Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units / Testing Equipment

Description

6. **Apparatus**
   6.1 Volatile Fog Test Apparatus:
   6.1.1 The dimensions and components are found in Fig. 2. The construction of the apparatus shall be capable of maintaining 50 +- 3°C. In order to maintain this temperature, a fan shall be mounted in the box. The fan shall run 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. 1?2 or 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 shall be located as shown in Fig. 2.
   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 +- 5 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 +- 6 m2 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 +- 2°C.
   6.1.8 Alternatively, an electric chilling apparatus shall be used to control the cooling plate.
   6.2 Ultraviolet Light Source:
   6.2.1 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. The source shall consist of one 300 W ultraviolet lamp3 and shall be placed as shown in Fig. 1. The output of the UV source shall be measured from a distance of 355 +- 5 mm with a long-wave ultraviolet meter4 and shall not be less than 400 µW/cm
   6.3 Fog Examination Light Source:
   6.3.1 The source shall consist of two fluorescent light bulbs in a standard two bulb fixture. These bulbs shall be 20 W, cool white bulbs and shall be nominally 610 mm in length.
7. **Test Specimen Preparation**
   7.1 The sealed insulating glass units shall be sealed a minimum of 4 weeks from date of manufacture to allow for stabilization before testing begins. The manufacturer has the option to waive this requirement.
   7.2 The glass surfaces shall be clean prior to testing

8. **Procedure**
   8.1 Chamber Preparation:
   8.1.1 The cooling plate shall be clean and the contact surface shall be flat.
   8.1.2 For double-glazed units with low-e coatings, the cold plate shall be located on the low-e coated lite.
   8.1.3 For triple-glazed units, both cavities shall be tested. Two units shall be tested with the exterior lite (as identified by the manufacturer) towards the cooling plate and two units shall be tested with the interior lite (as identified by the manufacturer) towards the cooling plate.
   8.2 Test Procedure:
   8.2.1 Randomly select two double-glazed specimens or four triple-glazed specimens for testing.
   8.2.2 Examine the surfaces of each test specimen prior to testing for flaws and deposits as indicated in 8.3. Record the position or location of any surface flaws that are seen. If any deposits are seen, the specimen shall not be tested.
   8.2.3 Mount the two selected specimens within a volatile fog test apparatus similar to that shown in Fig. 2 and close the lid before turning on the UV lamp.
   8.2.4 Turn on the UV lamp source.
   8.2.5 Maintain all thermocouples (shown in Fig. 2 as TC1, TC2, TC3 and TC4) at 50 +- 3°C. The fan and vents shall be used to regulate this air temperature. The temperature differential from thermocouple #1 to thermocouple #2 shall not exceed 3°C. The temperature differential from thermocouple #3 to thermocouple #4 shall not exceed 3°C.

8.2.6 Maintain the temperature of the cooling water at 21 +- 2°C. Determine the temperature of the cooling water immediately after it leaves the test apparatus for each cooling plate.

8.2.7 If an electric chilling apparatus is used to control the cooling plate temperature, maintain the required temperature as noted in 8.2.6. Measure the temperature of the surface of the cold plate portion of this device.
8.2.8 The specimens shall be exposed to these conditions for a period of seven days or as determined by the specifier.
8.2.9 For triple pane units, both cavities shall be tested. Two units shall be tested with the exterior lite (as identified by the manufacturer) towards the cooling plate and two units shall be tested with the interior lite (as identified by the manufacturer) towards the cooling plate.
8.3 After exposure, remove the test specimens from the test apparatus. Examine them carefully for fog by holding at arm’s length (approximately 500 to 750 mm) from the eyes. Move the specimen to any angle necessary using both reflected and transmitted light to thoroughly check the surface of the glass for fogging.

