



Designation: ~~E2190~~—~~10~~ E2190 – 19

Standard Specification for Insulating Glass Unit Performance and Evaluation¹

This standard is issued under the fixed designation E2190; 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 covers preassembled permanently sealed insulating glass units with one or two ~~airspaces~~cavities and preassembled insulating glass (IG) units with capillary tubes intentionally left ~~open~~open or closed.

1.2 This specification is applicable only to ~~sealed~~ insulating glass units that are constructed with glass-glass or suspended film.

1.3 This specification is applicable to both double-glazed and triple-glazed insulating glass units; for triple-glazed insulating glass units where both of the outer lites are glass and ~~inner~~middle lite is either glass or a suspended film.

1.4 The qualification of test specimens is based on frost/dew point and on the absence of fog after the specified test durations.

1.5 The qualification of argon ~~gas-filled~~gas-filled test specimens is based on ~~the qualifications in 1.3~~ and maintaining the specified argon gas amounts before and after testing to Test Method [E2188](#).

1.6 Qualification under this specification is intended to provide a basis for evaluating the durability of ~~sealed~~ insulating glass units.

1.7 This specification is not applicable to ~~sealed~~ insulating glass units containing a spandrel glass coating due to test method limitations.

1.8 This specification does not cover other physical requirements such as appearance, thermophysical properties, heat and light transmission, and glass displacement.

NOTE 1—~~Sealed insulating~~ Insulating glass units qualified according to this specification are not necessarily suitable for structurally glazed applications. Factors such as sealant longevity when exposed to long term ultraviolet light and the structural properties of the sealant must be reviewed for these applications. For more information on the requirements for structural sealant glazing applications, refer to Specification [C1369](#), Guide [C1249](#), and Test Method [C1265](#).

1.9 The values stated in SI units are to be regarded as standard. ~~No other units of measurement are included in this~~ The values given in parentheses after SI units are provided for information only and are not considered standard.

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

1.11 *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](#)

[C717 Terminology of Building Seals and Sealants](#)

[C1036 Specification for Flat Glass](#)

[C1249 Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications](#)

[C1265 Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications](#)

[C1369 Specification for Secondary Edge Sealants for Structurally Glazed Insulating Glass Units](#)

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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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.

E546 Test Method for Frost/Dew Point of Sealed Insulating Glass Units

E631 Terminology of Building Constructions

E2188 Test Method for Insulating Glass Unit Performance

E2189 Test Method for Testing Resistance to Fogging in Insulating Glass Units

E2269 Test Method for Determining Argon Concentration in Sealed Insulating Glass Units using Gas Chromatography

E2649 Test Method for Determining Argon Concentration in Sealed Insulating Glass Units Using Spark Emission Spectroscopy

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3. Terminology

3.1 Definition of Terms:

3.1.1 For definitions of terms found in this Specification, refer to Terminologies **C162**, **C717**, and **E631**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 baseline set, n—a set of specimens, submitted for testing to this specification, all fabricated at the same time, with the same insulating glass construction (same sealants, same spacer, same glass thickness, same cavity thickness, etc.) but without internal components.

3.2.2 cavity, n—the space or gap between lites of an insulating glass unit. Cavities may be air-filled, or inert gas-filled.

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 space(s), intended for vision areas of buildings. The unit is normally used for windows, window walls, picture windows, sliding doors, patio doors, skylights, or other types of fenestration.

3.2.4 internal components, n—the components in an insulating glass unit that do not contribute to water vapor control or gas retention of the cavity. Internal components may be decorative such as false muntins or brass caming, or may be functional such as internal blinds.

4. Performance Requirements

4.1 To pass the specification for Test Method **E2188**:

4.1.1 Six units shall complete all testing unbroken. These units shall have frost/dew points determined and reported. The final frost/dew points shall be -40°C or colder when measured in accordance with Test Method **E546** or equivalent.

4.2 To pass the specification for Test Method **E2189**:

4.2.1 The units that complete Test Method **E2189** shall have no fog visible after testing.

4.1 Baseline Set Performance—To pass the specification for argon-filled units: A baseline set (with no internal components) of IG unit specimens, fabricated at the same time, shall be submitted and meet the following:

4.1.1 The average initial argon gas concentration of the specimens prior to testing to Six specimens from the baseline set shall be tested to Test Method **E2188** shall be a minimum of 90 %. No individual test specimen shall have an argon concentration of less than 50 %, with no final frost/dew point warmer than -40°C (40°F).

4.1.2 Two specimens (if double-glazed) or four specimens (if triple-glazed) from the baseline set shall be tested to Test Method **E2189** with no volatile fog visible after testing.

4.1.3 If argon filling is specified, the same six specimens in 4.1.1 average shall also have an initial average argon concentration of 90 % or greater prior to testing to Test Method **E2188** final argon gas, AND the final average argon concentration of the same six specimens shall be 80 % or greater after testing to Test Method **E2188** shall be a minimum of 80 %. No individual test specimen shall have an argon concentration of less than 50 %.

4.2 Fog—Internal Component Performance—No fog shall be visible after testing in accordance with If specifying internal components, additional testing to Test Method **E2189**; is required. This testing is supplementary and separate from the baseline set. It does not affect the results of the baseline set.

4.2.1 Two specimens (if double-glazed) or four specimens (if triple-glazed) made with internal components, using the exact same sealing system, geometry, and glass construction as the baseline set in 4.1, shall be tested to Test Method **E2189** with no volatile fog visible after testing.

