Petition CP 12-3

SCHIFFHARDIN LLP

William M. Hannay
312-258-5617
whannay@schiffhardin.com

233 South Wacker Drive
Suite 6600
Chicago, Illinois 60606
t 312.258.5500
f312.258. 5600
www.schiffhardin.com

June 26, 2012

BY E-MAIL

Mary F. Toro
Director of Regulatory Enforcement
Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814

Re: Petition of Safety Glazing Certification Council to Initiate Rulemaking

Dear Ms Toro:

Following up on our conference call last month, I am enclosing (in pdf format) a copy of the Petition of the Safety Glazing Certification Council to Initiate Rulemaking to Amend 16 C.F.R. Part 1201, Safety Standard for Architectural Glazing Materials, and three accompanying exhibits.

You had suggested that we submit this petition to you and that you would forward it to the Secretary of the Commission for docketing.

We appreciate your courtesy in this matter and look forward to working with the Staff in connection with our petition. Please let me know if you have any questions now or in the future.

Very truly yours,

William M. Hannay

cc: Thomas Henehan

Petition CP 12-3

BEFORE THE
U.S. CONSUMER PRODUCT SAFETY COMMISSION

PETITION REQUESTING THE COMMISSION TO INITIATE A RULEMAKING TO AMEND 16 C.F.R. PART 1201, SAFETY STANDARD FOR ARCHITECTURAL GLAZING MATERIALS

PETITION OF
SAFETY GLAZING CERTIFICATION COUNCIL

William M. Hannay
Counsel for Safety Glazing Certification Council
Schiff Hardin LLP
233 S. Wacker Drive, Suite 6600
Chicago IL 60606
(312) 258-5617

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INTRODUCTION

Pursuant to Sections 7 and 9 of the Consumer Product Safety Act, 15 U.S.C. Sections 2056 and 2058, and the U.S. Consumer Product Safety Commission ("Commission") regulations issued thereunder at 16 C.F.R. Part 1201, the Safety Glazing Certification Council files this petition requesting the Commission to initiate a rulemaking to amend 16 C.F.R. Part 1201, Safety Standard for Architectural Glazing Materials, by replacing the test procedures now contained in 16 C.F.R. § 1201.4 with the methods of test for safety glazing materials set forth in ANSI Z97.1 (most current version).

- The proposed amendment is illustrated in a markup of 16 C.F.R. Part 1201, attached hereto as Exhibit A.
- A copy of the most current version of ANSI Z97.1 is attached hereto as Exhibit B.[1]
- A comparison of the two test methods is attached hereto as Exhibit C.

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[1] The most current version of ANSI Z97.1 is designated "2009$^{\epsilon 2}$", meaning that it was approved pursuant to ANSI procedures in 2009 and was shortly thereafter amended to correct minor errata ("$^{\epsilon 2}$") after publication. The attached copy is licensed to CPSC for the purposes of this petition.

In support of this request, SGCC® submits the following information:

INTEREST OF THE PETITIONER

The Safety Glazing Certification Council ("SGCC®") is a non-profit corporation that provides for the certification of safety glazing materials to various safety standards, including 16 CFR Part 1201 and ANSI Z97.1. Established in 1971, SGCC® has the following purposes:

(a) To promote public safety by encouraging maintenance of the highest standards of excellence in the manufacture of safety glazing materials.

(b) To encourage and cooperate in developing standards related to other performance characteristics of glazing products.

(c) To plan, organize, direct, coordinate and maintain a certification program for glazing materials to assure that glazing products meet applicable standards or performance requirements adopted or approved by the Council.

The organization is managed by a board of directors comprised equally of representatives from the public interest sector and from the safety glazing industry. For more than thirty years, SGCC® has maintained a certification program under which manufacturers of safety glazing products voluntarily submit their products for testing to an SGCC-approved independent testing laboratory. The testing procedures used in SGCC®'s program are those established in ANSI Z97.1 and CPSC 16 C.F.R. Part 1201. Participants in the SGCC® program undergo facility auditing and independent test sample selection and testing every 6 months. SGCC® currently has over 150 licensed manufacturers with approximately 250 manufacturing or fabricating facilities in the United States and over 15 foreign countries.

Management and control of SGCC® is vested in a board of directors, half representing industry and half representing the public interest. To prevent industry dominance of SGCC®

actions, half the voting power of the board resides in the public interest directors regardless of the number of directors present at a meeting. For further information, see http://sgcc.org.

SGCC® licensees that manufacture or fabricate safety glazing materials must certify that the labeled material complies with the applicable specification (either or both 16 CFR Part 1201 or ANSI Z97.1). Compliance of a certified product with the applicable specification(s) is checked periodically by approved independent testing laboratories under the supervision of a qualified Administrator, retained by and responsible to SGCC®, who is unaffiliated with any licensee of safety glazing materials.

PROPOSED AMENDMENT TO PART 1201

Based on over 30 years experience in the administration of the certification of safety glazing materials under both ANSI Z97.1 and CPSC's 16 CFR Part 1201, SGCC® represents to the Commission that consumers and the glazing industry would be far better served by replacing Part 1201's older test procedures with ANSI Z97.1's more efficient and more modern procedures. By testing under a single test procedure for both standards, consumers would be assured of more uniform and up-to-date methods of testing to confirm the safety characteristics of glazing products, the industry will avoid the burden and confusion from having to conduct duplicative testing, and the test laboratory community will have the clarity of a single methodology and avoid the necessity of having to maintain separate types of testing equipment.

16 CFR Part 1201 serves two functions: (1) it serves as a specification for glazing materials in doors (and other locations) as described in § 1201.1 and (2) it sets forth a test methodology in § 1201.4 to establish that glazing products meet that specification. SGCC® does not propose any change to the scope and exemptions contained in § 1201.1; we do, however, recommend replacing the test methodology contained in § 1201.4.

SGCC® recommends that -- in lieu of the test methodology described in § 1201.4 -- ANSI Z97.1 (most current version) be substituted as the test method. Specifically, SGCC® proposes that all of the text of §1201.4 (and the accompanying Figs. 1-5) be deleted and that in their place be substituted the following:

> **§ 1201.4 Test procedures**
>
> Testing shall be in accordance with the test provisions of ANSI Z97.1 (most current version), "American National Standard for Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test."[2]

A copy of 16 C.F.R. Part 1201 -- marked to show the proposed deletion and addition -- is attached hereto as Exhibit A. A copy of the most current version of ANSI Z97.1 (licensed to CPSC for the purposes of this petition) is attached hereto as Exhibit B. *See* ANSI Z97.1, Sections 4 ("Specimens to Be Tested") and 5 ("Test Specifications").

HISTORY AND PROCEDURES OF ANSI Z97.1

ANSI Z97.1 (Standard - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test) was first developed under the auspices of the American National Standards Institute in the 1960s. Successive Accredited Standards Committees (ASCs) have been formed over the intervening years to review, develop and maintain Z97.1 to establish the specifications and methods of test for the safety properties of "safety glazing materials" (glazing materials designed to promote safety and to reduce or minimize the likelihood of cutting and piercing injuries when the glazing materials are broken by

[2] Copies of ANSI Standard Z97.1 (most current version) are available from the American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, or online at http://webstore.ansi.org/FindStandards.aspx?SearchString=Z97.1&SearchOption=0&PageNum=0&SearchTermsArray=null%7cZ97.1%7cnull.

human contact) as used for all building and architectural purposes. The ASC maintains a public website at http://www.ansiz97.com.

The current version of the ANSI standard ($2009^{\epsilon 2}$) is a successor standard to the 2004^{ϵ} edition and is the product of several years of meetings, votes, and ongoing work by the Accredited Standards Committee and its members. The 2004^{ϵ} standard succeeded those of the 1984 (reaffirmed in 1994), 1975, 1972 and 1966 editions. The current standard, like its predecessors, was developed under procedures accredited by ANSI as meeting the criteria for American National Standards. The consensus committee that approved the Standard was balanced to ensure that individuals from competent and concerned interests have had an opportunity to participate. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer, in this case ASC Z97.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution. The current ASC for Z97.1 consists of representatives from approximately 30 glass manufacturers, interlayer makers, fabricators, consultants, and specifiers as well as 12 individual members (including the Administrator of the SGCC®) and observers (including representatives of the CPSC).[3]

[3] The primary observer for the CPSC on ASC Z97 was Thomas Caton, and the alternate member was Mark Kumagai.

RATIONALE FOR THE AMENDMENT

Congress has expressed its preference in 15 U.S.C. § 2056(b) for the Commission to rely upon voluntary consumer product safety standards whenever compliance with such voluntary standards would eliminate or adequately reduce the risk of injury addressed and it is likely that there will be substantial compliance with such voluntary standards. Here, SGCC® believes that these Congressional concerns and the public interest would be well-served by the replacement of the existing test methodology set forth in Section 1201.4 with the methods of test for safety glazing material set forth in ANSI Z97.1 (most current version). (A chart comparing and commenting on the differences between CPSC 16 C.F.R. 1201 and ANSI Z97.1 is attached to this Petition as **Exhibit C**.)

As a historical matter, in its original development of 16 CFR Part 1201, the Commission was influenced by ANSI Z97.1.[4] The test methodology in Section 1201.4, however, has not been maintained and kept up-to-date, and many aspects of it that need clarification have not been clarified since its original adoption by the Commission. By contrast, ANSI Z97.1 has continued to evolve and improve, through and including the current 2009$^{\epsilon 2}$ version, and has regularly been modified to deal with important issues that have arisen over the years.[5] For example, 16 CFR § 1201.4 does not provide any guidance for testing "bent glass" – which has become a

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[4] The Commission noted that it reviewed information contained in ANSI Z97.1-1975 to determine appropriate levels of test impact energy, see 42 Fed. Reg. 1434, and revised its proposed labeling language to conform with ANSI Z97.1's labeling requirements, see 42 Fed. Reg. 1441. The test method set forth in 16 CFR § 1201.4 was also influenced by ANSI Z97.1-1972. *Cf.* 41 Fed. Reg. 6182 (Feb. 11, 1976) (proposed rule permitting continued use of Z97.1 impact test frames). This language, however, did not appear in the final version of the Rule in January 1977. *Cf.* 41 Fed. Reg. 1445.

[5] For the very reason that Z97.1 is regularly updated, SGCC® recommends that the phrase "most current version" be added to the references to Z97.1 in the revised Section 1201.4 in order to ensure that Part 1201's test procedures are always up-to-date.

commercially important building tool – while ANSI Z97.1-2009$^{\epsilon 2}$ does. There are other practical issues in the use of Section 1201.4 test equipment that have been clarified and addressed in Z97.1-2009$^{\epsilon 2}$ (*e.g.*, evaluation of laminated glass after breakage).

The use of a single test method and qualification procedure – ANSI Z97.1 (most current version) – would allow greater understanding by consumers, specifiers (such as architects), building code officials, as well as the industry and the test labs. Unlike Part 1201, ANSI Z97.1 is updated and reviewed on a five to ten year cycle so that it has and will remain in step with the industry and technology being used by consumers.[6]

In the view of SGCC®, ANSI Z97.1 is a more rigorous test standard than Part 1201 and will better protect the consumer. For example:

(1) Z97.1 requires that more samples be tested while Section 1201.4 has been interpreted as requiring only one sample to be tested,

(2) Z97.1 requires an additional center-punch test for some products, and

(3) Z97.1 builds in increased durability test requirements.

From a safety perspective, it should be noted that ANSI Z97.1 does not include wired glass as a "safety glazing material" and similarly excludes from the definition other types of glass that, if broken, can be hazardous not only because of their cutting and piercing potential, but also because a break may be life threatening.[7] The new interpretation and qualification

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[6] SGCC® notes that the National Highway Traffic Safety Administration ("NHTSA") has taken a similar approach to that recommended here. On July 12, 2005, NHTSA published a Final Rule amending 49 CFR 571.205, Glazing Materials, see 132 FR 39959, which adopts by reference ANSI/SAE Z26.1-1996 for the testing of automotive glazing materials.

[7] 16 CFR 1201(c) exempts from wired glass Part 1201 where its use is required by ordinance and also excludes certain other products. SGCC® is not requesting any change in these exemptions.

procedures for ANSI Z97.1 will allow for tighter control over glazing performance in hazardous locations including doors.

There is a trend towards adopting and referencing ANSI Z97.1 in other standards. For example, Z97.1 is now being referenced in Building Codes such as IBC 2012 and IRC 2012. In addition, Z97.1 is referenced in the new standard for glass in table tops being developed by ASTM's Subcommittee F15.42 on Furniture Safety. *See* ASTM WK22334, http://www.astm.org/database.cart/workitems/WK22334.htm. (Glass in table tops has been an issue with injuries over the past years and is not addressed in 16 CFR Part 1201.)

Currently, 16 CFR Part 1201 covers only doors, door leaves and such. Glazing materials, however, are being used in much broader expanses than in the past, and ANSI Z97.1 is commensurately broad. There is great confusion in the industry regarding which test methodology needs to be used in what circumstance and how different the tests are, as between the ANSI and CPSC standards. SGCC is often asked whether one test method is acceptable for the other. At present, manufacturers must shoulder the burden of paying for dual qualification testing when the adoption of a single test procedure could avoid that unnecessary duplication.

