Designation: F3007 – 13

An American National Standard

Standard Test Method for Ball Drop Impact Resistance of Laminated Architectural Flat Glass[1]

This standard is issued under the fixed designation F3007; 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 the destructive ball drop testing of laminated flat glass products intended for use in architectural glazing applications.

1.2 This test method is intended for use as an in-plant quality control test to evaluate the impact performance of laminated flat glass when a 2.3 kg, 83 mm diameter smooth solid steel ball is dropped from a user selected height.

1.3 This test method is not a substitute for safety glazing test requirements of ANSI Z97.1 or CPSC 16 CFR 1201.

1.4 This test method is applicable to symmetrical and asymmetrical annealed, heat-strengthened, chemically strengthened, fully tempered laminated architectural flat glass including but not limited to: float, patterned, sheet, sandblasted, grooved, and fritted.

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

1.6 *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. Some specific hazards statements are given in Section 7 on Hazards.*

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

C1422 Specification for Chemically Strengthened Flat Glass

2.2 *ANSI Standards:*[3]

Z26.1 American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways—Safety Standard

Z97.1 American National Standard for Safety Glazing Materials Used in Buildings—Safety Performance Specification and Methods of Test

2.3 *CPSC Standards:*[4]

CPSC 16 CFR 1201 Safety Standard for Architectural Glazing Materials

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology C162.

4. Summary of Test Method

4.1 In this test method, a single lite of laminated glass (either made to size or cut to size) that has been fabricated from glass meeting the specification of Specifications C1036 or C1048, or both, and quality parameters of Specification C1172 is removed from the production process and subjected to destructive ball drop testing. After impact, the retention performance of the laminate is recorded and achieved drop height documented.

5. Significance and Use

5.1 The impact performance of laminated glass varies with the glass ply thickness, type, and kind as well as the thickness and type of interlayer used in the overall configuration.

5.2 Specific safety properties are required for laminated glass to meet the safety glazing requirements of ANSI Z97.1 and CPSC 16 CFR 1201. Compliance with the minimum quality requirements of Specification C1172 does not constitute compliance or assure compliance with the referenced safety glazing standards.

[1] This test method is under the jurisdiction of ASTM Committee F12 on Security Systems and Equipment and is the direct responsibility of Subcommittee F12.10 on Systems Products and Services.

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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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from U.S. Consumer Product Safety Commission (CPSC), 4330 East West Hwy., Bethesda, MD 20814, http://www.cpsc.gov.

5.3 While this test method does not replace the test requirements of ANSI Z97.1 or CPSC 16 CFR 1201 safety glazing standards addressed above, destructive ball drop impact testing does provide a method of expeditious in-plant evaluation of laminated glass products being fabricated.

5.4 Impact procedures for testing in accordance with safety glazing standards ANSI Z97.1 and CPSC 16 CFR 1201 differ from this ball drop test method; however, the penetration resistance of a single laminated lite can be determined and used for quality control purposes.

6. Apparatus

6.1 A smooth solid steel ball weighing 2.3 ± 0.1 kg.

6.2 A support frame constructed similar to Fig. 1.

6.3 A mechanism for ensuring the unimpeded drop of the ball from rest onto the test specimen within 25 mm of center.

7. Hazards

7.1 **Warning:** Test impact is intended to result in glass fracture. Proper glass handling safety gear should be worn at all times during specimen handling, testing, evaluation, and disposal.

8. Test Specimen Size

8.1 Test specimen size is 305 ± 10 mm by 305 ± 10 mm.

9. Procedure

9.1 Record the minimum thickness of the specimen.

NOTE 1—The thickness of the specimen shall be measured at the midpoint of the four sides within 1 in. of the edge. Multiple measurements can be made at various locations on the glazing. The thinnest thickness from all measurements shall be reported.

9.2 The specimens shall be conditioned at 24 ± 5°C for at least 4 h, immediately prior to the performance of the ball drop test.

NOTE 2—Very thick specimens may require conditioning for longer periods of time.

9.3 Record the specimen temperature at the surface to be impacted.

9.4 Place the specimen on the support frame. Specimen may be clamped to retain it in the frame during testing.

9.5 Raise the steel ball to the selected height ensuring that upon release from an at-rest position, the ball will drop unimpeded and impact the center of the specimen within 25 mm of center.

9.6 Within a 5 s interval after impact, determine the penetration resistance/retention characteristics of the specimen using Table 1.

