AERC 1.2

Physical Test Methods for Measuring Energy Performance Properties of Fenestration Attachments

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Foreword

The Attachments Energy Rating Council (AERC) is an independent, public interest, non-profit organization whose mission is to develop and maintain a program to allow participants to rate, label, and certify the performance of fenestration attachments.

AERC 1 provides the main technical rating procedures to determine the energy performance properties (U-factor, SHGC, VT, and Air Leakage) of fenestration attachments installed in combination with standardized baseline windows and skylights under standardized conditions. This supporting document, AERC 1.2, provides the physical test methods for measuring these performance properties when they cannot be simulated. The energy performance ratings determined by these technical procedures are designed to be used in conjunction with AERC's labeling and certification program, as detailed in *AERC 100 National Standard for Rating the Energy Performance of Fenestration Attachments*.

1. Introduction

The purpose of this document is to provide physical test methods for measuring the energy performance properties of fenestration attachments under standardized conditions when they cannot be calculated through computer simulations in accordance with AERC 1. The energy performance properties include overall heat transfer coefficient (U-factor), solar heat gain coefficient (SHGC), visible transmittance (VT), and air leakage (AL).

2. Scope

This standard shall apply to interior and exterior fenestration attachments, defined as products attached to installed fenestration or attached to or near the perimeter of the inner or outer wall surrounding fenestration.

The test procedures of this standard apply to the following fenestration attachment product types:

- Cellular Shades
- Slat Shades
- Roller Shades
- Secondary Windows including Storm Windows, Window Panels, and Commercial Secondary Windows
- Pleated Shades
- Solar Screens
- Surface Applied Films

This standard does not apply to or address:

- Primary windows, doors, or skylights.
- Attachments over windows or doors in interior walls of buildings and not part of the thermal envelope of the building.

- Changes in performance properties over time of fenestration attachments or the windows, doors, and skylights over which they are installed.
- Changes in performance properties using conditions other than the standardized environmental, installation, and baseline window conditions specified in this document.

3. Referenced Documents and Standards

AERC 1 Revision 5 (2020), *Procedures for Determining Energy Performance Properties of Fenestration Attachments,* Attachments Energy Rating Council, New York NY, www.aercnet.org.

AERC 1.1 Revision 5 (2019) – *Procedures for Determining the Optical and Thermal Properties of Window Attachment Materials*, Attachments Energy Rating Council, New York NY, www.aercnet.org.

ASTM C1199-14, *Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods*, ASTM International, West Conshohocken PA, 2014, www.astm.org.

ASTM E283-04(2012), *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*, ASTM International, West Conshohocken PA, 2012, www.astm.org.

ASTM E1175-87(2015), *Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere*, ASTM International, West Conshohocken PA, 2015, www.astm.org.

NFRC 201-2017, *Procedure for Interim Standard Test Method for Measuring the Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods,* National Fenestration Rating Council, Greenbelt MD, 2014, www.nfrc.org.

4. Terminology

4.1. Definitions

See AERC 400 Appendix A and the other reference documents. Where there is a difference in definition between AERC 400 Appendix A and other reference documents, the definition of AERC 400 shall take precedence.

4.2. Acronyms

AERC	Attachments Energy Rating Council
AL	Air leakage
ASTM	American Society of Testing Materials
CGDB	Complex glazing database
IGDB	International glazing database
ISO	International Standards Organization

NFRC	National Fenestration Rating Council
SHGC	Solar heat gain coefficient
VT	Visible transmittance

5. Test Procedures

This section provides the test procedures for measuring U-factor, SHGC, and VT of fenestration attachment products used in combination with a standardized baseline window under standardized conditions.

This section also provides the test procedures for measuring AL ratings of fenestration attachment products when mounted over a calibrated test panel.

5.1. Baseline Window and Attachment Installation

Appendix A provides specifications (dimensions, materials, and standard sizes) for the Baseline Window B (nonmetal-framed, double pane clear glass) of AERC 1 that shall be used when testing U-factor, SHGC, and VT of fenestration attachments.

