



Designation: E3120 – 17

Standard Specification for Evaluating Accelerated Aging Performance of Environmentally Controlled Dynamic Glazings¹

This standard is issued under the fixed designation E3120; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification is applicable to environmentally controlled dynamic glazings (ECDG) whose visible light transmittance or near infrared light transmittance properties, or both, can be changed reversibly by exposure to changing environmental conditions such as temperature and sunlight intensity. This includes thermochromic and thermotropic glazing, but currently excludes photochromic glazings as neither Test Method E3119 nor this specification provide a procedure to access multiple states of photochromic glazing specimens.

1.2 This specification does not apply to other types of dynamic glazing which require an electrical stimulus to change light transmittance, such as electrochromic glazings.

1.3 This specification covers environmentally controlled dynamic glazing (ECDG) in monolithic glass, monolithic laminated glass, or pre-assembled, permanently sealed insulating glass units with one or more cavities in which at least one lite is an ECDG (which may be in the form of a laminated lite or a single pane with coatings or film applied). This specification is also applicable to ECDG devices in pre-assembled insulating glass units with capillary tubes intentionally left open. As applicable, this specification also requires conformance to Specification E2190.

1.4 This specification is applicable only to monolithic glass, monolithic laminated glass, and sealed insulating glass units that are constructed with glass and fabricated for vision glass areas for use in buildings, such as sliding doors, windows, skylights, and exterior wall systems.

1.5 Qualification under this specification is intended to provide a basis for evaluating the aging performance of environmentally controlled dynamic glazing in monolithic glass, monolithic laminated glass, and sealed insulating glass units.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.22 on Durability Performance of Building Constructions.

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1.7 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.

1.8 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

C162 Terminology of Glass and Glass Products

C1036 Specification for Flat Glass

C1048 Specification for Heat-Strengthened and Fully Tempered Flat Glass

C1172 Specification for Laminated Architectural Flat Glass

E631 Terminology of Building Constructions

E2190 Specification for Insulating Glass Unit Performance and Evaluation

E3119 Test Method for Accelerated Aging of Environmentally Controlled Dynamic Glazing

G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

3. Terminology

3.1 *Definitions*—For definitions of terms found in this specification, refer to Terminologies C162, E631, and G113.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *environmentally controlled dynamic glazing, n*—in a prepared opening of a building, the glazing material installed in which the optical properties can change in response to environmental stimuli such as sunlight and/or temperature.

3.2.2 *photochromic glazing, n*—an environmentally controlled dynamic glazing which changes its optical properties in response to exposure to solar radiation.

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.

3.2.3 *sealed insulating glass unit, n*—a preassembled unit, comprising lites of glass, which are sealed at the edges and separated by dehydrated cavity(s), intended for vision areas of buildings. The unit is normally used for windows, window walls, picture windows, sliding doors, patio doors, or other types of fenestration.

3.2.4 *specular (regular) transmittance, n*—the optical transmittance that does not include light with a diffuse component.

3.2.5 *thermochromic glazing, n*—an environmentally controlled dynamic glazing which changes its optical properties in response to exposure to a broad range of temperatures (≥ 10 °C).

3.2.6 *thermotropic glazing, n*—an environmentally controlled dynamic glazing which changes its optical properties at a discrete temperature or over a small range of temperatures (that is, < 10 °C).

3.2.7 *transition temperature, n*—specifically in thermotropic ECDG, it is temperature at which the optical properties of a given glazing switches between highest transmittance state and lowest transmittance state.

3.2.7.1 *Discussion*—In thermochromic glazing, the optical properties change continuously over a broad temperature range (that is, ≥ 10 °C) and so do not have a transition temperature.

3.3 Acronyms Used in This Specification:

3.3.1 *ECDG*—environmentally controlled dynamic glazing.

3.3.2 *IG*—insulating glass.

3.3.3 *IGU(s)*—insulating glass unit(s).

3.3.4 T_H —highest specified temperature for recording spectral data.

3.3.5 T_L —lowest specified temperature for recording spectral data.

3.3.6 T_M —midrange specified temperature for recording spectral data.

3.3.6.1 *Discussion*—For thermotropic glazings, T_M shall be a temperature 1 to 3 °C less than the stated transition temperature, if single value is given for the transition temperature. T_M shall be a temperature 1 to 3 °C less than the midpoint of stated transition temperature range, if a range of values is stated for the transition temperature for the thermotropic glazing.

3.3.7 τ_H —visible light (photopic) specular transmission of a specimen at T_H .

3.3.8 τ_L —visible light (photopic) specular transmission of a specimen at T_L .

3.3.9 τ_M —visible light (photopic) specular transmission of a specimen at T_M .

4. Performance Requirements

4.1 For the specimens tested to Test Method E3119, visible light transmittance in the highest transmittance state and the lowest transmittance state shall change by no more than ± 5 %T absolute. That is:

$$|\tau_H(\text{initial}) - \tau_H(\text{final})| \leq 0.05 \quad (1)$$

$$|\tau_M(\text{initial}) - \tau_M(\text{final})| \leq 0.05 \quad (2)$$

$$|\tau_L(\text{initial}) - \tau_L(\text{final})| \leq 0.05 \quad (3)$$

where:

$\tau_H(\text{initial})$ = the visible light transmittance at T_H measured prior to testing according to Test Method E3119.

$\tau_M(\text{initial})$ = the visible light transmittance at T_M measured prior to testing according to Test Method E3119.

$\tau_L(\text{initial})$ = the visible light transmittance at T_L measured prior to testing according to Test Method E3119.

$\tau_H(\text{final})$ = the visible light transmittance at T_H measured after testing according to Test Method E3119.

$\tau_M(\text{final})$ = the visible light transmittance at T_M measured after testing according to Test Method E3119.

$\tau_L(\text{final})$ = the visible light transmittance at T_L measured after testing according to Test Method E3119.

4.2 Insulating glass test specimens containing the ECDG shall meet the requirements of Specification E2190.

4.3 Monolithic laminated glass test specimens containing the ECDG shall meet the requirements of Specification C1172.

4.4 Monolithic glass test specimens containing the ECDG that are flat glass, but are not heat-treated, shall meet the requirements of Specification C1036.

4.5 Monolithic glass test specimens containing the ECDG that are heat-treated flat glass shall meet the requirements of Specification C1048.

5. Specimen Preparation

5.1 Five identical specimens shall be prepared for testing to Test Method E3119. One specimen shall remain untested for comparison and four shall be exposed to the test conditions according to Test Method E3119. The minimum test specimen size is 150 × 300 mm. Four specimens must be able to fit onto the test plane simultaneously.

5.2 Test specimens for determining conformance to Specification E2190 shall be prepared as described in Specification E2190 for IG specimens.

5.3 Test specimens for determining conformance to Specification C1172 shall be prepared as described in Specification C1172 for monolithic laminated glass specimens.

5.4 Test specimens for determining conformance to Specification C1036 shall be prepared as described in Specification C1036 for monolithic glass specimens.

5.5 Test specimens for determining conformance to Specification C1048 shall be prepared as described in Specification C1048 for monolithic glass specimens.

6. Procedure

6.1 Follow Test Method E3119.

6.1.1 The specimen temperatures as measured within 25 ± 5 mm of the center of the outer surface of the ECDG shall be maintained at 85 ± 7 °C.

6.1.2 As described in Test Method E3119, take one set of visible light transmittance measurements at T_L , T_M , and T_H at