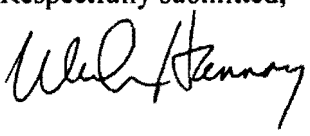
ANSI Z97.1 broadly defines and applies to safety glazing products for all applications, while 16 CFR Part 1201 applies more narrowly. The existence of two test methodologies for the two standards creates confusion among members of the industry, the consuming public, and the building code community. Because of this confusion, various specifying entities reference one or both standards. This in turn forces most manufacturers to perform redundant testing to both standards. This creates wasted expense and a misutilization of resources.

CONCLUSION

For these reasons, SGCC respectfully requests that this petition be docketed for public comment and urges the Commission to publish the revised 16 CFR § 1201.4 as a proposed rule and move rapidly towards issuance of the revision as a final rule under the Consumer Product Safety Act.

DATED: June 26, 2012

Respectfully submitted,



William M. Hannay
Counsel for Safety Glazing Certification Council
Schiff Hardin LLP
233 S. Wacker Drive, Suite 6600
Chicago IL 60606

EXHIBIT A

§ 1145.5 Emberizing materials (embers and ash) containing respirable free-form asbestos; risk of cancer associated with inhalation of asbestos fibers.

(a) The Commission finds that it is in the public interest to regulate the risk of cancer associated with inhalation of asbestos fibers from artificial emberizing materials (embers and ash) containing respirable free-form asbestos under the Consumer Product Safety Act (CPSA) rather than under the Federal Hazardous Substances Act (FHSA) because of the desirability of avoiding possibly lengthy, resource-consuming, inefficient rulemaking proceedings under the FHSA, and because of the availability of civil penalties under the CPSA for knowing noncompliance.

(b) Therefore, artificial emberizing materials (embers and ash) containing respirable free-form asbestos are regulated under the CPSA.

[42 FR 63354, Dec. 15, 1977]

§§ 1145.9–1145.15 [Reserved]

§ 1145.16 Lighters that are intended for igniting smoking materials and that can be operated by children; risks of death or injury.

(a) The Commission finds that it is in the public interest to regulate under the Consumer Product Safety Act any risks of injury associated with the fact that lighters intended for igniting smoking materials can be operated by young children, rather than regulate such risks under the Federal Hazardous Substances Act or the Poison Prevention Packaging Act of 1970.

(b) Therefore, if the Commission finds regulation to be necessary, risks of death or injury that are associated with lighters that are intended for igniting smoking materials, where such risks exist because the lighters can be operated by young children, shall be regulated under one or more provisions of the Consumer Product Safety Act. Other risks associated with such lighters, and that are based solely on the fact that the lighters contain a hazardous substance, shall continue to be regulated under the Federal Hazardous Substances Act.

[58 FR 37556, July 12, 1993]

§ 1145.17 Multi-purpose lighters that can be operated by children; risks of death or injury.

(a) The Commission finds that it is in the public interest to regulate under the Consumer Product Safety Act any risks of injury associated with the fact that multi-purpose lighters can be operated by young children, rather than to regulate such risks under the Federal Hazardous Substances Act or the Poison Prevention Packaging Act of 1970.

(b) Therefore, if the Commission finds regulation to be necessary, risks of death or injury that are associated with multi-purpose lighters because the lighters can be operated by young children shall be regulated under one or more provisions of the Consumer Product Safety Act. Other risks that are associated with such lighters, and that are based solely on the fact that the lighters contain a hazardous substance, shall continue to be regulated under the Federal Hazardous Substances Act.

[64 FR 71884, Dec. 22, 1999]

PART 1201—SAFETY STANDARD FOR ARCHITECTURAL GLAZING MATERIALS

Subpart A—The Standard

Sec.

1201.1 Scope, application and findings.
1201.2 Definitions.
1201.3 General requirements.
1201.4 Test procedures.
1201.5 Certification and labeling requirements.
1201.6 Prohibited stockpiling.
1201.7 Effective date.
FIGURE 1 TO SUBPART A—GLASS IMPACT TEST STRUCTURE
FIGURE 2 TO SUBPART A—TEST FRAME
FIGURES 3 AND 4 TO SUBPART A—TEST SPECIMENS
FIGURE 5 TO SUBPART A—IMPACTOR

Subpart B [Reserved]

Subpart C—Statements of Policy and Interpretation

1201.40 Interpretation concerning bathtub and shower doors and enclosures.

AUTHORITY: Secs. 2, 3, 7, 8, 14, 19, Pub. L. 92-573, 86 Stat. 1212-17; (15 U.S.C. 2051, 2052, 2056, 2058, 2063, 2068).

SOURCE: 42 FR 1441, Jan. 6, 1977, unless otherwise noted.

Subpart A—The Standard

§ 1201.1 Scope, application and findings.

(a) *Scope.* This part 1201, a consumer product safety standard, prescribes the safety requirements for glazing materials used or intended for use in any of the following architectural products:

(1) Storm doors or combination doors.

(2) Doors.

(3) Bathtub doors and enclosures.

(4) Shower doors and enclosures.

(5) [Reserved]

(6) Sliding glass doors (patio-type).

It also requires that these architectural products which incorporate glazing materials be constructed with glazing materials that meet the requirements of this part. The safety requirements are designed to reduce or eliminate unreasonable risks of death or serious injury to consumers when glazing material is broken by human contact.

(b) *Application.* This part 1201 shall apply to glazing materials, as that term is defined in § 1201.2(a)(11), for use in the architectural products listed in paragraph (a) of this section; and to those architectural products listed in paragraph (a) of this section if they are made with, or incorporate glazing materials as that term is defined in § 1201.2(a)(11). The standard applies to glazing materials and architectural products incorporating glazing materials that are produced or distributed for sale to or for the personal use, consumption or enjoyment of consumers in or around a permanent or temporary household or residence or in recreational, school, public, or other buildings or parts thereof. This part 1201 applies only to those glazing materials manufactured after the effective date of the standard; and to those architectural products identified in paragraph (a) of this section that are manufactured after the effective date of the standard. Thus, architectural products identified in paragraph (a) of this section manufactured after the effective date of the standard must incorporate glazing materials that comply with the standard. For purposes of this standard, fabricators are considered to be manufacturers of the architectural products listed in paragraph (a) of this section. Architectural glazing materials used in the products listed in paragraph (a) of this section and used in mobile homes are not subject to the provisions of this part 1201. While this part 1201 prescribes a test method to determine whether glazing materials subject to this part 1201 standard meet the requirements of the standard, the standard itself does not require that a manufacturer test any glazing materials or products subject to the standard. All obligations of manufacturers to perform testing are imposed by section 14 of the Consumer Product Safety Act and certification regulations which will be established by a separate rulemaking proceeding. However, the Commission intends to use the test procedures set forth in this part 1201 to determine whether materials and products subject to the standard meet the requirements of the standard.

(c) *Exemptions.* The following products, materials and uses are exempt from this part 1201:

(1) Wired glass used in doors or other assemblies to retard the passage of fire, where such door or assembly is required by a federal, state, local, or municipal fire ordinance.

(2) Louvers of jalousie doors;

(3) Openings in doors through which a 3 inch diameter sphere is unable to pass;

(4) Carved glass (as defined in § 1201.2(a)(36)), dalle glass (as defined in § 1201.2(a)(37)), or leaded glass (as defined in § 1201.2(a)(14)), which is used in doors and glazed panels (as defined in §§ 1201.2(a)(7) and (a)(10)) if the glazing material meets all of the following criteria:

(i) The coloring, texturing, or other design qualities or components of the glazing material cannot be removed without destroying the material; and

(ii) The primary purpose of such glazing is decorative or artistic; and

(iii) The glazing material is conspicuously colored or textured so as to be plainly visible and plainly identifiable as aesthetic or decorative rather than functional (other than for the purpose of admitting or controlliing admission

of light components or heat and cold); and

(iv) The glazing material, or assembly into which it is incorporated, is divided into segments by conspicuous and plainly visible lines.

(5) Glazing materials used as curved glazed panels in revolving doors;

(6) Commercial refrigerated cabinet glazed doors.

(d) *Findings*[1]—(1) *The degree and nature of the risk of injury the rule is designed to eliminate or reduce.* The Commission finds that the nature of the risks of injury this standard is designed to eliminate or reduce are as follows:

(i) Lacerations, contusions, abrasions, and other injury or death resulting from walking or running into glazed doors or sliding glass doors believed to be open or glazed panels mistaken as a means of ingress or egress, or pushing against glazing material in doors or glazed panels in an attempt to open a door.

(ii) Lacerations, contusions, abrasions, and other injury or death resulting from accidentally falling into or through glazed doors, sliding glass doors, glazed panels, bathtub doors and enclosures and shower doors and enclosures.

(iii) Lacerations, contusions, abrasions, and other injury or death resulting from the act of installing, replacing, storing or otherwise manipulating glazing material in doors, sliding glass doors, glazed panels, bathtub doors and enclosures and shower doors and enclosures, or from broken glazing material in doors, sliding glass doors, glazed panels, bathtub doors and enclosures and shower doors and enclosures. The Commission estimates that 73,000 injuries associated with architectural glazing materials in the architectural products within the scope of this standard were treated in hospital emergency rooms during 1975, and that about 2,400 of these injuries required the patients to be hospitalized. Extrapolating to total injuries in the United States the Commission further estimates that approximately 190,000 injuries were associated with architectural glazing products covered by this standard. Although injuries occur at any age, children aged 14 and under appear to be at particular risk of injury since as a group they represent approximately half the injuries while comprising less than 30 percent of the population. Lacerations are the most common injuries associated with architectural glazing materials and account for 72 percent to 93 percent of the injuries associated with the architectural products identified in paragraph (a) of this section. These lacerative injuries span a broad spectrum of severity and extent of body part affected. During 1975, an estimated 200 injuries were treated in emergency rooms for lacerations over 25 to 50 percent of the victims' bodies and over 7,000 persons were treated for lacerations to the head or face. On the basis of all injury information available to the Commission, it is apparent that the severity of the injuries associated with architectural glazing materials ranges from minor cuts to damage to tendons, nerves, muscles, and blood vessels resulting in extensive surgery. Peripheral nerve injuries result in varying degres of loss in sensation and motion which may never be restored completely. Tendon and muscle injuries may involve loss of movement. Some victims of architectural glazing material incidents are disfigured, and sustain emotional trauma as well. Severing of arteries and veins has led to death. One way of quantifying the extent of the public health problem relating to injuries associated with products is to estimate the total number of disability days resulting from the injuries. Using average days of restricted activity by age for specific injuries and body parts (Vital and Health Statistics, Series 10, Number 57, National

[1] The Commission's findings apply to the architectural glazing standard as issued at 42 FR 1426, on January 6, 1977. Since that date, the Commission has revoked portions of the standard which prescribed requirements for "glazed panels" (45 FR 57383, August 28, 1980); an accelerated environmental durability test for plastic glazing materials intended for outdoor exposure (45 FR 66002, October 6, 1980); and a modulus of elasticity test, a hardness test, and an indoor aging test applicable to plastic glazing materials (47 FR 27856, June 28, 1982). However, the findings have not been revised and they are therefore, not fully applicable to the remaining requirements of the standard.

Center for Health Statistics, U.S. Department of Health, Education, and Welfare), it is estimated that about 230,000 days of restricted activity resulted from injuries associated with architectural products which were treated in emergency rooms alone.

(2) *The approximate number of consumer products, or types or classes thereof, subject to the standard.* The types of glazing materials affected by or subject to the standard are laminated glass, tempered glass, wired glass, organic-coated glass, annealed glass, and plastics. Architectural products that incorporate the aforementioned glazing materials that are also affected by or subject to the standard are: storm doors or combination doors, doors, bathtub doors, and enclosures, shower doors and enclosures, glazed panels and sliding glass doors (patio-type) (see paragraph (a) of this section). The Commission has estimated that 13 to 16 percent of the total market for glazing material incorporated in products within the scope of the standard will be affected by the standard. Most of the glazing subject to the standard is currently covered by state safety glazing legislation. To date, more than 30 states have enacted safety glazing legislation, but this legislation is neither consistent nor completely uniform among states. Annual markets for the architectural products which incorporate glazing material and that are within the scope of the standard have been estimated by the Commission in terms of square feet of glazed area and number of units. The market for glazing material incorporated in products within the scope of the standard was estimated to be 234.8 million square feet in 1975. These figures are discussed in the Economic Impact Statement, pp. 3–7, and appendix A to the Economic Impact Statement, pp. 18–30, which are available for review in the Office of the Secretary of the Commission, Washington, D.C. 20207.

(3) *The need of the public for the architectural glazing material and products incorporating that glazing material subject to the standard, and the probable effect of the standard upon the utility, cost or availability of those products to meet the need of the public*—(i) *The need of the public for the architectural glazing materials and products incorporating that glazing material.* The need of the public for architectural products within the scope of the standard incorporating glazing material is substantial since these products serve such functions as transmission of light, visual communication, protection from weather, ventilation, and indoor climate control, and since reasonable substitutes for these products do not exist as a group. Each of the types of glazing material subject to the standard has individual properties which meet public needs, although one type of glazing material is often an acceptable substitute for another.

(ii) *Probable effect of the standard upon the cost of architectural glazing materials and architectural products incorporating the glazing material to meet the need of the public for the products.* The probable cost effects of the standard for architectural glazing materials are listed below.

