in specified increments to force air through the material (Fig. 1). Thus, the test is conducted under a combined air pressure gradient and concentration gradient that allows examination of the interaction of convective and diffusive mass transfer across the specimen. This method is designed for use on relatively air-permeable textile materials because for air-impermeable materials, the results will be the same as the diffusion test alone.

5. Significance and Use

5.1 The water vapor transport properties of textile materials are of considerable importance in determining the comfort properties of clothing systems. Water vapor transport through porous textiles may occur due to both diffusion (driven by vapor concentration differences) and convection (driven by gas pressure differences).

5.2 For air permeable porous materials, a very small pressure gradient can produce large convective flows through the pores in the structure. In many standard water vapor permeability test methods, when used for materials with high air permeability, slight variations in pressure gradient across a specimen will greatly influence the measured water vapor transport properties. Therefore, the water vapor transport properties of the porous and non-porous textile materials cannot be directly compared when the method has no provision

¹ These test methods are under the jurisdiction of ASTM Committee F23 on Protective Clothing and are the direct responsibility of Subcommittee F23.60 on Human Factors.

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

² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 04.06.

⁴ *Annual Book of ASTM Standards*, Vol 11.03.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.