



Designation: ~~E2189-02~~ Designation: E2189 - 10

Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units¹

This standard is issued under the fixed designation E2189; 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 test method covers procedures for testing the resistance to fogging of preassembled permanently sealed insulating glass units or insulating glass units with capillary tubes intentionally left open.

1.2 This test method is applicable only to sealed insulating glass units that are constructed with glass.

~~1.3 The unit construction used in this test method contains construction details that are essential components of the test. Different types of glass, different glass thicknesses and different airspace sizes may affect the test results.~~

~~1.4 This test method is not applicable to sealed insulating glass units containing a spandrel glass coating due to testing limitations.~~

~~1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.~~

~~1.6~~

1.3 This test method 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 the inner lite is either glass or a suspended film.

1.4 The unit construction used in this test method contains construction details that are essential components of the test. Different types of glass, different glass thicknesses and different airspace sizes may affect the test results.

1.5 This test method is not applicable to sealed insulating glass units containing a spandrel glass coating due to testing limitations.

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

1.7 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 and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 *ASTM Standards:*²

C162 [Terminology of Glass and Glass Products](#)

C717 [Terminology of Building Seals and Sealants](#) [ASTM E2189-10](#)

E631 [Terminology of Building Constructions](#)

E2188 [Test Method for Insulating Glass Unit Performance](#)

~~E2190~~ [E2190 Specification for Insulating Glass Unit Performance and Evaluation](#)

3. Terminology

3.1 *Definition of Terms:*

3.1.1 For definitions of terms found in the standard, refer to Terminology C717, Terminology C162 and Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 fog, n—visible deposits present after testing in accordance with Section 8 —that were not present prior to testing. Fog does not include defects in a glass coating or the glass substrate when examined prior to testing.

4. Significance and Use

4.1 This test method is intended to provide a means for testing the resistance to fogging in sealed insulating glass units.

4.2 This test method is also intended to provide a means for testing the resistance to fogging caused by components in the

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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*, Vol 15.02, volume information, refer to the standard's Document Summary page on the ASTM website.

interior of the unit. These interior components include, but are not limited to, suspended or applied films, decorative components, muntins, and coatings.

5. Test Specimens

5.1 Each test specimen shall be manufactured in accordance with Test Method E2188, Section 5 or Specification E2190, Section 5, or both.

5.2 For double-glazed units, at least three specimens of identical component materials and construction shall be submitted.

5.3 For triple-glazed units, at least five specimens of identical component materials and construction shall be submitted. For these units, the manufacturer must specify the exterior surface., Section 5.

5.2 For test specimens containing muntin bars, the specimens shall be fabricated with the muntin bars dividing the specimens into nine equal areas (3 by 3). See Fig. 1.

5.3 Viewing of the fog shall not be compromised by any internal component.

5.4 For double-glazed units, at least three specimens of identical component materials and construction shall be submitted.

5.5 For triple-glazed units, at least five specimens of identical component materials and construction shall be submitted. For these units, the manufacturer shall specify the exterior surface.

NOTE 1—Certain reflective coatings may interfere with the ability to view fog.

5.46 During all stages of storage and handling, the units shall be held in a vertical position with equal support to all panes and no compression loading.

5.5 Two units shall be randomly selected for this test. Damaged units shall not be tested.

6. Apparatus

6.1 *Volatile Fog Test Apparatus :*

6.1.1 The dimensions and components are found in Fig. 1. The construction of the apparatus shall be capable of maintaining $50 \pm 3^{\circ}\text{C}$ ($122 \pm 5^{\circ}\text{F}$). 3°C . In order to maintain this temperature, a fan shall be mounted in the box. The fan shall run continuously, as needed in order to maintain the air temperature in the apparatus.

6.1.2 The apparatus shall be constructed from sturdy, solid materials that minimize the escape of ultraviolet light into the surrounding area. $\frac{1}{2}$ or $\frac{3}{4}$ in. plywood has been found suitable for this purpose. Stainless steel construction is also acceptable.

6.1.3 The interior of the apparatus shall have a reflective surface. If plywood is used to construct the apparatus, then line the entire interior of the apparatus with aluminum foil or other reflective material.

6.1.4 The test specimen supports are shall be located as shown in Fig. 1.

6.1.5 The cooling plates are constructed of a conductive material such as copper or brass. The cooling plates shall be nominally $150 \pm 5 \text{ mm}$ ($5.91 \pm 0.20 \text{ in.}$) diameter and shall be placed directly in complete contact with the glass surface for the duration of the test. Alternatively, a rectangular cooling plate shall be $0.0177 \pm 0.0006 \text{ m}$

6.1.5 The chamber shall have radiation-shielded thermocouples to continuously monitor the chamber air temperature at the locations shown in Fig. 2, identified by the labels TC1 through TC4.

6.1.6 The cooling plates shall be constructed of a conductive material such as copper or brass. The cooling plates shall be $150 \pm 5 \text{ mm}$ diameter and shall be placed directly in complete contact with the glass surface for the duration of the test. Alternatively, a rectangular cooling plate shall be $177 \pm 6 \text{ m}^2$ ($27.4 \pm 1.0 \text{ in.}^2$) in area.