9.7 Record laminated glass construction, temperature, production date, drop height, and result (see Section 11).

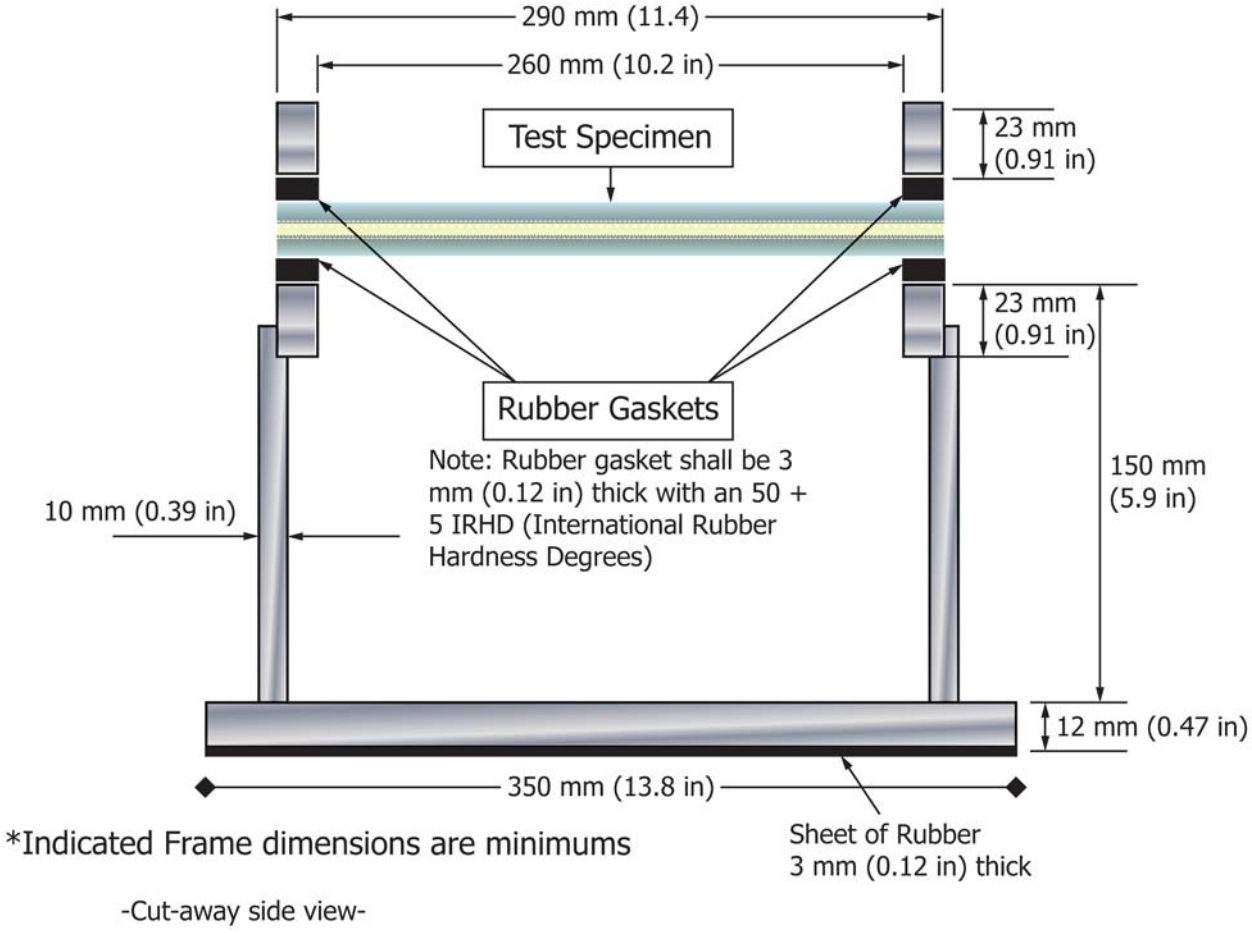

FIG. 1 Holding Fixture for Drop Test

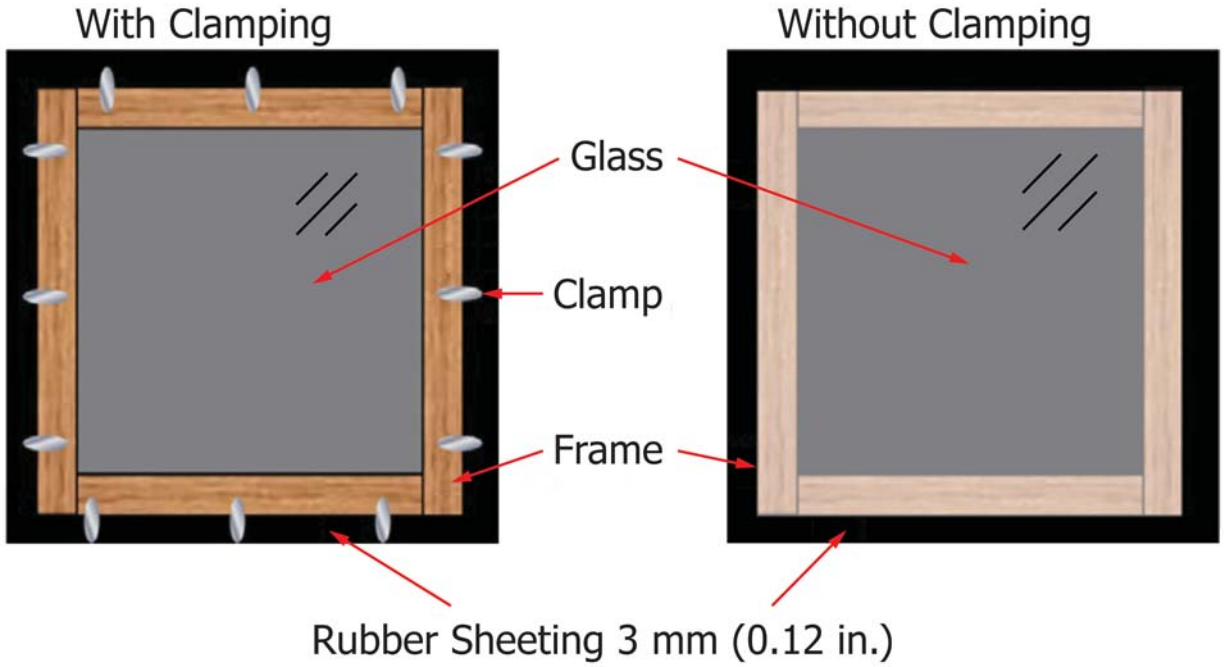

FIG. 2 Holding Fixture Top View With and Without Clamping

TABLE 1 Retention Characteristics After Ball Drop

NOTE 1—If the specimen completely leaves the frame, the test for that specimen will be deemed a non-test. Another specimen shall be tested with increased clamping force sufficient to retain the specimen during testing.

	Retention Characteristics	Result
1	Ball Held – glass unbroken	Pass
2	Ball Held – glass broken, no tears in interlayer	Pass
3	Ball Held – glass broken, tears in interlayer which do not permit a non-compressible 83 mm diameter ball to pass freely within 5 s	Pass
4	Ball not retained	Fail

9.8 Repeat test on at least two additional 305 by 305 ± 10 mm specimens of the same configuration and production lot at the same or elevated drop heights.

10. Interpretation of Results

10.1 The results are interpreted according to Table 1.

10.2 Three specimens from the same lot shall be tested and all three shall exhibit passing retention characteristics.

