



Designation: E1423 – 21

Standard Practice for Determining Steady State Thermal Transmittance of Fenestration Systems¹

This standard is issued under the fixed designation E1423; 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 practice covers standard test specimen sizes and test conditions as well as the calculation and presentation of the thermal transmittance and conductance data measured in accordance with Test Method C1199. The standard sizes and conditions are to be used for fenestration product comparison purposes. The specifier may choose other sizes and conditions for product development or research purposes.

1.2 This practice deals with the determination of the thermal properties of a fenestration system installed vertically without the influences of solar heat gain and air leakage effects.

NOTE 1—To determine air leakage effects of fenestration systems, Test Method E283/E283M or E1424 should be referenced.

NOTE 2—See Appendix X1 regarding garage doors and rolling doors.

1.3 This practice specifies the procedure for determining the standardized thermal transmittance of a fenestration test specimen using specified values of the room-side and weather-side surface heat transfer coefficients, h_h and h_c , respectively.

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *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.*

¹ This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.51 on Performance of Windows, Doors, Skylights and Curtain Walls.

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2. Referenced Documents

2.1 ASTM Standards:²

C168 Terminology Relating to Thermal Insulation

C1199 Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods

C1363 Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

E283/E283M Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E631 Terminology of Building Constructions

E783 Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

E1424 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen

2.2 Other Documents:

ANSI/DASMA 105 Test Method for Thermal Transmittance and Air Infiltration of Garage Doors and Rolling Doors³

NFRC 102 Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems⁴

3. Terminology

3.1 *Definitions*—Definitions and terms are in accordance with Terminology E631 and C168, from which the following have been selected and modified to apply specifically to fenestration systems. See Fig. 1 and Fig. 2 for variable identification. (For further information on definitions and procedures, see Appendix X2 or Test Method C1199.)

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>.

⁴ Available from National Fenestration Rating Council (NFRC), 6305 Ivy Ln., Suite 140, Greenbelt, MD 20770, <http://www.nfrc.org>.