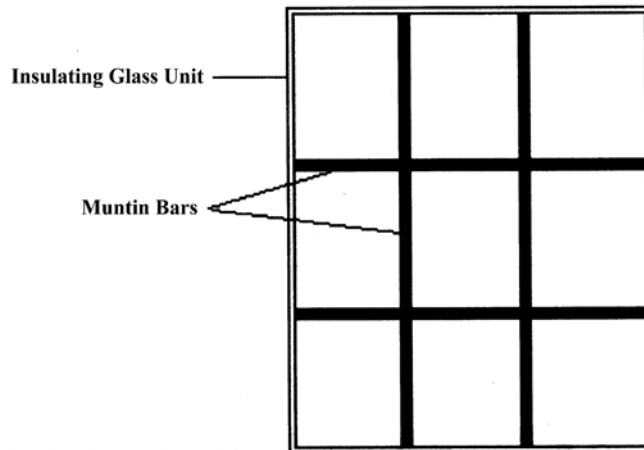


FIG. 1 Schematic Drawing of Insulating Glass Unit with Muntin Bars

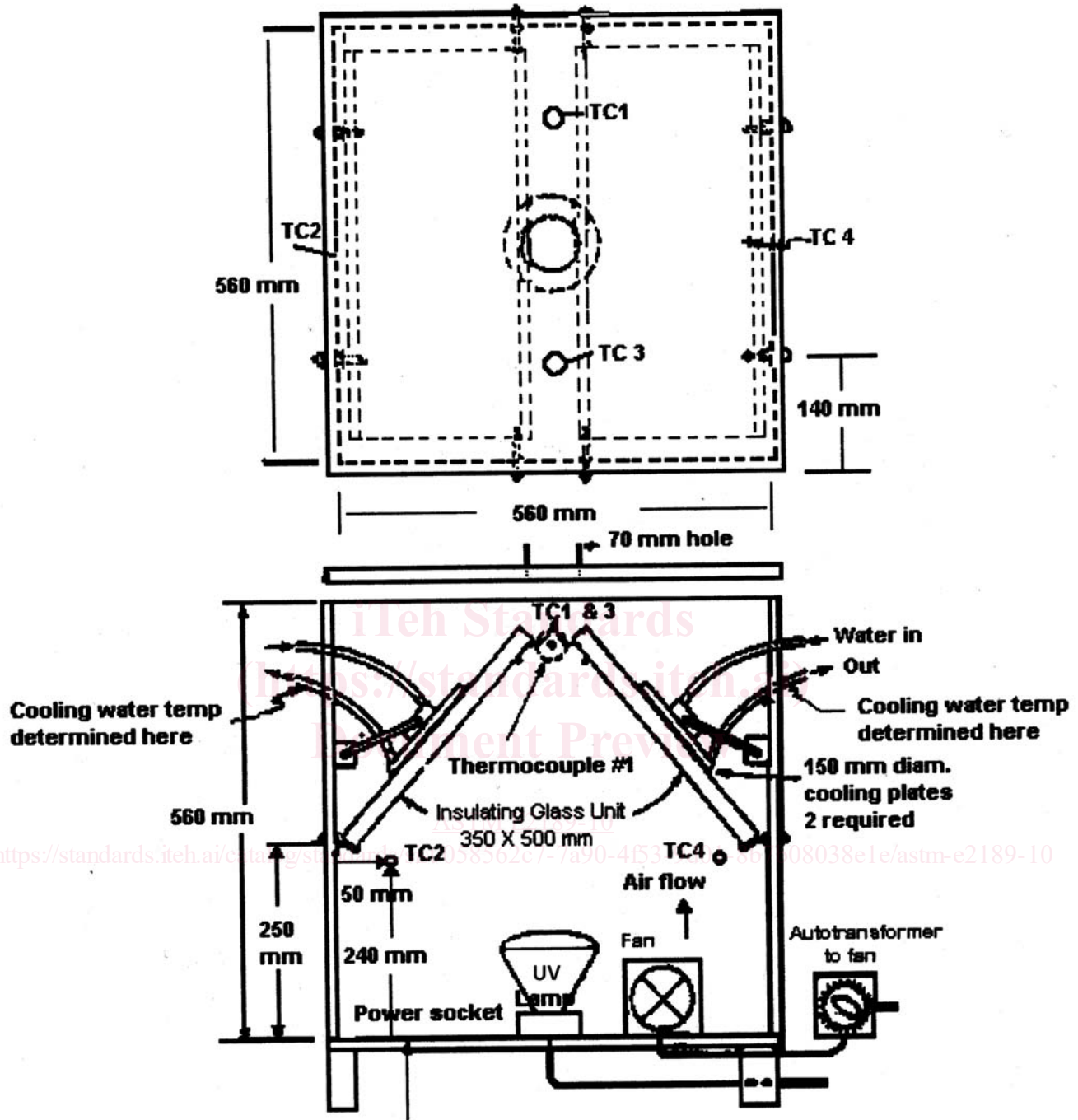


FIG. 2 Volatile Fogging Exposure Box

6.1.6 The cooling water temperature is determined as the water immediately exits the apparatus from each cooling plate as shown in Figure 1. The cooling water temperature at these locations shall be $21 \pm 2^\circ\text{C}$. in area with an aspect ratio (long side/short side) less than or equal to 1.4.

6.1.7 The cooling water temperature shall be determined as the water immediately exits the apparatus from each cooling plate as shown in Figure 1. The cooling water temperature at these locations shall be $21 \pm 2^\circ\text{C}$.

6.1.8 Alternatively, an electric chilling apparatus shall be used to control the cooling plate.

6.2 Ultraviolet Light Source:

Note 2—

6.2.1 **Warning:** Ultraviolet Warning—Ultraviolet light sources used in this test method are harmful to the human body, especially to the eyes. Appropriate protective measures must be observed. 6.2.1 The source shall consist of one ultraviolet lamp.