> ***Exception****: For commercial secondary windows, determination of the U-factor, SHGC, and VT in combination with Baseline Window D is required as specified in AERC 1. Use of Baseline Window B is not required.*

AL ratings of fenestration attachments are not determined over a baseline window, but are instead tested over a calibration test panel as described in Section 5.5.

Ratings shall be determined with the attachment product mounted within the window recess (inside mount) or outside the window recess (outside or overlap mount) of the baseline window in as specified in Table 5-1 of AERC 1.

- For exterior products to be rated as installed within the window recess (inside mount), the attachment plane shall be as indicated in the baseline window drawing in Appendix A. Any reductions in product width/height inside the opening shall be 6 mm +- 1 mm (3 mm on each side) for all products except:
  - Reductions shall be 3 mm +- 1 mm for secondary windows.
  - Window films shall completely cover the glazing area.
- For exterior products to be rated as installed outside the window recess (overlap mount), the attachment plane shall be as indicated in the baseline window drawings in Appendix A, and overlap the window frame by 50 +/- 6 mm (2 +/- ¼ inches) on each side.
- For interior products to be rated as installed within the window recess (inside mount), the attachment shall be installed with the closest surface of the attachment 37 +/- 6 mm mm (1.5 +/- ¼ inches) inwards from the plane of glazing towards the interior of the building when fully deployed and any slats / vanes rotated perpendicular to the glazing

plane (also see Appendix A). Any reductions in product width/height inside the opening shall be 6 mm +- 1 mm (3 mm on each side) for all products except:

  - Secondary windows and their associated seals shall fill the opening.
  - Window films shall completely cover the glazing area.

- For interior products to be rated as installed outside the window recess (overlap mount), the attachment shall be modeled as installed on the head/jambs/sill as indicated in the baseline window drawings in Appendix A, and overlap the window frame by 50 +/- 6 mm (2 +/- ¼ inches) on each side.
- Where installation according to these dimensions is precluded by physical constraints, the mounting distance between the attachment product and the glazing plane may be modified to accommodate the attachment product, extending the head / jambs / sills if necessary using coniferous wood (spruce-pine-fir). Any variations in these dimensions shall be recorded.

5.2. U-factor

Where physical testing of U-factor is required, the U-factor shall be measured in a hot box calorimeter in accordance with ASTM C1199 with the attachment product installed in combination with the required Baseline Window as detailed in Section 5.1 and Appendix A.

For attachment products intended for use over skylights and other sloped fenestration that are tested in the vertical orientation, the tested U-factor shall be multiplied by 1.20 to provide the equivalent U-factor at a slope of 20 degrees above horizontal.

The U-factor for operable fenestration attachment products shall be tested in both the fully open and fully closed positions, except as noted for specific product categories in Section 5.2 of AERC 1.

A tested U-factor for one product may also represent the tested U-factor for other products that may be grouped in accordance with AERC 1 Section 5.2 and AERC 1.1.

5.3. Solar Heat Gain Coefficient

Where physical testing of SHGC is required, the SHGC shall be measured in a solar calorimeter in accordance with NFRC 201 with the attachment product installed in combination with the required Baseline Window as detailed in Section 5.1 and Appendix A.

The SHGC for operable attachment products shall be tested in both the fully open and fully closed positions, except as noted for specific product categories in Section 5.2 of AERC 1.

A tested SHGC for one product may also represent the tested SHGC for other products that may be grouped in accordance with AERC 1 Section 5.2 and AERC 1.1.

5.4. Visible Transmittance

Where physical testing of VT is required, the VT shall be measured in accordance with ASTM E1175 with the attachment product installed in combination with the required Baseline Window as detailed in Section 5.1 and Appendix A.

The VT for operable attachment products shall be tested in both the fully open and fully closed positions, except as noted for specific product categories in Section 5.2 of AERC 1.