(A) The cost impact of the standard on consumers will be concentrated in those states with no present state safety glazing legislation. In those states, the average increase in cost per housing start resulting from the standard is estimated to range from $30 to $50, or approximately one-tenth of one percent of the price of a typical new house; and the cost for residential remodeling and replacement is expected to be in the range of $0.25 to $0.30 per household annually.

(B) The increased cost of glazing material for nonresidential uses will be paid ultimately by consumers through higher prices of goods and services. Generally, the increased cost of glazing is not passed to consumers immediately, but is spread over the life of the nonresidential structure. Therefore, the increased cost to consumers for glazing material in nonresidential structures will probably rise slowly over time to an annual level of approximately $1.10 per household in states with no safety glazing legislation and $0.20 to $0.50 per household in the other states. In many of the states with state regulations, the impact of the standard on residential construction and new housing prices will be near zero, since most of the glazing is currently covered by the state glazing legislation.

(C) The probable effect of the standard on the various glazing materials within the scope of the standard will differ. The retail price of laminated glass used in some Category II applications will probably increase by 10 to 15 percent per square foot. The incremental cost to consumers for ungraded laminated glass is estimated to be approximately $0.14 per household, annually. The cost to consumers for tempered glass, organic-coated glass, and plastics is not expected to increase because of the standard. Information available to the Commission indicates that the technology needed for producing wired glass which can comply with the standard is not readily available. See appendix A of the Economic Impact Statement, pp. 45–56, for the incremental cost calculation by product category and application.

(iii) *Probable effect of the standard upon the utility of architectural glazing materials and architectural products incorporating the glazing materials to meet the need of the public for the products.* The probable effect of the standard in regard to the utility of architectural glazing materials and the architectural products incorporating glazing material should be to increase the utility of the products. The basic effect of the standard would be the substitution of certain safer glazing materials for annealed glass in certain architectural products. The Commission believes that such a substitution would increase utility for most consumers because of the usually increased durability of the glazing material that complies with the Commission's standard, and the knowledge that the product incorporating the glazing material is safer. There will be disutility for those consumers who prefer non-complying wired glass and organic-coated glass when these materials become unavailable for certain applications due to their likely inability to comply with the standard. However, the share of the glazing material market claimed by organic-coated and wired glass is small.

(iv) *Probable effect of the standard upon the availability of architectural glazing materials and architectural products incorporating the glazing materials to meet the need of the public for the products.* The Commission finds that the proposed standard should not have impacts of significant magnitude on the availability of architectural products within the scope of the standard, since domestic production capacity appears to be sufficient to handle any increased demand for glazing material to be used in those products. In addition, an increased demand for raw materials necessary to manufacture glazing materials that comply with the standard will be small in comparison to the volume of raw materials currently used for glazing for the products that will be subject to the standard. Furthermore, no major change in demand for the architectural products subject to the standard incorporating glazing materials which would affect production is expected. The Commission finds that, in the absence of technological advances, certain glazing materials will no longer be available for particular applications. Unless technological advances are made, wired glass will be unavailable for use in the architectural products within the scope of the standard with the exception of fire door applications where special provisions of the standard apply. Similarly, organic-coated glass which has the film applied to annealed glass at the factory may no longer be available for Category II products due to an inability to pass those impact test provisions of the standard. The availability of glass replacement glazing in residential applications may be reduced, since plastic glazing often will be the only economical material available to consumers when immediate replacement is needed.

(4) *Any means of achieving the objectives of the standard while minimizing adverse effects on competition or disruption or dislocation of manufacturing and other commercial practices consistent with the public health and safety.* The Commission has considered other means of achieving the objective of the standard, but has found none that it believes would have fewer adverse effects on competition or that would cause less disruption or dislocation of manufacturing and other commercial practices, consistent with the public health and safety. For the glazing industry in general, the disruptions and dislocations

of existing manufacturing and commercial practices due to the standard are expected to be minor. However, it is possible that individual segments of the glazing materials industry are likely to be adversely affected by the standard. Specifically, there is likely to be disruption to the wired glass market, the organic-coated glass market and, to a lesser extent, to the laminated glass market. Manufacturers of wired glass will face a serious problem because technological improvements in the product will need to be made before wired glass can be used in Category I applications and because it probably will not be usable at all in Category II applications (see § 1201.2(a) (3) and (4) of the standard), since there appears to be little prospect at this time of developing a wired glass product capable of withstanding the Category II, 400 foot pound impact test prescribed in § 1201.4 of the standard. Laminated glass currently used for Category I applications can meet the 150 foot pound impact test requirements, but not all laminated glass currently used for Category II applications can meet the 400 foot pound impact test requirements. The price increase for technologically upgrading laminated glass will be borne by consumers. The Commission believes, however, that the competitive impact of the proposed changes would not severely weaken the position of laminated glass in the market place. The wired glass, organic-coated glass, and laminated glass markets affected by the standard are small in relation to the entire industry. The standard is not expected to have an appreciable impact on foreign or domestic competition. Increased competition is expected between primary glass temperers and regional temperers, with primary temperers taking an increased share of the original storm door, sliding door, bathtub enclosure and shower door markets. Sales of nonresidential glazing for major nonresidential buildings will remain with the primary glass companies. The regional temperers are expected to handle almost all the tempering of glazing for smaller nonresidential buildings. Thus, they will gain some of this market at the expense of local dealers and distributors. However, the distributors and dealers probably will operate as order takers for the smallest jobs. It is expected that glazing distributors and dealers will experience reduced market shares in both the residential and nonresidential new glazing markets. This will occur as a result of the transfer of business to the primary glass manufacturers and regional temperers, since tempered glass must be produced to size and it is not feasible to keep in inventory all sizes which might be needed.

(5) *Summary finding.* The Commission finds that there are unreasonable risks of injury associated with architectural glazing materials used in the architectural products listed in paragraph (a) of this section. In assessing the question of whether unreasonable risks of injury or injury potential are associated with architectural glazing materials, the Commission has balanced the degree, nature and frequency of injury against the potential effect of the standard on the ability of architectural glazing materials to meet the need of the public and the effect of the standard on the cost, utility, and availability of architectural glazing materials to meet that need. The Commission finds that this standard, including its effective date, is reasonably necessary to eliminate or reduce the unreasonable risks of injury associated with architectural glazing materials and that promulgation of the standard is in the public interest.

(Sec. 9(e), Pub. L. 92-573, 86 Stat. 1215 (15 U.S.C. 2058(e)) (5 U.S.C. 553)

[42 FR 1441, Jan. 6, 1977, as amended at 43 FR 57246 Dec. 7, 1978; 45 FR 57389, Aug. 28, 1980; 47 FR 27856, June 28, 1982; 49 FR 7107, Feb. 27, 1984]

§ 1201.2 Definitions.

(a) As used in this part 1201:

(1) *Annealed glass* means glass that has been subjected to a slow, controlled cooling process during manufacture to control residual stresses so that it can be cut or subjected to other fabrication. Regular polished plate, float, sheet, rolled, and some patterned surface glasses are examples of annealed glass.

(2) *Bathtub doors and enclosures* means assemblies of panels and/or doors that are installed on the lip of or immediately surrounding a bathtub.

(3) *Category I products* means any of the following architectural products:

(i) Storm doors or combination doors that contain no single piece of glazing material greater than 9 square feet (0.83 square meters) in surface area of one side of the piece of glazing material.

(ii) Doors that contain no single piece of glazing material greater than 9 square feet (0.83 square meters) in surface area of one side of the piece of glazing material.

(4) *Category II products* means any of the following architectural products:

(i) Shower doors and enclosures.

(ii) Bathtub doors and enclosures.

(iii) Sliding glass doors (patio type).

(iv) Storm doors or combination doors that contain any piece of glazing material greater than 9 square feet (0.83 square meters) in surface area of one side of the piece of glazing material.

(v) Doors that contain any piece of glazing material greater than 9 square feet (0.83 square meters) in surface area of one side of the piece of glazing material.

(5) *Distributor* means a person to whom a consumer product is delivered or sold for purposes of distribution in commerce, including persons cutting glazing material to size, except that such term does not include a manufacturer or retailer of such product.

(6) *Distribution in commerce* means to sell in commerce, to introduce or deliver for introduction into commerce, or to hold for sale or distribution after introduction into commerce.

(7) *Door* means an assembly that is installed in an interior or exterior wall; that is movable in a sliding, pivoting, hinged, or revolving manner of movement; and that is used by consumers to produce or close off an opening for use as a means of human passage.

(8) *Fabricator* means any person who assembles or otherwise incorporates glazing materials into an architectural product listed in §1201.1(a). A fabricator is considered a manufacturer as defined in paragraph (a)(16) of this section.

(9) *Glass* means a hard, brittle, amorphous substance produced by fusion, usually consisting of mutually dissolved silica and silicates that also contains sods and lime. It may be transparent, translucent, or opaque.

(10) [Reserved]

(11) *Glazing material* means glass, including annealed glass, organic coated glass, tempered glass, laminated glass, wired glass; or combinations thereof where these are used:

(i) In openings through the architectural products listed in §1201.1(a), or

(ii) As the architectural products themselves, e.g. unframed doors.

(12) *Jalousie door* means a door (as "door" is defined in paragraph (a)(7) of this section) having an opening glazed with operable, overlapping louvers. Each louver is one of a series of overlapping pieces of glazing material designed to admit ventilation and light but exclude rain and is typically operated by a crank and gear mechanism.

(13) *Laminated glass* means glazing material composed of two or more pieces of glass, each piece being either tempered glass, heat strengthened glass, annealed glass or wired glass, bonded to an intervening layer or layers of resilient plastic material.

(14) *Leaded glass* means a decorative composite glazing material made of individual pieces of glass whose perimeter is enclosed by lengths of durable metal such as lead or zinc and the pieces of glass are completely held together and supported by such metal. Such pieces of glass can be clear, colored, beveled, painted, or flashed and etched.

(15) *Manufacture* means to manufacture, produce or assemble.

(16) *Manufacturer* means any person who manufactures, fabricates or imports a glazing material or architectural product listed in §1201.1(a) that incorporates glazing material.

(17) *Mirror* means a treated, polished or smooth glazing material that forms images by the reflection of light.

(18) *Mobile home* means a structure transportable in one or more sections, which is eight body feet (2.4 body meters) or more in width and is thirty-two body feet (9.7 body meters) or more in length, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities.

(19) *Other buildings or parts thereof* means buildings or parts thereof (other than residential, school, public, or recreational buildings) in which all or part of the building is open to the public with or without specific invitation. Included are buildings or parts thereof such as banks and recreational or retail facilities in a building and multiuse buildings that contain residential units.

(20) *Organic-coated glass* means a glazing material consisting of a piece of glass, coated and bonded on one or both sides with an applied polymeric coating, sheeting, or film.

(21) *Patio door* (See "sliding glass doors (patio-type)" in paragraph (a)(31) of this section).

(22) *Permanent label* means a label that will remain permanently legible and visible after installation of the glazing material and that would be destroyed in attempts to remove it from the glazing material and includes (but is not limited to) sandblast, acid etch, hot-stamp, and destructible polyester labels.

(23) [Reserved]

(24) *Private labeler* means an owner of a brand or trademark on the label of a consumer product which bears a private label, and includes any fabricator, distributor, or installer who cuts certified and permanently labeled glazing materials into smaller pieces.

(25) *Public building* means a building of public assembly or meeting including (but not limited to) a museum, place of worship, or restaurant.

(26) *Recreational building* means a building used for recreational purposes including (but not limited to) a theater, stadium, gymnasium, amusement park building or library.

(27) *Residential building* means a building, permanent or temporary, such as a single or multifamily residence, including (but not limited to) a house, apartment building, lodging home, dormitory, hotel, motel, hospital, sanitarium, and nursing home, used as a dwelling for one or more persons or families and any structure which is attached to, a part of, or appurtenant to such a building. Public areas of all residential buildings, such as lobbies and other common facilities, are included within the definition of "other buildings or parts thereof" in paragraph (a)(19) of this section. For purposes of this part 1201, a mobile home as defined in paragraph (a)(18) of this section is not considered to be a residential building.

(28) *Retailer* means a person to whom a consumer product is delivered or sold for purposes of sale or distribution by such person to a consumer; the term retailer includes a person who cuts glazing material to size for consumers.

(29) *School building* means a building designed primarily for the conduct of educational instruction and includes the classrooms, libraries, administrative offices, auditoriums, eating and sanitary facilities, stadiums, gymnasiums and all other structures associated with such buildings.

(30) *Shower door and enclosure* means an assembly of one or more panels installed to form all or part of the wall and or door of a shower stall.

(31) *Sliding glass door (patio-type)* means an assembly of one or more panels, at least one of which is suitably movable for use as a means of human ingress or egress. The term includes the nonmovable and movable panels of such assembly.

(32) *Storm door (or combination door)* means a movable assembly, used in tandem with an exterior door to protect the exterior door against weather elements and/or to improve indoor climate control.

(33) *Tempered glass* means a piece of specially heat treated or chemically treated glass that cannot be cut, drilled, ground, or polished after treatment without fracture. When fractured at any point, if highly tempered, the entire piece breaks into small particles.

(34) *Wired glass* means a single piece of annealed glass that contains wire embedded in the body of the glass.

(35) *Commission* means the Consumer Product Safety Commission.

(36) *Carved glass* means a decoration glazing material in which a permanent visible design has been produced by polishing, grinding, or otherwise removing portions of the surface.

