



Designation: E 576 – 88 (Reapproved 1999)^{ε1}

Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position¹

This standard is issued under the fixed designation E 576; 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.

This standard has been approved for use by agencies of the Department of Defense.

^{ε1} NOTE—Keywords were added in October 1999.

1. Scope

1.1 This test method describes a field or laboratory procedure for determining the frost point within the air space(s) of sealed insulating glass units, and establishes the criteria for determining whether that point is below or above a given or specified temperature.

1.2 This test method also describes the apparatus to be used for these determinations.

1.3 *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.* For specific hazard statements, see Notes 2 and 3.

2. Referenced Documents

2.1 *ASTM Standards:*

C 1036 Specification for Flat Glass²

E 77 Test Method for Inspection and Verification of Thermometers³

E 774 Specification for Sealed Insulating Glass Units⁴

3. Terminology

3.1 *frost point*—the temperature at which visible frost begins to deposit on the lower air space glass surface of a sealed insulating glass unit in contact with the measuring surface of the frost point apparatus.

3.2 *frost state*—the case where the frost point of a sealed insulating glass unit is above the test temperature specified by the purchaser or user.

3.3 *no-frost state*—the case where the frost point of a sealed insulating glass unit is below the temperature specified by the purchaser or user.

4. Summary of Test Method

4.1 This test method is conducted by the use of a special apparatus, consisting basically of two chilled cylindrical metal blocks positioned one over the other and separated by a gap of controllable distance. The upper block has an exposed flat circular surface, 25 mm (1 in.) in diameter, and can be chilled to far below the ice point by regulating the air gap distance between it and the lower metal block which is maintained at approximately -78°C (-109°F) by dry ice. The test specimen is placed in contact with this chilled flat circular surface of the upper block for specified short periods of time, with the metal surface at successively lower temperatures, to determine at what temperature frost appears on the corresponding lower air space glass surface.

5. Significance and Use

5.1 This test method is suitable for use under actual or simulated in-service conditions; that is, one side of the unit is exposed to room temperature, while the other side is exposed to natural or simulated weather conditions. Where the glazing conditions and the 24-h history are different or changed from previous conditions, the frost point may not be comparable to a previous measurement.

5.2 This test method is applicable for the uncoated or unfilmed clear (transparent) glass pane of sealed insulating glass units. If this apparatus is used with coated or filmed glass pane, the coating or film on the surface of glass pane may be damaged.

¹ This test method is under the jurisdiction of the ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.22 on Durability Performance of Building Constructions.

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² *Annual Book of ASTM Standards*, Vol 15.02.

³ *Annual Book of ASTM Standards*, Vol 14.03.

⁴ *Annual Book of ASTM Standards*, Vol 04.11.