A tested VT for one product may also represent the tested VT for other products that may be grouped in accordance with AERC 1 Section 5.2 and AERC 1.1.

5.5. Air Leakage

Where testing of AL is required, the air leakage shall be measured in accordance with the attachment product installed over a calibration test panel as detailed below and in Appendix B. Air leakage shall be measured in accordance with ASTM E283 at a test pressure of 75 Pa (1.57 psf) applied to the exterior side of the product / test panel assembly. Operable attachment products shall be tested in the fully closed position.

The calibration test panel shall consist of a PMMA acrylic panel with minimum 6 mm thickness mounted and sealed in a coniferous wood buck to accommodate installation of the test specimen. The calibration test panel shall include drilled orifice holes and/or an attached needle valve to create a nominal air leakage rate of 10.2 L/s/m^2 (2.0 cfm/ft^2) when tested in accordance with ASTM E283 at a test pressure of 75 Pa (1.57 psf).

Prior to testing each attachment product, the air leakage of the calibration test panel alone shall first be measured in accordance with ASTM E283 at a test pressure of 75 Pa (1.57 psf), and the needle valve or holes shall be used to adjust the measured air leakage to 10.2 ± 0.1 L/s/m^2 (2.0 ± 0.02 cfm/ft^2).

As specified in AERC 1, the test opening size shall be 1200 mm x 1500 mm. The test specimen shall be installed on the side of the calibration test panel such that the orientation represents the installation of the attachment product over a primary window (i.e. exterior attachment products installed on the outward side of the calibration test panel towards where the test air pressure is applied; interior attachment products installed on the inward side of the calibration test panel away from where the test air pressure is applied). The attachment product shall be installed according to manufacturer instructions with no special sealing that would not be part of normal product installation, except removable foam sealing tape shall be allowed to be substituted for caulking and other permanent sealants.

For products that are not permanently attached to the window frame, retaining clips or brackets are allowed to be used to retain the attachment product in the wood buck while under pressure, provided they do not affect the measured air leakage. The clips and brackets shall be evenly spaced and designed to contact only the glazing of the product, leaving a clear distance a minimum of 0.5” from the frame of the product. There shall be no more than 15 contact points on the glazing with a size not to exceed 13 mm (0.5 in) diameter each.

The air leakage of the combined attachment product / test panel assembly shall then be measured in accordance with ASTM E283 at a test pressure of 75 Pa (1.57 psf).

The recorded air leakage shall be rounded and reported to the nearest 0.1 L/s/m^2 (0.02 cfm/ft^2), calculated using the test opening area (1200 mm x 1500 mm).