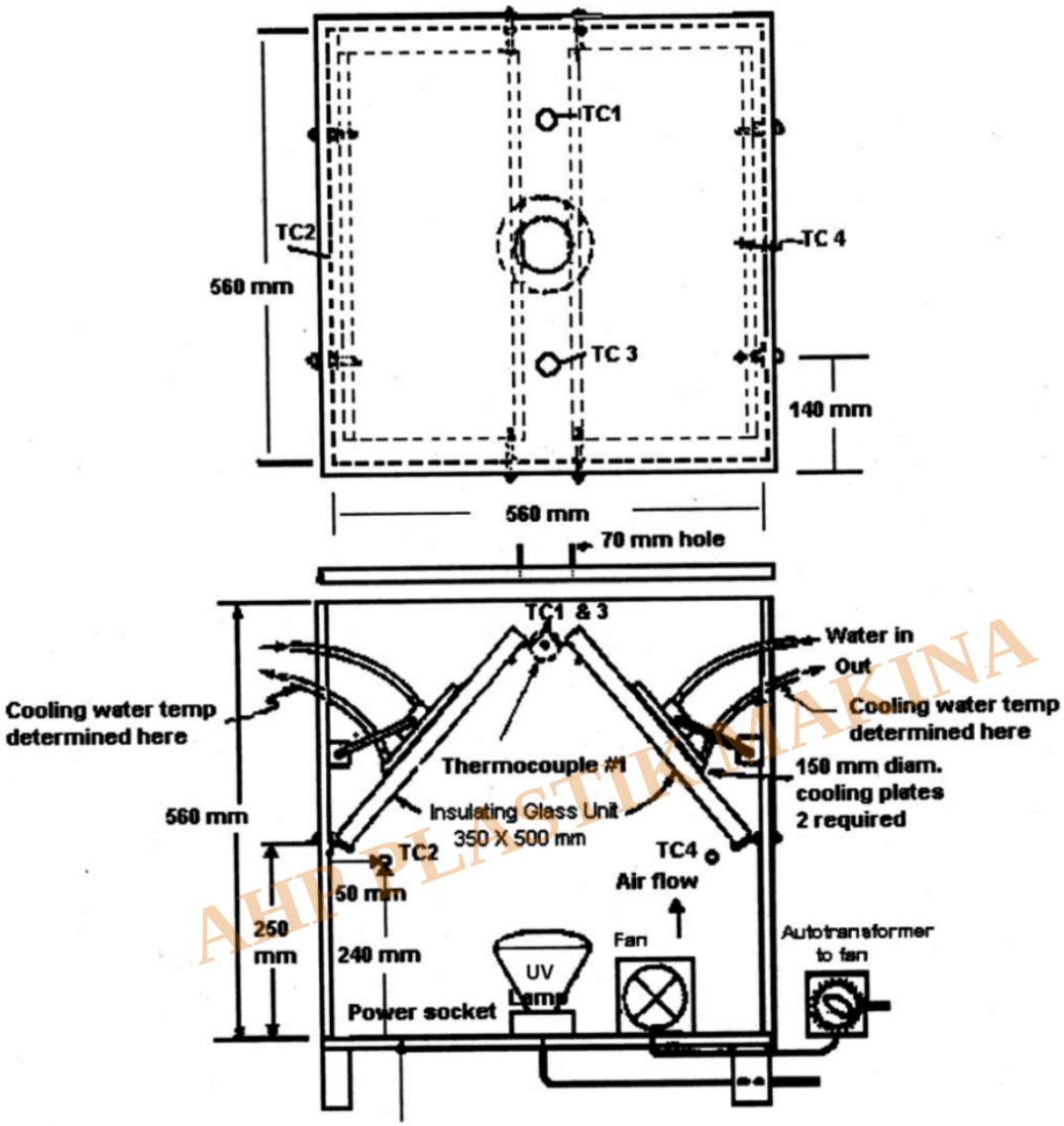

FIG. 2 Volatile Fogging Exposure Box

8.3.1 The examination for the presence of fog shall be done in a dark room or darkened area where the only light source for viewing the test specimens in the fog examination light source described in 6.3.
8.3.2 The lights used to examine the test specimens shall be a minimum of 1.5 m from the examiner.
8.3.3 To view the specimens in transmitted light, hold the test specimens in front of the fluorescent bulbs and examine the area of glass where the cooling plate had been located. 8.3.4 To view the specimens in reflected light, the examiner shall stand between the light source and the test specimens. Hold the test specimens to reflect the fluorescent light and again examine the glass surface as in 8.3.3.
8.3.5 The glass surface shall be viewed directly through the area where the cooling plate was located during testing and through the opposite lite of glass.
8.3.6 In addition to examining the area under the cooling plate, the entire glass surface shall be examined and compared to the glass surface before testing. Flaws or deposits seen after testing shall be recorded and reported.
8.4 If fog is not observed, record this information. The testing is complete.
8.5 If fog is observed, record this information and hold the test specimen(s) for 24 h at room

temperature. After this 24-h period, re-examine the specimen(s), as in 8.3.
8.6 Record the temperature readings for each of the four thermocouples at least once during the testing period.
8.7 If fog is not observed, record this information. The testing is complete.
8.8 If fog is observed at the 24-h observation, record this information and hold the test specimen an additional 6 days. After the 7 day period, reexamine the specimens, as in 8.3.
8.9 The units shall show no evidence of fogging when tested and viewed in accordance with 8.3-8.8.

Fogging Tester for Insulating Glass Units

- SS304 test chamber
- PID temperature controller
- Equipped with 3 thermocouples
- 150mm diameter cooling plates
- Chiller included for cooling plates
- Fog examination light source
- UV source equipped inside chamber
- Air circulation inside chamber

Category

1. Equipment for Standards
2. Standards