



Designation: F1868 – 17

Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate¹

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INTRODUCTION

Clothing is often made of materials that impede the flow of heat and moisture from the skin to the environment. Consequently, people may suffer from heat stress or cold stress when wearing clothing in different environmental conditions. Therefore, it is important to quantify the thermal resistance and evaporative resistance of clothing materials and to consider these properties when selecting materials for different clothing applications.

1. Scope

1.1 This test method covers the measurement of the thermal resistance and the evaporative resistance, under steady-state conditions, of fabrics, films, coatings, foams, and leathers, including multi-layer assemblies, for use in clothing systems.

1.2 The range of this measurement technique for intrinsic thermal resistance is from 0.002 to 0.5 K·m²/W and for intrinsic evaporative resistance is from 0.0 to 1.0 kPa·m²/W.

1.3 The values in SI units shall be regarded as standard. No other units of measurement are included in this 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 consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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

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 F23.60 on Human Factors.

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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.

C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

D1518 Test Method for Thermal Resistance of Batting Systems Using a Hot Plate

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

F1291 Test Method for Measuring the Thermal Insulation of Clothing Using a Heated Manikin

F1494 Terminology Relating to Protective Clothing

F2370 Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin

2.2 Other Standards:

ISO 11092 Textiles – Physiological Effects – Measurement of Thermal and Water-Vapour Resistance Under Steady-State Conditions (Sweating Guarded-Hotplate Test)³

3. Terminology

3.1 Definitions:

3.1.1 *clo, n*—a unit of thermal resistance (insulation) equal to 0.155 K·m²/W.

3.1.1.1 *Discussion*—The value of the *clo* was selected as roughly the insulation value of typical indoor clothing, which should keep a resting man (producing heat at the rate of 58 W/m²) comfortable in an environment at 21 °C, air movement 0.1 m/s.

3.1.2 *evaporative resistance, n*—The resistance to the flow of moisture vapor from a saturated surface (high vapor pressure) to an environment with a lower vapor pressure.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.