(37) *Dalle glass* or dalle de verre (including faceted glass) means a decorative composite glazing material made of individual pieces of glass which are

INSERT

§ 1201.4 Test Procedures

Testing shall be in accordance with the test provisions of ANSI Z97.1 (most current version), "American National Standard for Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test." 2/

2/ Copies of ANSI Standard Z97.1 (most current version) are available from the American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, or online at http://webstore.ansi.org/FindStandards.aspx?SearchString=Z97.1&SearchOption=0&PageNum=0&SearchTermsArray=null%7cZ97.1%7cnull.

imbedded in a cast matrix of concrete or epoxy.

(b) Definitions given in the Consumer Product Safety Act, and not repeated in this section, are applicable to this part.

(c) Test methods and recommended practices published by the American Society for Testing and Materials (ASTM) [1], and referred to in this part 1201, are hereby incorporated by reference into this part.

(d) Test methods and recommended practices published by the American National Standards Institute (ANSI) and referred to in this part 1201, are hereby incorporated by reference into this part.

(Sec. 9(e), Pub. L. 92-573, 86 Stat. 1215; (15 U.S.C. 2058(e); (5 U.S.C. 553))

[42 FR 1441, Jan. 6, 1977, as amended at 42 FR 61860, Dec. 7, 1977; 43 FR 50422, Oct. 30, 1978; 43 FR 57247, Dec. 7, 1978; 45 FR 57389, Aug. 28, 1980; 47 FR 27856, June 28, 1982]

§ 1201.3 General requirements.

(a) All glazing materials to which this standard applies, as described in § 1201.1, shall meet the impact and environmental test requirements in § 1201.4, and shall be labeled by manufacturers in accordance with § 1201.5.

(b) Glazing materials used in architectural products not listed in § 1201.1(a) are not subject to this part. Any material not listed in the definition of "glazing material" in § 1201.2(a)(11) is not subject to this part 1201.

[42 FR 1441, Jan. 6, 1977, as amended at 47 FR 27856, June 28, 1982]

§ 1201.4 Test procedures.

(a) *Types of tests*—(1) *Impact test.* Specimens shall be struck as prescribed by paragraph (d)(1) of this section using equipment specified by paragraphs (b) (1) and (2) of this section. Results of the impact test are to be interpreted in accordance with paragraph (e)(1) of this section. The test specimens shall be selected in accordance with paragraphs (c) (1) and (2) of this section.

(2) *Accelerated environmental durability tests.* Each specimen of glazing material subject to this part 1201 shall be tested in accordance with the accelerated tests referenced in table 1, "Accelerated Tests" of this section. However, tempered glass, wired glass, and annealed glass are not required to be subjected to the accelerated environmental durability tests.

TABLE 1—ACCELERATED TEST (APPLICABLE PARAGRAPHS)

Glazing materials	Specimen	Test equipment	Exposure	Criteria for passing
Laminated glass	§ 1201.4(c)(1) and (c)(3)(i)	§ 1201.4(b)(3)(i)	§ 1201.4([illegible])(2)(i)	§ 1201.4(e)(2)(i)
Organic coated glass	§ 1201.4(c)(1) and (c)(3)(ii)(B)	§ 1201.4(b)(3)(ii)	§ 1201.4([illegible])(2)(ii)(B)	§ 1201.4(e)(2)(ii)(B)
Tempered glass	Exempt			
Wired glass	Exempt			
Annealed glass	Exempt			

(3) Separate testing is required for different glazing materials or for differences within a type of glazing material that could noticeably affect performance in the impact or environmental durability tests. Such differences could include (but are not limited to): Nominal thickness or thicknesses, method of manufacture (in appropriate cases), types and amounts of additives, and composition of base materials and adhesives.

(b) *Test equipment*—(1) *Impact test frame and subframe.* (See figures 1, 2, 3, and 4.) (i) The impact test frame shall be constructed to minimize movement and deflection of its members during testing. For this purpose, the structural framing and bracing members shall be steel angles 3 inches by 5 inches by ¼ inch (7.7 centimeters by 12.7 centimeters by 0.7 centimeters) or other sections and materials of equal or greater rigidity.

[1] ASTM test methods and recommended practices are approved by, published by, and available for purchase from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

(ii) The structural framing shall be welded or securely bolted at the corners and braced by one of the alternate methods shown in figure 1 and shall be securely bolted to the floor.

(iii) The inner subframe (see figures 2, 3, and 4) for securing the test specimen on all four edges shall be reinforced at each corner. The material is shown as wood in figure 3, but other materials may be used: *Provided,* The test specimen will contact only the neoprene strips, which shall have a shore A durometer hardness of 30 to 50.

(iv) Any reasonable means may be used to secure the subframe to the test frame so long as the mounting is secure and the pressure on the glazing in the subframe is not significantly altered when the subframe is removed.

(v) Pressures on the test specimen shall be controlled, and the compression of the neoprene strips shall be between 10 and 15 percent of the original thickness of the neoprene. Securing methods such as wing bolts and clamps shall be uniformly spaced no greater than 18 inches (45 centimeters) apart with no fewer than two on any edge. To limit the compression of the neoprene and prevent distortion of the subframe, metal shims of an appropriate thickness shall be used as shown in figures 3 and 4.

(2) *Impactor.* (i) The impactor shall be a leather punching bag as shown in figure 5 on this section. The bag shall be filled with No. 7½ chilled lead shot to a total weight of completed assembly as shown in figure 5, of 100 pounds ±4 ounces (45.36±0.11 kilograms). The rubber bladder shall be left in place and filled through a hole cut into the upper part. After filling the rubber bladder, the top should be either twisted around the threaded metal rod below the metal sleeve or pulled over the metal sleeve and tied with a cord or leather thong. Note that the hanging strap must be removed. The bag should be laced in the normal manner. The exterior of the bag shall be completely covered by ½ inch (1.3 centimeters) wide glass filament reinforced pressure sensitive tape. (Figure 5.)

(ii) Provisions shall be made for raising the impactor or to drop heights of up to 48 inches (1.22 meters). At its release it shall have been supported so that the rod going through its center was in line with the steel support cable in a manner designed to minimize wobble or oscillation after its release.

(3) *Environmental durability test equipment*—(i) *Boil test.* Two containers of water shall be provided with means to maintain one at 150° ±5 °F (66° ±2 °C) and the second at a slow boil at atmospheric pressure. The containers shall be large enough to accept a rack holding three specimens, each 12 inches (30 centimeters) square, of the glazing material in a vertical position. The rack shall be positioned so that each specimen is surrounded by at least one inch (2.5 centimeters) of water.

(ii) *Simulated weathering test.* The equipment shall be a xenon arc (water-cooled) Weather-Ometer employing a lamp rated at 6500 watts and automatic light monitoring and control systems. Borosilicate inner and outer filters shall be used. An appropriate water spray cycle shall be used. Operating procedures shall be in accordance with ASTM G 26–70, "Standard Recommended Practice for Operating Light—and Water-Exposure Apparatus (Xenon-Arc Type) for Exposure of Nonmetallic Materials," April 13, 1970, as augmented for plastics by ASTM D 2565–70, "Standard Recommended Practice for Operating Xenon-Arc Type (Water-Cooled) Light- and Water-Exposure Apparatus for Exposure of Plastics," Procedure B, June 12, 1970, which are incorporated by reference. Copies of both documents are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103. They are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* This incorporation by reference was approved by the Director of the Federal Register. These materials are incorporated as they exist in the edition which has been approved by the Director of the Federal Register and which has been filed with the Office of the Federal Register.

(c) *Test specimens*—(1) *Condition of specimens.* All specimens shall be tested

as supplied by the manufacturer, following removal of any temporary protective masking materials. No tests shall be commenced before the specimens have been stored in the laboratory for 4 hours. Specimens shall be arranged to permit free circulation of air to all surfaces during this period.

(2) *Impact specimens.* Impact specimens shall be of the largest size manufactured up to a maximum width of 34 inches (86 centimeters) and a maximum height of 76 inches (1.9 meters). Specimens shall be tested for each nominal thickness offered by the manufacturer.

(3) *Environmental durability specimens*—(i) *Boil test.* Three pieces 12 inches by 12 inches (30 centimeters by 30 centimeters) with nominal thickness identical to those submitted for the impact test shall be used.

(ii) *Weathering tests*—(A) [Reserved]

(B) *Organic-coated glass*—(*1*) *Orientation specified.* Six organic-coated glass specimens 2 inches by 6 inches (5 centimeters by 15 centimeters) by nominal thickness identical to those submitted for the impact test shall be used.

(*2*) *Orientation unspecified.* Nine organic-coated glass specimens, 2 inches by 6 inches (5 centimeters by 15 centimeters) by nominal thickness identical to those submitted for the impact test shall be used except that when the glazing material is symmetric across its thickness, six specimens may be used.

(iii) *Indoor service.* Four additional samples identical to those submitted for the impact test.

(d) *Test procedures*—(1) *Impact test procedure.* Each specimen shall be struck within 2 inches (5 centimeters) of its geometric center with the impactor dropped from a single height, designated according to the product category. Specimens for Category I shall be impacted one time from a drop height of 18 to 18½ inches (458 to 470 millimeters). Specimens for Category II shall be impacted one time from drop height of 48 to 48½ inches (1.22 to 1.23 meters). For all specimens that are not symmetric from surface to surface, an equal number of specimens shall be impacted on each side. For glazing materials which will be evaluated by paragraph (e)(1)(iii) of this section, this impact test procedure is not required.

(2) *Environmental durability test procedures*—(i) *Boil test.* The specimens shall be immersed in the 150 F (66 °C) water for 3 minutes. They shall then be quickly removed and immersed in the boiling water and left there for 2 hours. The specimens shall then be removed, cooled, and dried for examination as specified in paragraph (e)(2)(i) of this section.

(ii) *Accelerated weathering test.* The specimens shall be retained in the Weather-Ometer (paragraph (b)(3)(ii) of this section) for a period of 1200±1 hours, and exposed to a radiant flux of 50 microwatts per square centimeter (12 calories per second per square centimeter) while monitoring at a wavelength of 340 nanometers.

(A) [Reserved]

(B) *Organic-coated glass*—(*1*) *Orientation specified.* Three specimens shall be mounted with the surface that is intended to be oriented indoors faced away from the radiation source; the other three specimens shall be kept in darkness at 73 °F (23 °C) for use as controls. Materials so tested shall be labeled according to §1201.5(c) of this part 1201.

(*2*) *Orientation unspecified.* Three specimens shall be mounted with one of the surfaces toward the radiation; three specimens shall be mounted with the other surface toward the radiation, and three specimens shall be kept in darkness at 73 °F (23 °C) for use as controls. When the glazing material is symmetric across its thickness, three specimens shall be irradiated.

(e) *Interpretation of results*—(1) *Impact test.* A glazing material may be qualified for use in both Category I and Category II products if it meets the impact requirements for Category II. A glazing material shall be judged to pass the impact test if the specimen tested meets any one of the criteria listed in paragraphs (e)(1) (i) through (v) of this section:

(i) When breakage occurs (numerous cracks and fissures may occur) no opening shall develop in the test sample through which a 3 inch (76 millimeter) diameter solid steel sphere, weighing 4 pounds ±3 oz (1.81±0.08 kilograms), passes when placed (not dropped) in the opening and permitted to remain for a period of one second

For this criterion, the sample after being impacted shall be placed, while remaining in the subframe, in a horizontal, impact side up position with a minimum of one foot (31 centimeters) of free space immediately beneath the specimen.

(ii) When breakage occurs, what appear to be the 10 largest particles shall be selected within 5 minutes subsequent to the test and shall weigh no more than the equivalent weight of 10 square inches (64 square centimeters) of the original specimen. For the purposes of this section *particle* means a portion of a broken test specimen which is determined by identifying the smallest possible perimeter around all points in the portion of the broken test specimen, always passing along cracks or exposed surfaces.

(iii) [Reserved]

(iv) The specimen does not remain within the subframe and no breakage is caused by the impactor.

(v) The specimen does not break.

(2) *Environmental durability tests*— (i) *Boil test.* The glass itself may crack in this test, but no bubbles or other defects shall develop more than ½ inch (12 millimeters) from the outer edge of the specimen or from any crack that may develop. Any specimen in which the glass cracks to an extent that confuses the interpretation of the results shall be discarded, and another specimen shall be tested in its stead.

(ii) *Accelerated weathering test*—(A) [Reserved]

(B) *Organic-coated glass.* Specimens shall be judged satisfactory if they pass both the adhesion test and the tensile test described below in paragraph (e)(ii)(B) (*1*) and (*2*) of this section.

(*1*) *Adhesion test (organic-coated glass only)*—(*i*) *Specimens.* The specimens for this test are the 2 inch by 6 inch (5 centimeters by 15 centimeters) weathered specimens and the control specimens. The specimens shall be conditioned just prior to the performance of the adhesion test at 73° ±6 °F (23° ±3 °C) and 50±5 percent relative humidity for 24 hours.

(*ii*) *Apparatus.* The test apparatus shall consist of a constant-rate-of-extension-type (CRE) tensile tester with the moving crosshead set to move at 12 inches per minute (5 millimeters per second) and load range such that the average pull force will fall at 30 to 50 percent of full scale. A cutter shall be used containing new razor blades for cutting 1 inch (25 millimeter) wide specimens of the organic coating on the glass. The razor blades shall be used one time only.