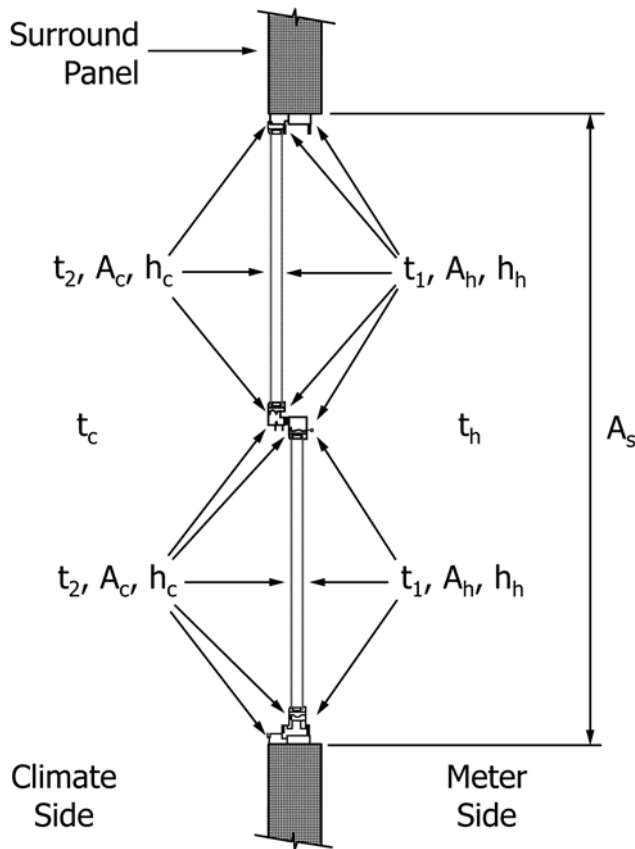


FIG. 1 Window Mounted Flush with Climate Side of Surround Panel

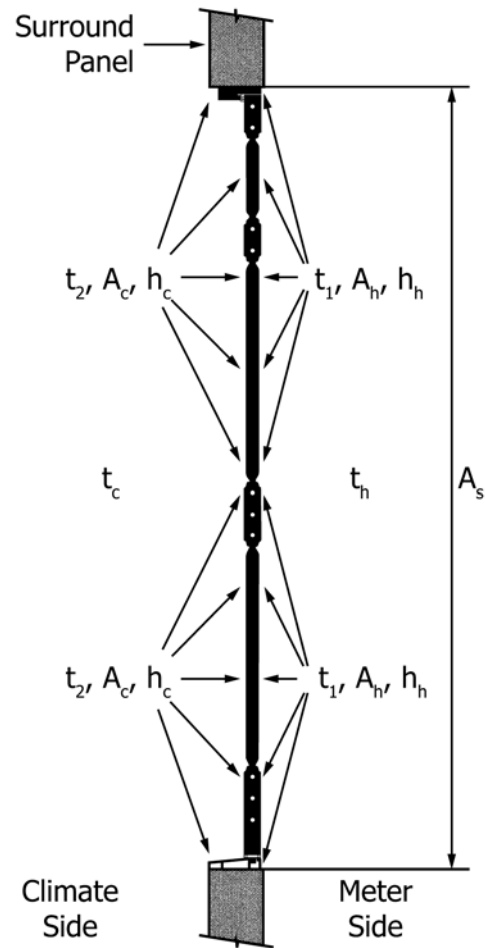


FIG. 2 Door Mounted Flush with Climate Side of Surround Panel

3.1.1 *surface heat transfer coefficient, h* (sometimes called *surface conductance* or *film coefficient*)—the time rate of heat flow from a unit area of a surface to its surroundings, induced by a unit temperature difference between the surface and the environment. Subscripts are used to differentiate between room-side ($_r$ or $_h$) and weather-side ($_w$ or $_c$) surface heat transfer coefficients (see Figs. 1 and 2).

3.1.2 *thermal transmittance U_s* (sometimes called *overall coefficient of heat transfer*)—the heat transfer in unit time through unit area of a test specimen and its boundary air films, induced by unit temperature difference between the environments on each side.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *standardized thermal transmittance, U_{ST}* —the heat transfer in unit time through unit area of a specimen (using standardized surface heat transfer coefficients) induced by unit temperature difference between the environments on each side.

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3.2.2 *surround panel* (sometimes called the *mask*, *mask wall*, or *homogeneous wall*)—a panel with a homogeneous core that may be faced with paint, plywood, or plastic in which the test specimen is mounted.

3.2.3 *test specimen*—the fenestration system or product being tested.

3.2.4 *thermal resistance, R_s* —the temperature difference between the environments on the two sides of a body or

assembly when a unit heat flow per unit time per unit area is established through the body or assembly under steady-state conditions. It is defined as follows:

$$R_s = \frac{1}{U_s} \quad (1)$$

where:

R_s = overall thermal resistance of specimen (air to air under test conditions), $(m^2 \cdot K)/W$ $((ft^2 \cdot hr \cdot ^\circ F)/Btu)$.

3.3 *Symbols*—The symbols, terms, and units used in this test method are as follows:

A_c total heat transfer surface area of test specimen on weather side, m^2

A_h total heat transfer surface area of test specimen on room side, m^2

A_s projected area of test specimen, (same as open area in surround panel), m^2

h_c surface heat transfer coefficient, weather side, $W/(m^2 \cdot K)$

h_h surface heat transfer coefficient, room side, $W/(m^2 \cdot K)$

h_{h+c} surface heat transfer coefficient, combined room and weather side, $W/(m^2 \cdot K)$

h_{STc} standardized surface heat transfer coefficient, weather side, $W/(m^2 \cdot K)$

h_{STh} standardized surface heat transfer coefficient, room side, $W/(m^2 \cdot K)$