5. Test Specimens

5.1 Each test specimen shall measure 355 ± 6 mm by 505 ± 6 mm and shall be composed of two or three lites of glass. Specimen Size:

5.1.1 Each test specimen shall measure 355 ± 6 mm by 505 ± 6 mm ($14 \pm \frac{1}{4}$ in. by $20 \pm \frac{1}{4}$ in.).

5.2 The glass and airspace thickness(es) for qualification under this specification shall be 4 mm glass with 12 mm airspace or 5 mm glass with 6 mm airspace.

5.3 For triple-glazed units, 4 mm glass with 6 mm airspaces shall be used.

5.2 If the required glass constructions in 5.2 and 5.3 are not available from the submitting manufacturer, then thicker glass or wider airspaces, or both shall be allowed. (For example, using 6 mm glass with 12 mm airspace.) This may result in a more rigorous test. Glass Construction:

5.2.1 For double-glazed specimens: 4 mm ($\frac{5}{32}$ in.) nominal glass with 12 mm ($\frac{1}{2}$ in.) cavity, or 5 mm ($\frac{3}{16}$ in.) nominal glass with 6 mm ($\frac{1}{4}$ in.) cavity.

5.2.2 For triple-glazed specimens: 4 mm ($\frac{5}{32}$ in.) glass with 6 mm ($\frac{1}{4}$ in.) cavities.

5.2.3 If the required glass constructions in 5.2.1 and 5.2.2 are not available from the submitting manufacturer, then thicker glass or wider cavities, or both, shall be allowed. (For example, using 6 mm glass with 12 mm cavity.) This may result in a more rigorous test.

5.2.4 All of the values noted in this section are nominal.

5.2.5 Tolerance of glass thickness shall be in accordance with Specification C1036.

5.2.6 Cavity tolerance shall be ± 0.8 mm ($1/32$ in.).

5.2.7 There shall be no internal components in the baseline set.

5.5 All of the values in 5.2 through 5.4 are nominal.

5.5.1 Tolerance of glass thickness shall be in accordance with Specification C1036.

5.5.2 Airspace tolerance(s) shall be ± 0.8 mm.

5.6 If specifying internal components, then these components shall be present in the test specimens made for testing to Test Method E2189.

5.7 Twelve double-glazed test specimens shall be submitted when testing to this specification. If specifying internal components, three of these specimens shall contain those components and shall be designated for testing to Test Method E2189.

5.8 Fourteen triple-glazed test specimens shall be submitted when testing to this specification. If specifying internal components, five of these test specimens shall contain those components and shall be designated for testing to Test Method E2189.

5.3 If specifying argon gas fill: *Glass Coatings* (if used):

5.3.1 The test specimens *Coatings* shall be argon filled using the same gas filling techniques as those used for manufacturing included in the specimens, if the manufacturer uses coatings in normal production.

5.3.2 For double-glazed, argon gas filled specimens: double-glazing specimens, one lite of the specimen shall be clear and the other shall have a coating applied to the inner surface.

5.9.2.1 Nine of the submitted test specimens shall be designated for testing with Test Methods E2188 and E2649. These specimens shall not contain any internal components such as muntin bars.

5.9.2.2 The remaining specimens of the set (three double-glazed units) shall be designated for Test Method E2189 where two of the test specimens are selected for testing. These specimens shall be the three specimens containing internal components if qualifying internal components as specified in 5.8.

5.3.3 For triple-glazed, argon gas filled specimens: triple-glazed specimens tested to Test Method E2188, both outer lites shall be clear glass and the middle lite shall have a metallic coating (either low E or reflective) on at least one surface.

5.9.3.1 Nine specimens shall be designated for testing with Test Methods E2188 and E2649. The test specimens shall have both outer lites made of clear glass and the middle lite shall have a metallic coating (either low E or reflective) on at least one surface. These specimens shall not contain any internal components such as muntin bars.

5.9.3.2 The remaining test specimens of the set (five triple-glazed units) shall be designated for Test Method E2189, where four of the specimens shall be tested. These specimens shall be the five specimens containing internal components if qualifying internal components as specified in 5.9.

5.3.4 For triple-glazed specimens tested to Test Method E2189 for the base set, one outer lite shall have a metallic coating (either low E or reflective). For specimens with internal components, the internal component shall be within the cavity with the metallic coating.

5.4 *Number of Specimens in a Submitted Baseline Set:*

5.4.1 Double-glazed with air or argon-filled units shall have 12 specimens per set.

5.4.2 Triple-glazed with air or argon-filled units shall have 14 specimens per set.

5.5 For qualifying specimens with argon gas fill, the specimens shall be made with the same gas-filling techniques as used for the manufacturer's production.

5.6 *Internal Components* (if used):

5.6.1 If internal components are specified, supplementary testing to Test Method E2189 is required.

5.6.2 Specimens in this supplementary testing to Test Method E2189 shall be made with the internal components, using the exact same sealing system and geometry as the baseline set that was tested without internal components.

5.6.3 The specimens with internal components can be made at a different time than the baseline set.

5.6.4 There shall be three specimens (two tested, one spare) submitted for double-glazed IG and five specimens (four tested, one spare) submitted for triple-glazed IG.

6. Test Methods

6.1 *For Air-Filled Units:*

6.1.1 Test six randomly selected specimens for 14 days in the high humidity phase, followed by 63 days in the weather cycle phase followed by 28 days in the high humidity phase in accordance with Test Method E2188.

6.1.2 Test two randomly selected double-glazed or four triple-glazed specimens for 7 days in accordance with Test Method E2189.

6.1 *For Argon-Gas Filled Units: Baseline Set Testing to Test Method E2188:*

6.1.1 In accordance with Test Method E2188, prepare the specimens as directed and follow the testing procedure.