(*iii*) *Procedure.* Using the razor cutter, cut a straight, 1 inch (25 millimeter) wide strip of the organic coating in the lengthwise direction of the glass specimen along and within ¼ inch (6 millimeters) of one edge. Peel back, cleanly and evenly, about 2 inches (50 millimeters) of one end of the 1 inch (25 millimeters) wide organic strip. Attach a strip of reinforced pressure sensitive tape to the side of the organic strip opposite the adhesive, to extend this free end to about 8 inches (200 millimeters) in length. Place the end of the glass panel from which the organic strip was removed in the lower clamp of the tensile tester and and the free end of the tape in the upper clamp. Peel the remainder of the organic strip from the glass mechanically and obtain a record of the pull force value. Determine and record the average pull force value for each specimen from the chart. Weathered and control specimens are to be tested alternately.

(*iv*) *Interpretation of results.* The organic-coated glass adhesion shall be judged satisfactory if the average pull force for the weathered specimens is no less than 90 percent of the average pull force for the control specimens.

(*2*) *Tensile strength test (organic-coated glass only).* (*i*) The specimens for this test are the same 2 inch by 6 inch (5 centimeter by 15 centimeter) specimens used in the adhesion test.

(*ii*) *Apparatus.* The CRE tensile tester shall be used with the moving crosshead set to move at 2 inches per minute (0.8 millimeter per second) and the load range such that the specimens will break at 30 to 60% of full scale. A cutter shall be used containing new razor blades for cutting ½ inch (12 millimeter) wide specimens of the organic coating on the glass. The razor blades shall be used one time only.

(*iii*) *Procedure.* Using the ½ inch (12 millimeter) razor cutter, cut a straight strip of the organic coating in the

lengthwise direction of the glass specimen for the full 6 inch (15 centimeter) length. Carefully peel this strip from the glass panel and test it for breaking strength in the tensile tester.

(*iv*) *Interpretation of results.* The organic coating tensile strength shall be judged satisfactory if the average tensile value of the weathered specimens is no less than 75 percent of the average of the control specimens. Weathered and control specimens are to be tested alternately.

(Sec. 9(e) Pub. L. 92-573, 86 Stat. 1215; (15 U.S.C. 2058(e)); (5 U.S.C. 553); Sec. 9(h), Consumer Product Safety Act, as amended by the Consumer Product Safety Amendments of 1981 (Pub. L. 92-673, as amended by Pub. L. 97-35, 15 U.S.C. 2057(h)) and 5 U.S.C. 553)

[42 FR 1441, Jan. 6, 1977, as amended at 43 FR 43705, Sept. 27, 1978; 43 FR 57594, Dec. 8, 1978; 45 FR 66007, Oct. 6, 1980; 46 FR 63250, Dec. 31, 1981; 47 FR 27857, June 28, 1982]

§ 1201.5 Certification and labeling requirements.

(a) Manufacturers and private labelers of glazing materials covered by this part 1201 shall comply with the requirements of section 14 CPSA (15 U.S.C. 2063) and regulations issued under section 14.

(b) [Reserved]

(c) Organic-coated glass that has been tested for environmental exposure from one side only must bear a permanent label on the coating stating "GLAZE THIS SIDE IN" and shall bear in the central 50 percent of the surface area the following message in letters at least ¼ inch (7 millimeters) high: "SEE PERMANENT LABEL FOR IMPORTANT MOUNTING INSTRUCTION." The latter message shall be attached to either side of the glazing by any means which shall ensure the message will remain in place until installation.

[42 FR 1441, Jan. 6, 1977, as amended at 45 FR 66007, Oct. 6, 1980]

§ 1201.6 Prohibited stockpiling.

(a) *Stockpiling.* For the purposes of this section, the term *stockpiling* means manufacturing or importing the affected products between the date of issuance of this part in the FEDERAL REGISTER and the effective date set out below in § 1201.7 at a rate significantly greater (prescribed in paragraph (b) of this section) than the rate at which the affected products were produced or imported during a base period (prescribed in paragraph (c)(2) of this section).

(b) *Prohibited acts.* Manufacturers and importers of glazing materials, fabricators, and manufacturers or importers of architectural products specified in § 1201.1(a) who incorporate glazing material shall not incorporate glazing materials which do not comply with the requirements of this part 1201 into such products between the date of issuance of this part in the FEDERAL REGISTER and the effective date set out in § 1201.7 below at a rate greater than the rate of production or importation during the base period (defined in paragraph (c)(2) of this section) plus ten percent. For wired glass used in doors or other assemblies subject to this part 1201 and intended to retard the passage of fire, when such doors or other assemblies are required by a Federal, State, local or municipal fire ordinance, the rate of production during the base period may be increased annually by no more than 10 percent.

(c) *Definitions.* As used in this section:

(1) *Rate of production (or importation)* means the total number of affected architectural products incorporating glazing material not complying with this part manufactured or imported during a stated base period.

(2) *Base period* means, at the option of the manufacturer or importer, any period of 180 consecutive days prior to January 6, 1977, said period to be selected within an interval which begins July 6, 1975.

§ 1201.7 Effective date.

The effective date of this part 1201 shall be July 6, 1977 except:

(a) For glazing materials used in doors or other assemblies subject to this part and intended to retard the passage of fire when such doors or other assemblies are required by a Federal, State, or local or municipal fire ordinance, the effective date shall be January 6, 1980.

(b) Architectural glazing materials manufactured before July 6, 1977 may be incorporated into architectural products listed in § 1201.1(a) through July 5, 1978 if:

(1) The architectural glazing material conforms to ANSI Standard Z97.1-1972 or 1975, "Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings," 1972 or 1975[2], which is incorporated by reference, and

(2) The architectural glazing material is permanently labeled to indicate it conforms to ANSI Z97.1-1972 or 1975 or is accompanied by a certificate certifying conformance to ANSI Z97.1 1972 or 1975.

(c) Tempered glass manufactured before July 6, 1977 may be incorporated into architectural products listed in § 1201.1(a) through July 5, 1981 if:

(1) The tempered glass conforms to ANSI Z97.1-1972 or 1975; and

(2) The tempered glass is permanently labeled to indicate it conforms to ANSI Z97.1-1972 or 1975 or is accompanied by a certificate certifying conformance to ANSI Z97.1-1972 or 1975.

(d) Laminated glass manufactured on or after July 6, 1977 through December 3, 1977 may be incorporated into category II products as defined in § 1201.2(a)(4) through July 5, 1978 if:

(1) The laminated glass conforms to ANSI Z97.1-1972 or 1975; and

(2) The laminated glass is permanently labeled to indicate that it conforms to ANSI Z97.1-1972 or 1975 or is accompanied by a certificate in accordance with section 14(a) of the CPSA certifying conformance to ANSI Z97.1-1972 or 1975.

(e) Architectural products manufactured between July 6, 1977 and July 5, 1978 incorporating glazing material in accordance with paragraph (b) of this section, may be distributed and sold without restriction.

(f) Architectural products manufactured between July 6, 1977 and July 5, 1981 incorporating tempered glass in accordance with paragraph (c) of this section, may be distributed and sold without restriction.

(g) Architectural products identified in § 1201.2(a)(4) manufactured between July 6, 1977 and July 5, 1978 incorporating laminated glass in accordance with § 1201.7(d) may be distributed and sold without restriction.

(h) Patinaed glass manufactured between July 6, 1977 and January 8, 1979, in accordance with the Commission's stay order published in the FEDERAL REGISTER of August 9, 1977 (42 FR 40188), may be sold without restriction. Architectural products incorporating such glazing may also be sold without restriction.

[43 FR 50422, Oct. 30, 1978, as amended at 43 FR 57247, Dec. 7, 1978; 46 FR 63250, Dec. 31, 1981]

[2] Copies of ANSI Standard Z97.1-1972 or 1975 are available from the American National Standards Institute, 1430 Broadway, New York, New York 10018. They are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* This incorporation by reference was approved by the Director of the Federal Register. These materials are incorporated as they exist in the editions which have been approved by the Director of the Federal Register and which have been filed with the Office of the Federal Register.