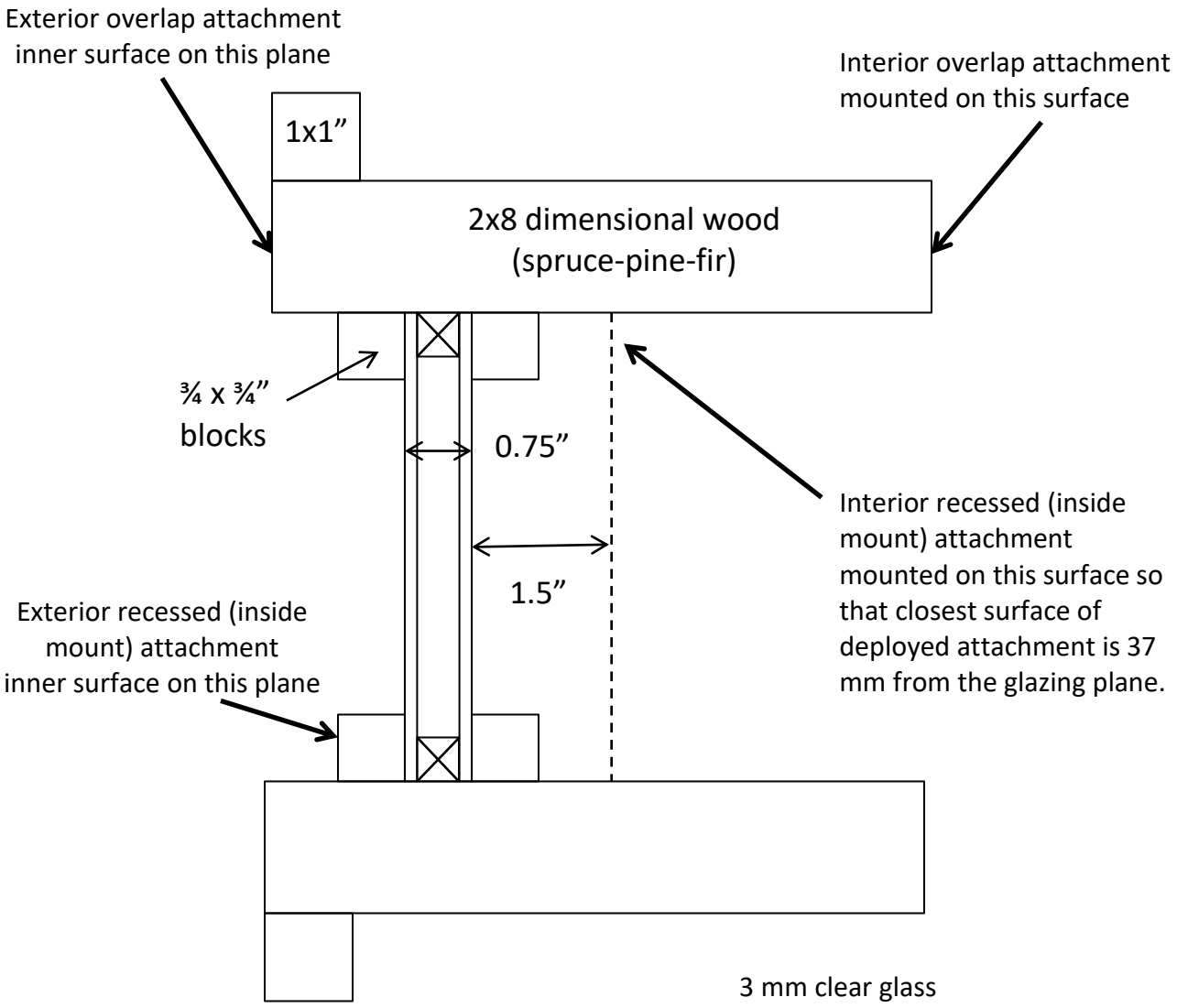
A tested AL for one product may also represent the tested AL for other products that may be grouped in accordance with AERC 1 Section 5.2 and AERC 1.1. The same AL result may be used for secondary windowswith different glazing that varies only in the coating, film, or tint.

Appendix A

Baseline Window B – Nonmetal-framed, double pane

The performance of attachments over all nonmetal-framed windows with double pane glazing (without low-E glass) shall be represented by the following generic wood fixed window.

Size: 1200 mm width x 1500 mm height



3 mm clear glass
(IGDB ID# 102, CLEAR_3.DAT)

½” air fill

Sealed IG (aluminum box spacer with loose fill dessicant, dual seal)

Coniferous wood: Spruce-Pine-Fir (SPF)

1/8” closed cell glazing tape or sealant applied to exterior stop prior to glazing

Baseline Window D – Metal-framed, single pane

The performance of attachments over all metal-framed windows with single pane glazing shall be represented by the following generic aluminum fixed window.

Size: 1200 mm width x 1500 mm height (exception: 1500 mm width x 1200 mm height for use with horizontal sliding storm windows and window panels)

See AERC 1, Appendix A – Baseline Window D for fully dimensioned framing.

Appendix B

Air Leakage Calibration Test Panel