



Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin¹

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INTRODUCTION

The type of clothing worn by people directly affects the heat exchange between the human body and the environment. The heat transfer is both sensible (conduction, convection, and radiation) and latent (evaporation). The evaporative resistance of a clothing ensemble is dependent upon the designs and materials used in the component garments, the amount of body surface area covered by the clothing, the distribution of the layers over the body, looseness or tightness of fit, and the increased surface area for heat loss. Evaporative resistance measurements made on fabrics alone do not take these factors into account. Measurements of the resistance to evaporative heat loss provided by clothing can be used with thermal resistance values (Test Method F1291) to determine the comfort or stress of people in different environments.

1. Scope

1.1 This test method covers the determination of the evaporative resistance of clothing ensembles. It describes the measurement of the resistance to evaporative heat transfer from a heated sweating thermal manikin to a relatively calm environment. Information on measuring the local evaporative resistance values for individual garments and ensembles is provided in Annex A1.

1.1.1 This is a static test that provides a baseline clothing measurement on a standing manikin.

1.1.2 The effects of body position and movement are not addressed in this test method.

1.2 The evaporative resistance values obtained apply only to the particular ensembles evaluated and for the specified environmental conditions of each test, particularly with respect to air movement and sweating simulations.

1.3 Evaporative resistance values reported in SI units shall be regarded as 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

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

2.2 *ISO Standards:*³

ISO 9920:2007 Ergonomics of the Thermal Environment—Estimation of the Thermal Insulation and Evaporation Resistance of a Clothing Ensemble

3. Terminology

3.1 *Definitions:*

3.1.1 *clothing area factor* (f_{cl}), n —the ratio of the surface area of the clothed body to the surface area of the nude body.

3.1.2 *clothing ensemble*, n —a group of garments worn together on the body at the same time.

3.1.3 *evaporative resistance*, n —the resistance to evaporative heat transfer from the body to the environment.

3.1.3.1 *Discussion*—The following evaporative resistance values can be determined in this test method when measured under isothermal conditions:

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.

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