FIGURE 1 TO SUBPART A OF PART 1201—GLASS IMPACT TEST STRUCTURE

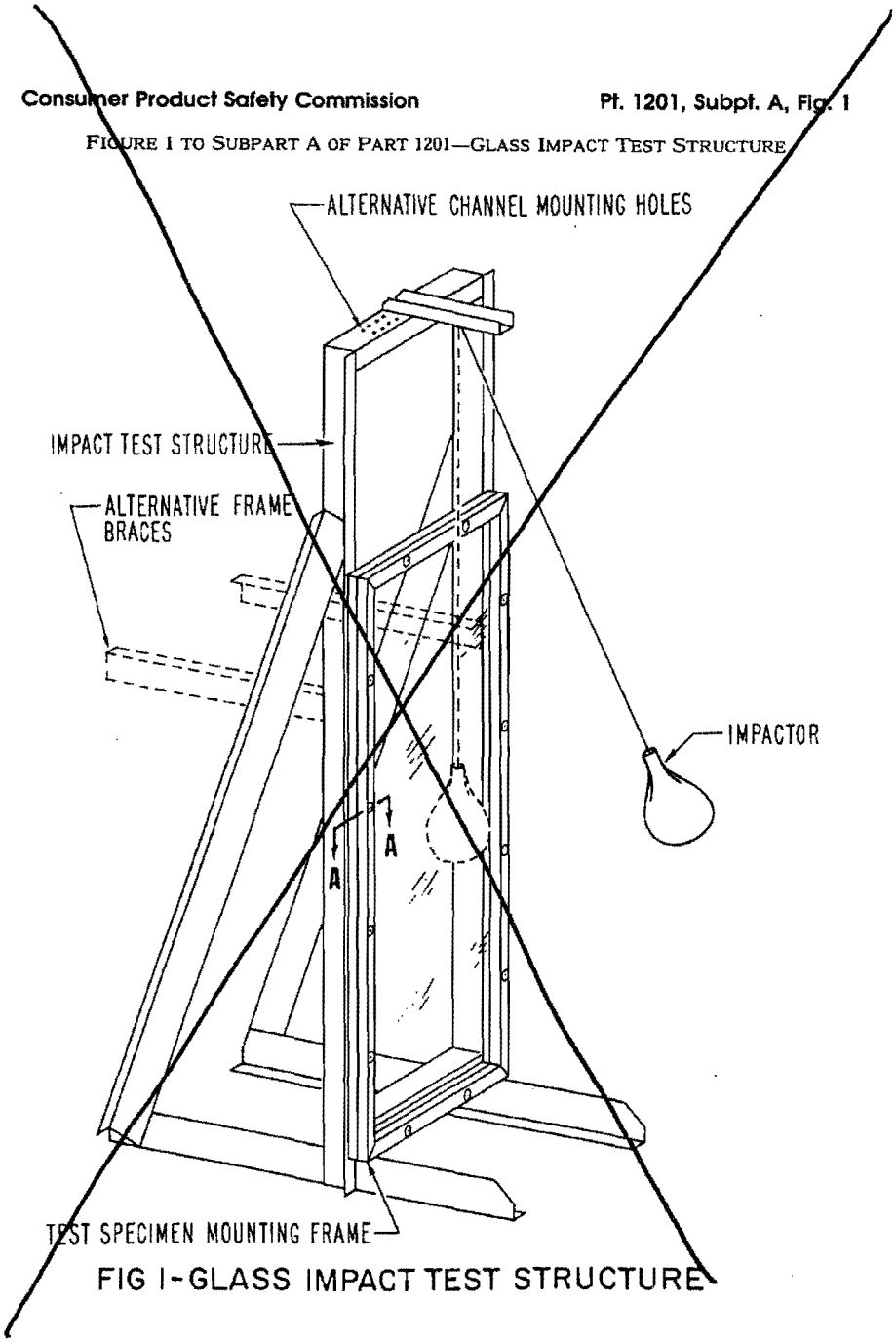


FIG 1-GLASS IMPACT TEST STRUCTURE

FIGURE 2 TO SUBPART A OF PART 1201—TEST FRAME

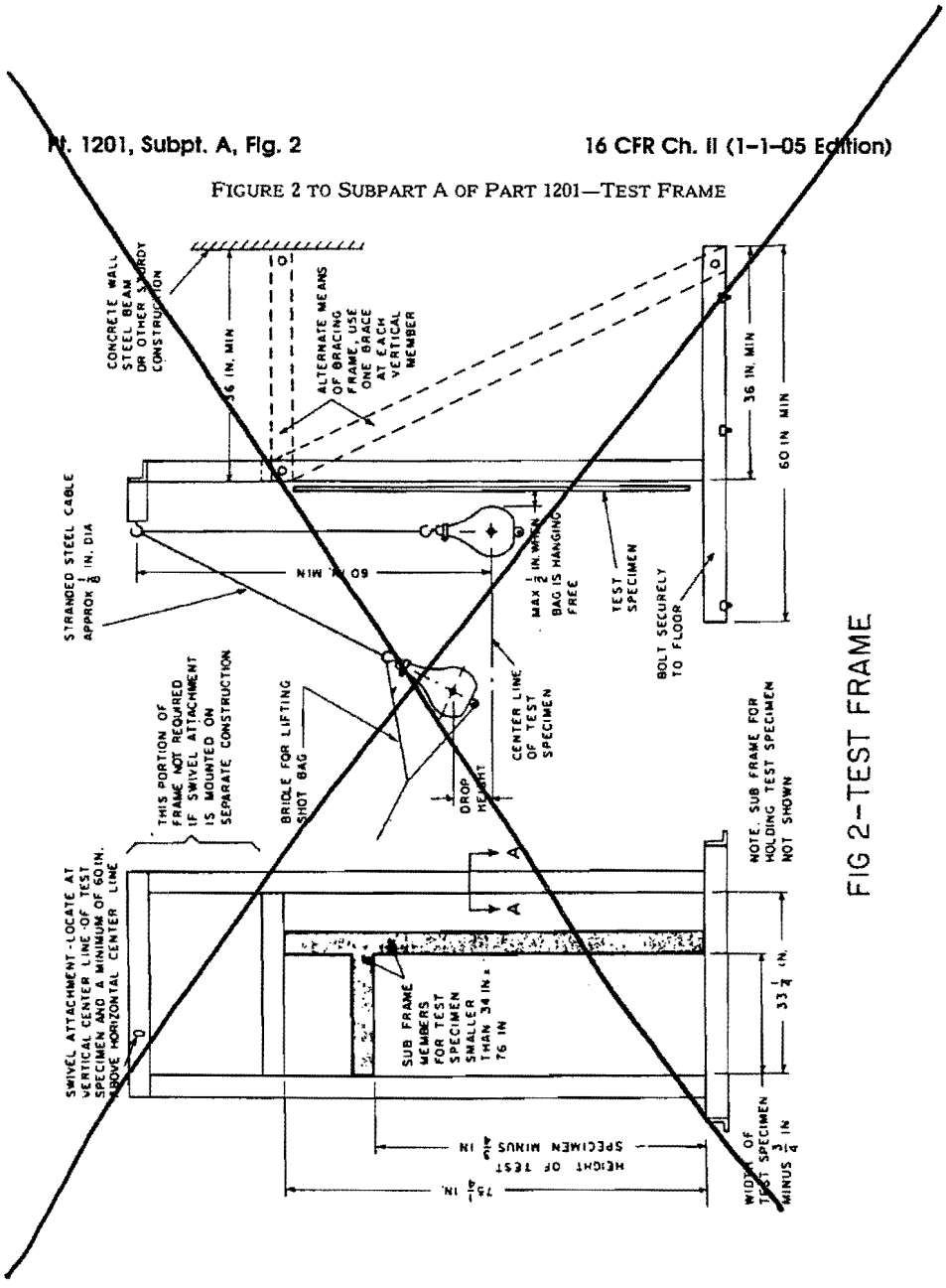


FIG 2–TEST FRAME

FIGURES 3 AND 4 TO SUBPART A OF PART 1201—TEST SPECIMENS

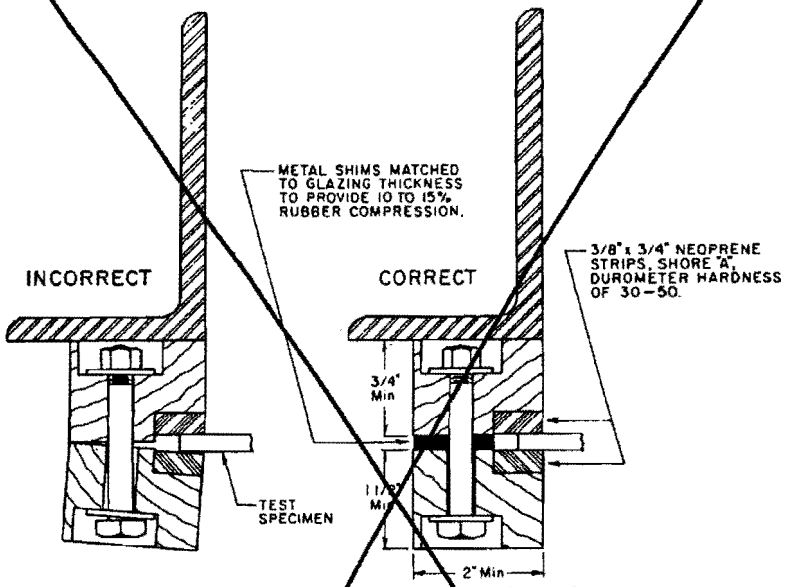


FIG 3—PROPERLY & IMPROPERLY CLAMPED TEST SPECIMEN (>1/8" THICK)

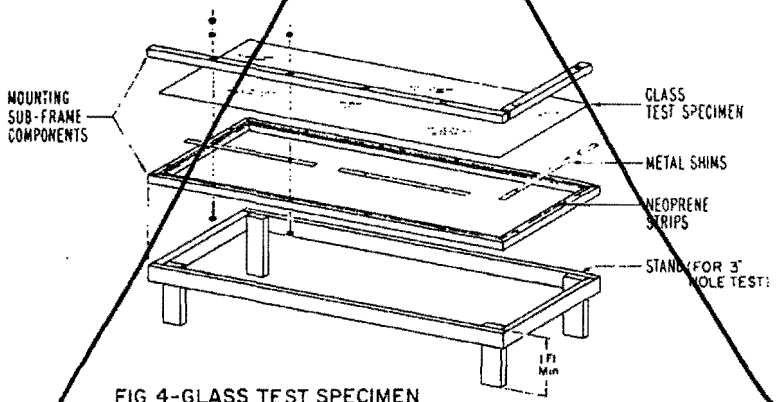


FIG 4-GLASS TEST SPECIMEN MOUNTING SUB-FRAME(EXPLODED) & STAND

FIGURE 5 TO SUBPART A OF PART 1201—IMPACTOR

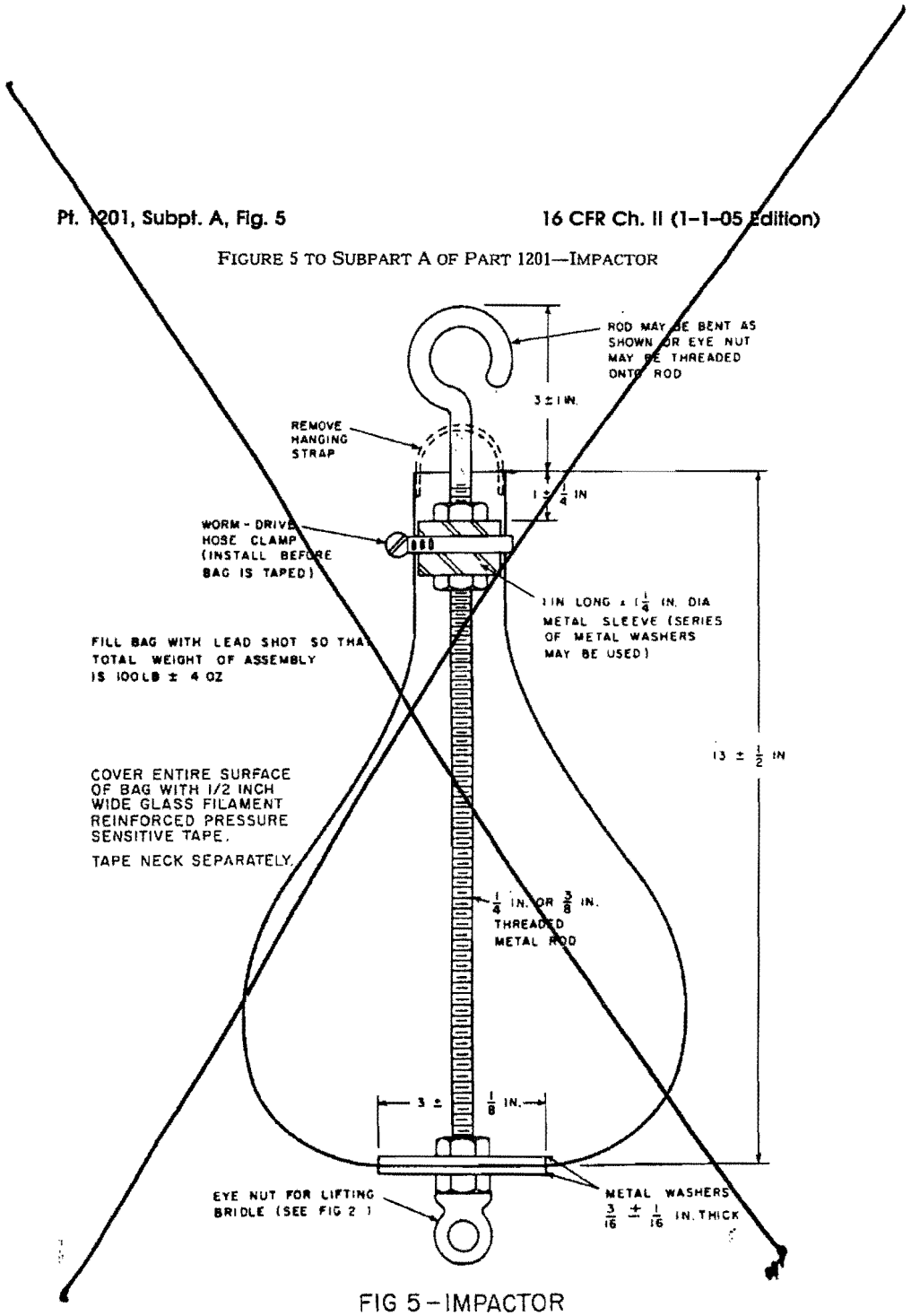


FIG 5 – IMPACTOR

Subpart B [Reserved]

Subpart C—Statements of Policy and Interpretation

§ 1201.40 Interpretation concerning bathtub and shower doors and enclosures.

(a) *Purpose and background.* The purpose of this section is to clarify the scope of the terms "bathtub doors and enclosures" and "shower door and enclosure" as they are used in the Standard in subpart A. The Standard lists the products that are subject to it (§ 1201.1(a)). This list includes *bathtub doors and enclosures,* a term defined in the Standard to mean "assemblies of panels and/or doors that are installed on the lip of or immediately surrounding a bathtub" (§ 1201.2(a)(2)). The list also includes *shower doors and enclosures,* a term defined to mean "(assemblies) of one or more panels installed to form all or part of the wall and/or door of a shower stall" (§ 1201.2(a)(30)). Since the Standard became effective on July 6, 1977, the question has arisen whether the definitions of these products include glazing materials in a window that is located over a bathtub or within a shower stall and in the exterior wall of a building. The definitions of the terms "bathtub doors and enclosures" and "shower door and enclosure" contain no specific exemption for glazing materials in such windows. If read literally, the Standard could include glazing materials in an exterior wall window located above a bathtub because that window could be interpreted as being "immediately surrounding" the bathtub. Similarly, the Standard, if read literally, could include glazing materials in an exterior wall window because that window could be interpreted as forming "all or part of the wall * * * of a shower stall."

(b) *Interpretation.* When the Consumer Product Safety Commission issued the Standard, it did not intend the standard to apply to any item of glazing material in a window that is located over a bathtub or within a shower stall and in the exterior wall of a building. The Commission clarifies that the Standard does not apply to such items of glazing material or such windows. This interpretation applies only to the term "bathtub doors and enclosures" and "shower door and enclosure" and does not affect the applicability of the Standard to any other product.

[46 FR 45751, Sept. 15, 1981]

PART 1202—SAFETY STANDARD FOR MATCHBOOKS

Sec.

1202.1 Scope and effective date.
1202.2 Findings.
1202.3 Definitions.
1202.4 Matchbook general requirements.
1202.5 Certification.
1202.6 Marking.
1202.7 Prohibited stockpiling.

AUTHORITY: Secs. 2, 3, 7, 9, 14, 16, and 19, Pub. L. 92-573, 86 Stat. 1212-17 (15 U.S.C. 2051, 2052, 2056, 2058, 2063, 2065, and 2068).

SOURCE: 43 FR 53709, Nov. 17, 1978, unless otherwise noted.

§ 1202.1 Scope and effective date.

(a) *Scope.* This part 1202, a consumer product safety standard, prescribes the safety requirements, including labeling requirements, for the matchbook. This part 1202 applies to all matchbooks manufactured in or imported into the United States after its effective date.

(b) *Effective date.* The effective date shall be May 4, 1978.

§ 1202.2 Findings.[1]

(a) *Risk of injury.* The Commission finds that unreasonable risks of injury from accidents are associated with matchbooks. These unreasonable risks,

[1] The Commission's findings apply to the matchbook standard that it published on May 4, 1977 (42 FR 22656-70). On Mar. 31, 1978, the U.S. Court of Appeals for the First Circuit set aside portions of that standard (*D. D. Bean & Sons, Co. v. CPSC,* 574 F. 2d 643). On Nov. 17, 1978, the Commission published a revised version of the standard which reflects the court's decision. However, the findings have not been revised and they are therefore not fully applicable to the revised matchbook requirements. For example, the revised standard does not address the unreasonable risk of injury of "[b]urn injuries that have been sustained by persons from fires that have been set by the afterglow of extinguished bookmatches" (§ 1202.2(a)(6)) because the court set aside the afterglow performance requirement.

American National Standard

for safety glazing materials used in buildings – safety performance specifications and methods of test

Standard
ANSI Z97.1-2009$^{\epsilon 2}$

25 West 43rd Street,
New York, New York 10036

ANSI Z97.1 – 2009ε2
Revision of ANSI Z97.1-2004e

American National Standard
for Safety Glazing Materials Used in Buildings -
Safety Performance Specifications and Methods of Test

Secretariat

Glazing Industry Secretariat Committee

Approved by Accredited Standards Committee (ASC) Z97
November 2009

American National Standards Institute, Inc.