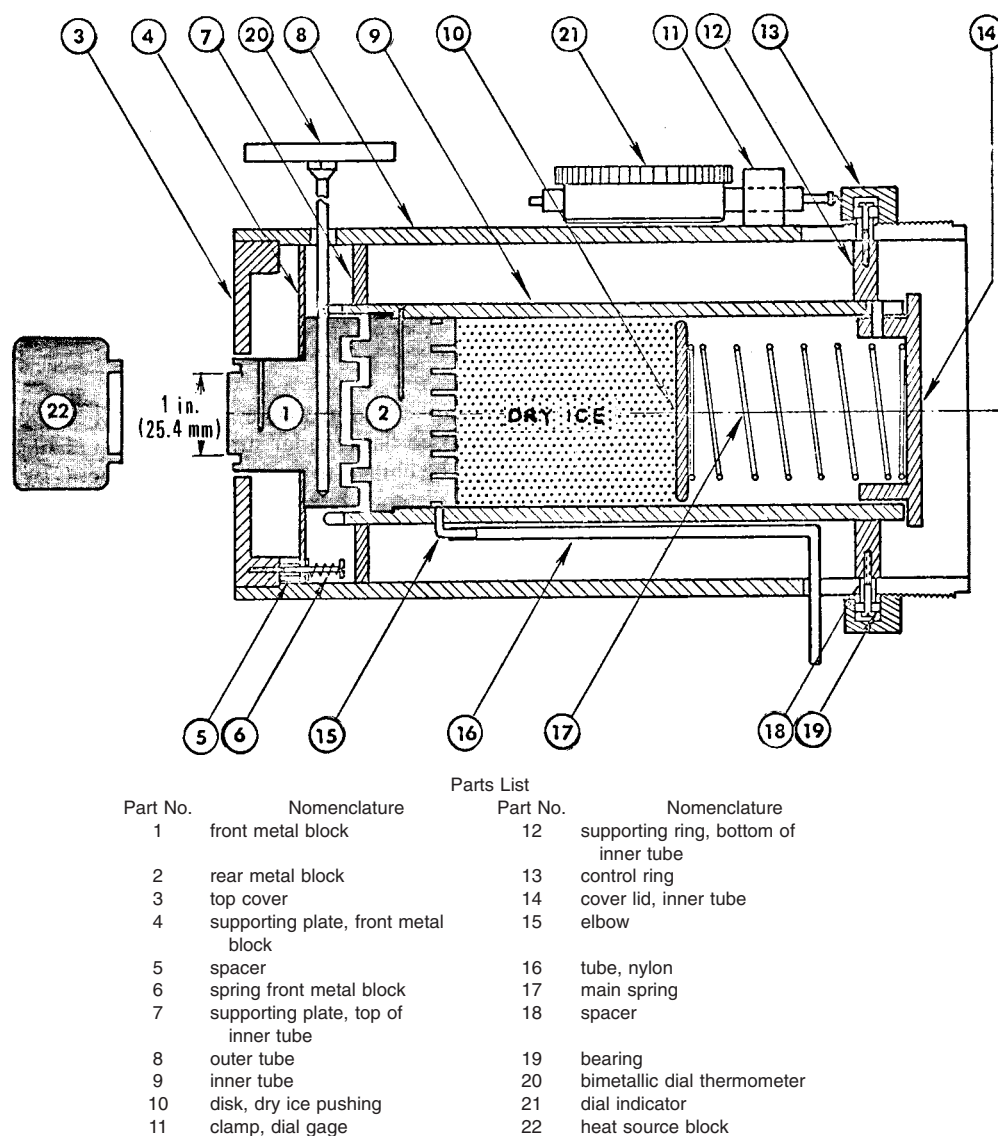


FIG. 1 Schematic Diagram of Frost Point Apparatus

5.3 This test method may require minor modifications to keep the measuring surface of the frost point apparatus in contact with the glass if the insulating glass unit is not in the true vertical position.

6. Apparatus

6.1 *Test Apparatus*⁵ (see Fig. 1), consisting of upper and lower cylindrical metal blocks, with a thermocouple, bimetallic thermometer, or other suitable temperature sensors being inserted in the upper block; a control ring; and an insulated containment cylinder fitted with a retainer spring assembly.

The two metal blocks are separated by a small air gap, the distance of which can be regulated by the control ring. The exposed flat circular surface of the upper block is 25 mm (1 in.) in diameter, has a ground or lapped finish, and when placed in contact with the glass test specimen, forms the frost point measuring surface. The lower block is chilled by a dry ice pack kept in contact with it by the retainer spring assembly, maintaining it at a temperature near to that of sublimating dry ice (-78°C (-109°F)). Because the solid metal blocks are highly conductive, the temperature of each is virtually uniform. Use of the control ring adjusts the air gap distance between the two blocks to give the desired thermal resistance across the air gap. The circular measuring surface of the upper block is thus readily adjusted to the desired temperature while in contact

⁵ Available from Dennis Industries, 20032 Waynegarden Court, Germantown, MD 20874.

with the test specimen. The circular measuring surface diameter specified is suitable for frost point measurement of glass up to 6.0 mm (¼ in.) thick.

6.1.1 *Upper and Lower Blocks*, aluminum alloy that may be anodized, conforming to the dimensions shown in Fig. 1. Other parts of the apparatus may be fabricated from any appropriate materials.