11. Report

11.1 Record the following information:

11.1.1 Date and time of specimen production and testing.

11.1.2 Laminated Glass configuration (use applicable sections).

11.1.2.1 Description of Glass:

(1) Glass Type

(2) Glass Kind (AN, HS, FT, etc.)

(3) Glass Thickness (nominal)

(4) Glass Color

(5) Glass Coating and surface identification

11.1.2.2 Description of Interlayer:

(1) Interlayer Type

(2) Interlayer Grade

(3) Interlayer Thickness (nominal)

(4) Interlayer color

11.1.2.3 Description of Plastic Glazing Material:

(1) Plastic Glazing Type

(2) Plastic Glazing Grade

(3) Plastic Glazing Thickness (nominal)

(4) Plastic Glazing Color

11.1.2.4 Overall Configuration Details.

11.1.2.5 Measured thinnest thicknesses.

11.1.3 Specimen Temperature.

11.1.4 Drop height(s).

11.1.5 Retention Characteristic.

12. Precision and Bias

12.1 The precision and bias of the procedure in this test method have not been determined.

13. Keywords

13.1 annealed glass; architectural flat glass; ball drop; chemically strengthened glass; flat glass; fragmentation; heat strengthened glass; laminated glass; retention; safety glass; safety glazing; tempered glass