ANSI Z97.1-2009ε – Modification to section 5.1.2.1.2 (1), (2), (3) and (4) to clarify interpretation of allowable changes after weathering.

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FORWARD

(This forward is not part of ANSI Z97.1-2009^{e2})

This standard was developed under procedures accredited as meeting the criteria for American National Standards. The consensus committee that approved the Standard was balanced to ensure that individuals from competent and concerned interests have had an opportunity to participate. It was developed within the approved scope as stated in section 1.1 of the standard.

This Standard is available for public review on a continuing basis. This provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large. The use of an addenda system will allow revisions made in response to public review or committee actions to be published as required.

This standard, which is the result of extended and careful consideration of available knowledge and experience on the subject, is intended to provide minimum requirements that are recommended for use, adoption, enforcement by federal, state and local authorities and by model codes. It is recommended that this standard be referenced but not incorporated in any statute.

This Standard does not recommend where safety glazing should be used or, when it is used, what type of glazing material should be used. For this information one should consult other codes, standards and manufacturer's information.

Neither the standards committee nor the secretariat feel that this standard is perfect or in its ultimate form. It is recognized that, although safety-glazing materials are widely used and accepted, new developments are to be expected and revisions of the standards are necessary as the art progresses and further experience is gained.

This standard is a successor standard to the 2004e edition. The 2004e standard succeeded those of the 1984 (reaffirmed in 1994), 1975, 1972 and 1966 editions.

In order for material to be considered for reference or to continue to be referenced in the ANSI Z97.1 standard, it shall meet the following criteria:

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2. The standard or portions of a standard intended to be enforced shall be written in mandatory language.
3. The scope or application of the reference material shall be clearly described.
4. The referenced material shall not have the effect of requiring proprietary materials.
5. The standard shall not prescribe a proprietary agency for quality control or testing.

For communication with the Committee please refer to the following page.

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Secretary, Z97 Main Committee
c/o Julia Schimmelpenningh
Solutia Inc.
730 Worcester St.
Springfield, MA 01151
JCSCHI@Solutia.com

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The Committee welcomes proposals for revisions to this Standard. Proposals should be as specific as possible: citing the paragraph number(s), the proposed wording and a detailed description of the reasons for the proposal. Pertinent documentation should be included.

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Subject: Cite the applicable paragraph number(s) and provide a concise description.

Edition: Cite the edition of the Standard for which the interpretation is being requested.

Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not a request for an approval of a proprietary design or situation.

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American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

1 Scope, Purpose, and Limitations

1.1 Scope.

This standard establishes the specifications and methods of test for the safety properties of safety glazing materials (glazing materials designed to promote safety and reduce the likelihood of cutting and piercing injuries when the glazing materials are broken by human contact) as used for all building and architectural purposes.

1.2 Purpose.

The purpose of this standard is to prescribe the minimum safety performance characteristics of safety glazing materials. This standard affords a basis for; (1) safety standards for adoption in regulations by federal, state, and local regulatory bodies; and (2) for use by building code officials, architects, designers, specifiers and others as a reference standard. Approval of a material under this standard constitutes acceptance of its safety characteristics and the retention of those characteristics. It is not to be construed as appraisal of its durability or appearance as a glazing material.

1.3 Limitations.

1.3.1 Conformance of a material to this standard demonstrates minimum acceptable safety characteristics of the material in use.

1.3.2 While this Standard relates to the minimum safety performance property test criteria for safety glazing materials, the lowest classification level herein per section 5.1.2 has NOT been accepted by all jurisdictions (e.g. CPSC 16 CFR 1201, building codes, etc...) as "safe performance" for unrestricted human impact accident modes. Therefore Class C herein applies to glazing material acceptable by the authority having jurisdiction that either:

(1) has restricted human impact accident modes in application; or that

(2) has a combination of minimal impact characteristics with a fire safety function other than energetic human impact alone.

1.3.3 Conformance of a material to this standard is not to be construed as an appraisal of its strength, durability or appearance as a glazing material, nor does this standard specify situations in which safety-glazing materials should be used.

1.3.4 This standard does not address the methods used for the installation of safety glazing materials.

1.3.5 A condition of conformance of a material to this standard is its uniform production so that it will consistently exhibit these safety characteristics.

1.3.6 Monolithic annealed glass, monolithic heat strengthened glass, monolithic chemically strengthened glass and monolithic fire rated wired glass are not considered safety glazing materials under this standard.

2 Referenced Standards

This standard is intended for use in conjunction with the cited editions of the following standards (see ANNEX X1 for edition year):

ASTM C1036, Standard Specification for Flat Glass[1].

ASTM C1048 Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT, Coated and Uncoated Glass[1].

ASTM C1172 Standard Specification for Laminated Architectural Flat Glass[1].

ASTM C1349 Standard Specification for Architectural Flat Glass Clad Polycarbonate[1].

ASTM C1464 Standard Specification for Bent Glass[1].

ASTM D618 Standard Practice for Conditioning Plastics for Testing[1].

ASTM D756 Practice for Determination of Weight and Shape Changes of Plastics under Accelerated Service Conditions[1].

ASTM D785 Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials[1].

ASTM D790 Standard Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Material[1].

ASTM D883 Standard Terminology Relating to Plastics[1].

ASTM D1003 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics[1].

ASTM D1435 Standard Practice for Outdoor Weathering of Plastics[1].

ASTM D2240 Standard Test Method for Rubber Property-Durometer Hardness[1].

ASTM D2565 Standard Practice for Xenon Arc Exposure of Plastics Intended for Outdoor Applications[1].

ASTM D6110 Standard Test Methods for Determining the Charpy Impact Resistance of Notched Specimens of Plastics[1].

ASTM E308 Practice for Computing the Colors of Objects by Using the CIE System[1].

1 ASTM, International. 100 Barr Harbor Drive, West Conshohocken, PA

ASTM E313 Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates[1].

ASTM G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials[1] .

Consumer Product Safety Commission (CPSC) 16 Code of Federal Regulations (CFR) Part 1201 Safety Standard for Architectural Glazing Materials[2] .

ISO 4892.2 Plastics - Methods of Exposure to Laboratory Light Sources - Part 2 Xenon Arc Sources[3] .

2 United States Code of Federal Regulations: title 16, volume 2; superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, United States.

3 International Organization for Standardization (ISO) Geneva Switzerland

3 Definitions

asymmetric material. Glazing in which component layers of its construction makeup are different in thickness, kind, type or pattern texture about its interlayer and/or central plane surface.

bent glass. Flat glass that has been shaped while hot into a form that has curved surfaces.

bubble. A visible gas pocket in the interlayer material or in the plastic glazing sheet material, or between the interlayer and another layer of glass or plastic glazing sheet material.

cracking. The visible breaking, splitting or fissuring, either partially or completely through the thickness of an individual layer of material.

crack-free particle. A portion of a broken test specimen that is determined by identifying the smallest possible perimeter around all points in the portion of the broken test specimen, always passing along un-separated cracks or exposed surfaces.

crazing. The visible breaking, splitting or fissuring of a material, typically patterned with a network of fine lines that do not penetrate through the thickness of an individual layer of material.

delamination. A condition in which one of the glass or plastic glazing sheet material layers loses its bond to an interlayer and separates physically.

discoloration. A visibly noticeable chemical or process induced color deviation in the appearance of a material.

fire-resistant wired glass. Flat transparent or translucent soda lime silicate glass which has an interconnected steel wire mesh, incorporated in the glass during its manufacturing process. To be considered as fire resistant, this product shall be covered by an appropriate listing body and when installed shall be labeled accordingly.

laminated glazing. A manufactured assembly consisting of at least one sheet of glass bonded to at least one other sheet of glass or plastic glazing material with an organic interlayer. Note: when broken, numerous cracks appear, but glass fragments tend to adhere to the interlayer. See ASTM C1172 for additional information.

> ***2-ply glass laminates.*** A laminated glass consisting of two sheets of glass bonded together with an interlayer.
>
> ***multi-ply glass laminates.*** A laminated glass consisting of more than two layers of glass and/or plastic glazing sheet material bonded together by interlayers, where both of the outer surfaces are glass.

glass/plastic laminates. A laminated glass consisting of one or more layers of glass and one or more layers of plastic glazing sheet material bonded together with one or more interlayer(s) in which the plastic surface faces inward when the glazing is installed in a structure.

mirrors. Architectural glazing materials whose intended use is based on their reflective quality. These materials are composed of a reflective surface and may have a substrate of glass, or plastic.

organic-coated glass. An assembly consisting of a sheet of glass covered on one or both surfaces with either: (1) an adhesive-applied organic film or sheeting, or (2) an applied coating. When broken numerous cracks appear, but the glass fragments tend to adhere to the applied organic material.

plastic glazing material. A single sheet of synthetic plastic material, a combination of two or more such sheets laminated together, or a combination of plastic material and reinforcement material in the form of fibers or flakes. This material contains as an essential ingredient an organic substance of large molecular weight; is solid in its finished state; and, at some stage in its manufacture or in its processing into finished articles, can be shaped by flow. See ASTM C1349 for additional information.

safety glazing materials. Glazing materials so constructed, treated, or combined with other materials that, if broken by human contact, the likelihood of cutting or piercing injuries that might result from such contact is reduced.

tempered glass. (also known as a toughened glass). Glass of any shape that has been subjected to a thermal treatment process characterized by uniform heating followed by rapid uniform cooling to produce compressively stressed surface layers. See ASTM C1048 for additional requirement information.

4 Specimens to Be Tested

Table 1: Grouping of Tests for Safety Glazing Materials

Test	Glazing Type[1]				
	Laminated Glazings	Tempered Glass	Organic Coated Glass	Plastic Glazing	Fire Resistant Wired Glass
Impact Test 5.1	X	X	X	X	X
Center Punch Fragmentation Test 5.2		X[2]			
Boil Test 5.3	X[3]				
Weathering Test 5.4	X[4,5]		X[4,5]	X[5]	
Indoor aging Test 5.4.3			X	X	
Hardness Test 4.7, 5.1.4 (3)				X[6]	
Modulus Test 4.7, 5.1.4 (3)				X[6]	

1 Bent and mirror glazing shall be tested in accordance with requirements of the base-glazing product; see section 4.4
2 Center Punch Fragmentation test is used to evaluate the fracture pattern of tempered glass specimens that do not break during impact test of section 5.1.
3 Excludes glass/plastic laminates
4 Weathering tests on laminated and organic coated glasses shall be performed on the thinnest construction of all components in clear glass with clear plastics.
5 Products intended for indoor use only are not subject to weathering test.
6 Only required if breakage occurs under impact

4.1 Condition of Specimens.

Tests shall be applied to specimens as shipped by the manufacturer and shall be representative of commercial production, except that any protective masking material shall be removed prior to test.

4.2 Thickness of Specimens.

The thickness of the specimens to be tested shall be measured and recorded along with the nominal thickness in accordance with accepted industry practice (for glass as set forth in ASTM C1036 or other national or international standards.). No manufacturer shall mark or advertise as

passing the tests, described in this standard, any product of different nominal thickness than that of the specimens passing the tests.

4.3 Size Classification of Specimens.

A description of impact specimens to be tested as required for size classification as set forth below:

Unlimited Size (U) 34 inches by 76 inches, ± 0.125 (1/8) inch (863 mm by 1930 mm, ± 3 mm)

Limited Size (L) Appropriate to Manufacturer, Largest size commercially produced by the manufacturer less than 34 inches by 76 inches, ± 1/8 inch (863 mm by 1930 mm, ± 3 mm). Minimum specimen size: 16 inches by 30 inches, ± 1/8 inch (406 mm by 762 mm, ± 3 mm).

No manufacturer submitting specimens that are in the Limited Size Classification shall mark or advertise as passing the tests, described in this standard, any product with either dimension greater than those of the specimens passing the tests.

4.4 Specimens for Impact Tests.

For impact test (see section 5.1) of any safety glazing material, four specimens, each of the thickness and size described in sections 4.2 and 4.3 respectively, shall be required. If the test specimens are of an asymmetric material, two shall be impacted from each side.

For impact test after aging (see section 5.4.4) of safety glazing materials used in indoor applications, four specimens, each of the thickness and size described in sections 4.2 and 4.3 respectively, shall be required. If the test specimens are of an asymmetric material two shall be impacted from each side.

For mirror glazing products using either reinforced or non-reinforced organic adhesive backing material, four specimens each with the backing material applied, of the thickness and size described in sections 4.2 and 4.3 respectively, shall be required. The specimens shall be impacted only on the non-reinforced side and with no other material applied.

Bent glass test methods shall be the same as for flat sample testing except as referenced in the text and figures of this standard (See **Figure 4, 4.1, 4.2, 4.3, 5** and **6**). For unlimited size (U) classification of bent glass, 34 in x 76 in (864 mm x 1930 mm) specimens with a simple arc-shaped bend of 40 inches (1016 mm) shall be tested. Interpretation of results shall be the same. See ASTM C1464 for additional information.

Note: *Where project specific requirements or limitations in production exist, other shapes and sizes may be tested and classified as limited (L).*

4.5 Specimens for Boil Test.

For boil test (see section 5.3) three specimens, each 12 inches by 12 inches, representative of commercial production and of identical manufacture and nominal thickness as submitted for impact testing (see section 4.4), shall be required.