6.1.2 *Calibrated Temperature-Measuring Device*, such as a thermocouple, thermistor, or bimetallic thermometer, having a suitable range graduated in 1°C (2°F) or smaller units, and an accuracy of $\pm 0.5^\circ\text{C}$ ($\pm 1^\circ\text{F}$) over the full scale. A suggested calibration of the bimetallic thermometer is described in Appendix X1.

6.2 *Vertical Attachment Fixture*⁵ (see Fig. 2), consisting of a

6.3 *Glass Thickness Gage*⁶ (see Fig. 3).

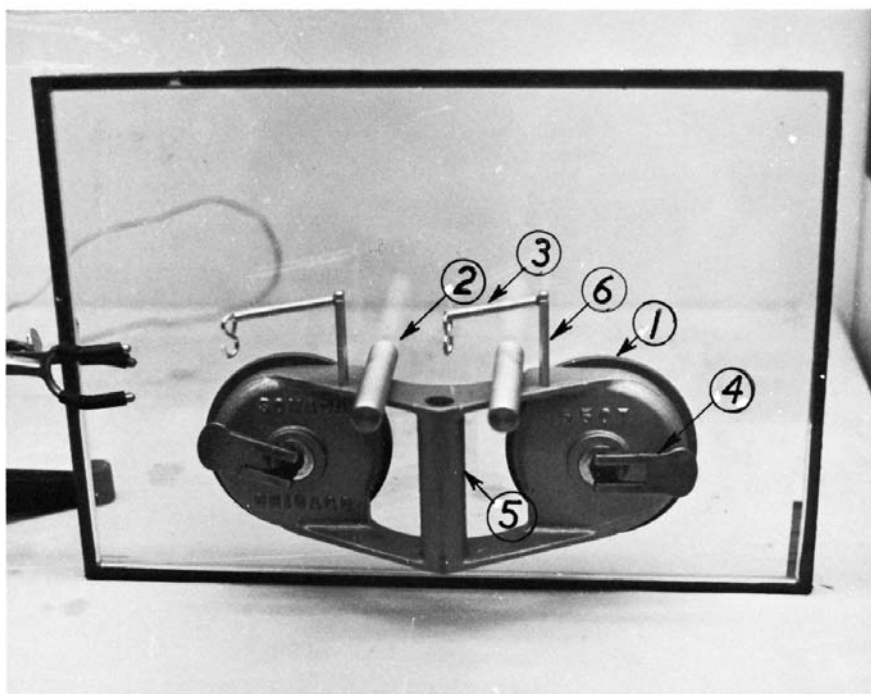
7. Test Unit

7.1 The sealed insulating glass unit to be tested should have a clear glass pane (see 5.2) in contact with the measuring side of the test apparatus and shall be positioned vertically.

8. Conditioning

8.1 Condition the unit to be tested at room temperature on both unit sides by exposing to a temperature of $24 \pm 3^\circ\text{C}$ ($75 \pm 5^\circ\text{F}$) for not less than 24 h prior to the testing.

8.2 Condition the unit to be tested under simulated in-service conditions by exposing to temperatures within $\pm 3^\circ\text{C}$ ($\pm 5^\circ\text{F}$) of the desired simulated conditions for not less than 24



Part No.	Parts List	Nomenclature
1	rubber vacuum cup	
2	guide rod	
3	clamping spring	
4	vacuum hand lever	
5	hand grip	
6	spring post	

FIG. 2 Vertical Attachment

twin-grip vacuum cup holder, two parallel guide rods, two spring posts, and two clamping springs. The vacuum cup is made of rubber. When the vertical attachment fixture is placed on the surface of clean glass and the vacuum hand lever is pushed down, the vertical attachment fixture becomes firmly attached to the glass surface. Other equivalent attachment fixtures may be used.

h prior to testing.

8.3 For the unit to be tested under actual in-service conditions, record or obtain the ambient temperatures of both sides of the unit at the start and end of a particular measuring period, and the 24-h temperature history prior to testing.

NOTE 1—At the present time, there is insufficient information to compare the measured frost point of the unit from the reported temperature

⁶ A device found suitable for this purpose, U.S. Patent No. 3320849, is available from J. R. Cumberland, Precision Optics, 4505 Beech Rd., Washington, DC 20031.