4.6 Specimens for Weathering Tests.

For weathering tests (see section 5.4), specimens as described in sections 4.6.1 and 4.6.2, representative of commercial production and of like thickness as submitted for impact testing (see section 4.4), shall be required.

4.6.1 Plastic Glazing Material.

One un-backed panel, a minimum 6 inches by 6 inches (152 mm by 152 mm), shall be exposed. One additional un-backed panel, a minimum 6 inches by 6 inches (152 mm by 152 mm), shall be kept in darkness and used as a control.

NOTE: A minimum of five specimens, each 0.5 inch by 5 inches (12.7 mm by 127 mm), is necessary for the Charpy Impact Test (ASTM D6110). Alternate panel sizes may be used provided that enough material exists to cut a total of five specimens after exposure. Edges shall be trimmed from exposed panels prior to cutting specimens to minimize edge effects. For materials suspected of being anisotropic, the direction of one axis shall be marked on each panel, and all specimens shall be cut in the same direction.

4.6.2 Laminated Glass and Organic-Coated Glass.

Six specimens, each, a minimum of 2 inches by 6 inches (50 mm by 152 mm) shall be prepared. Three specimens shall be exposed and three shall be kept in darkness and used as controls.

4.7 Specimens for Modulus and Hardness Tests

4.7.1 Specimens for Flexural Modulus.

The specimen dimensions are dependent on the thickness of the material and the span distance capabilities of the testing machine. The dimensions shall meet the requirements of ASTM D790 for flatwise tests. For common plastic glazing thicknesses and common testing machine capabilities, specimens 0.5 inch (12.7 mm) wide and 5 inches (127 mm) long can meet the requirements. Decreased width and/or increased length may be needed in some cases to meet the span to depth ratio, span to width ratio and span to length requirements of the standard.

4.7.2 Specimens for Rockwell Hardness.

The specimens shall be at least 1 inch (25 mm) square and at least 1/4 inch (6 mm) thick. Materials less than 0.25 inch (6 mm) thick may be stacked provided that the precautions noted in ASTM D785 are met.

5 Test Specifications

5.1 Impact Test.

Required specimens shall be tested as submitted except that any protective masking or protective material shall be removed prior to the test. Any applied coating integral to the specimens shall not be removed. The specimens shall be conditioned to a uniform test temperature between 65°F and 85°F (18°C and 29°C) for at least 4 hours with separation to permit free air circulation.

5.1.1 Apparatus.

The test apparatus shall consist of a test frame and an impactor system. The test frame consists of a main frame mounted on two base beams with stiffening members and a sub-frame, in which the specimen is held. The impactor system consists of the impactor, traction, release, and suspension devices.

(1) Main Frame. The main frame shall be constructed to minimize movement, deflection, twisting or racking of its members during testing. For this purpose, the structural framing members shall be steel angles 3 inches by 5 inches by 0.25 inch (76 mm by 127 mm by 6 mm) or other sections and materials of equal or greater rigidity. The main frame shall be welded or securely bolted at the corners and braced as shown in **Figure 1, Figure 2 and Figure 3**.

The main frame is mounted to a rigid floor and/or wall. Horizontal members made of steel sections connect the main frame to a rigid wall. The base beams are connected to the main frame by diagonal members of steel sections (see **Figure 1, Figure 2 and Figure 3**). Attach the two base beams of the main frame to a concrete base or floor using bolts M16 or equivalent.

Internal dimensions of main frame[4] (**Figure 2**) shall be:
Internal width: 33.25 inches ±0.2 inch (835 mm ±5 mm)
Internal height: 75.25 inches ± 0.2 inch (1902 mm ±5 mm)

[4] The internal dimensions of the main frame shall be 1.1 inch (28 mm) less than unlimited-size (34 inches by 76 inches [863 mm by 1930 mm]) specimen dimensions.

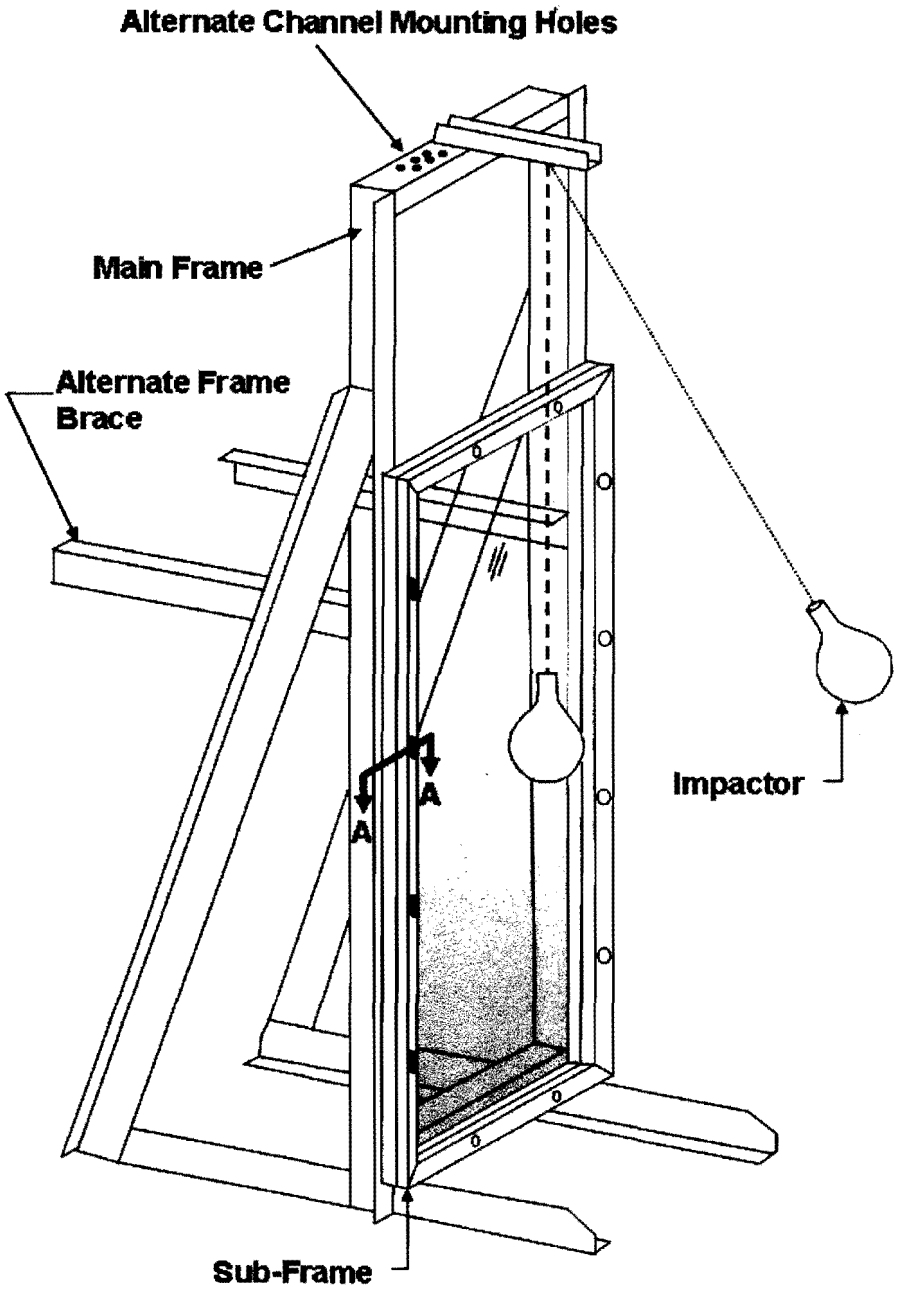

Figure 1: Impact Test Structure

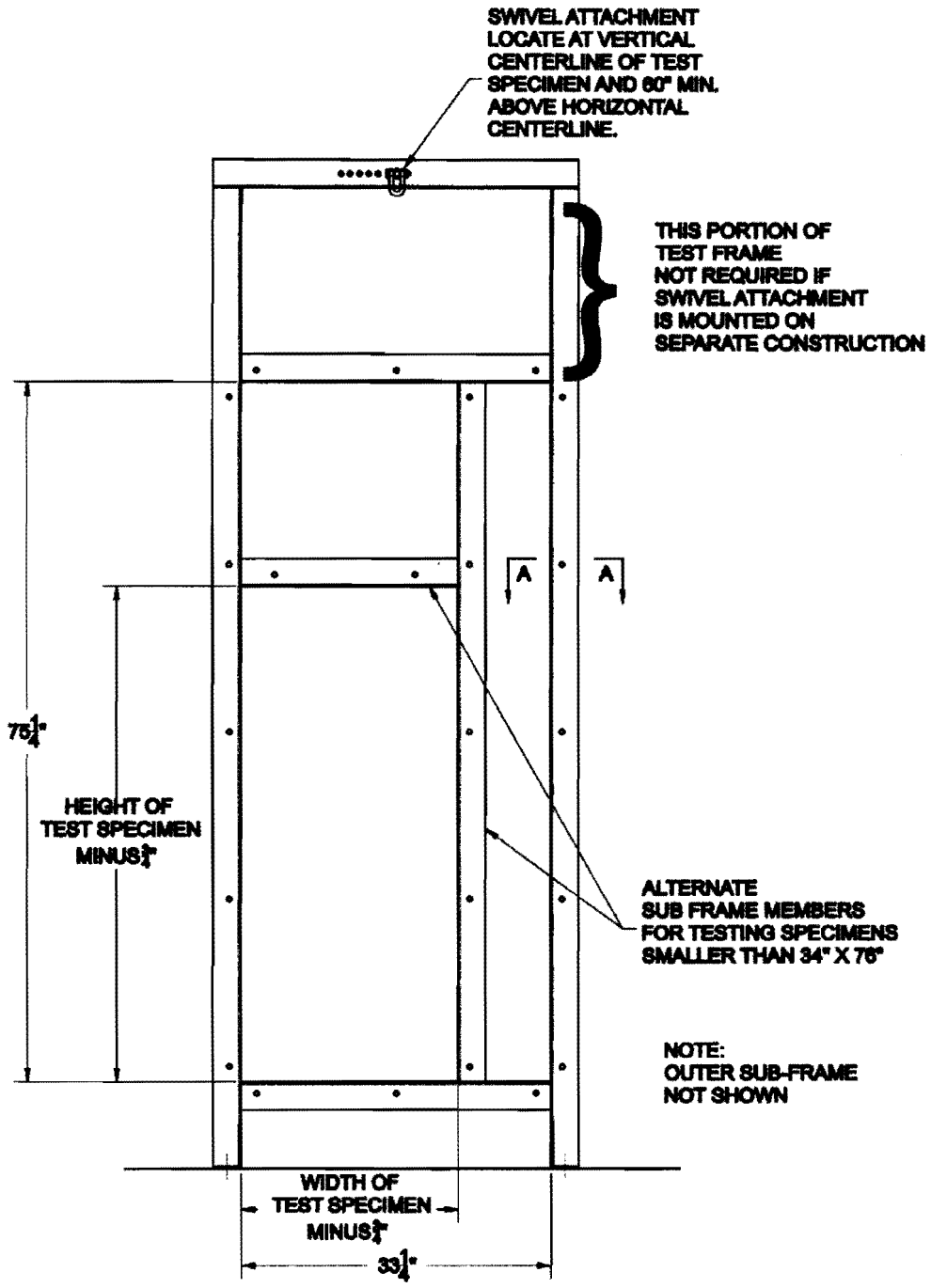

Figure 2: Impact Test Frame - Front View

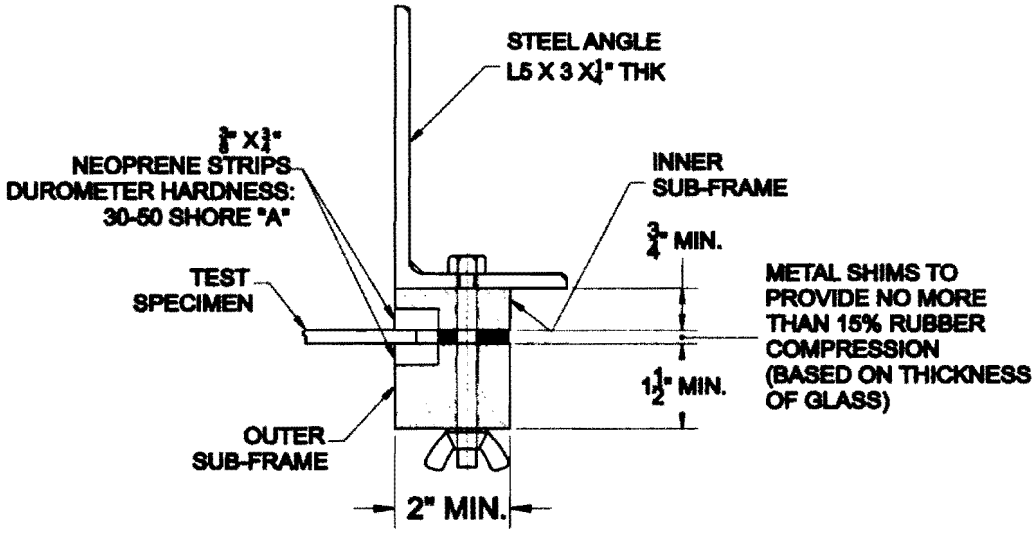

Figure 2.1: Detail of Section A-A PROPERLY Clamped Test Specimen (>1/8 inch (3 mm))

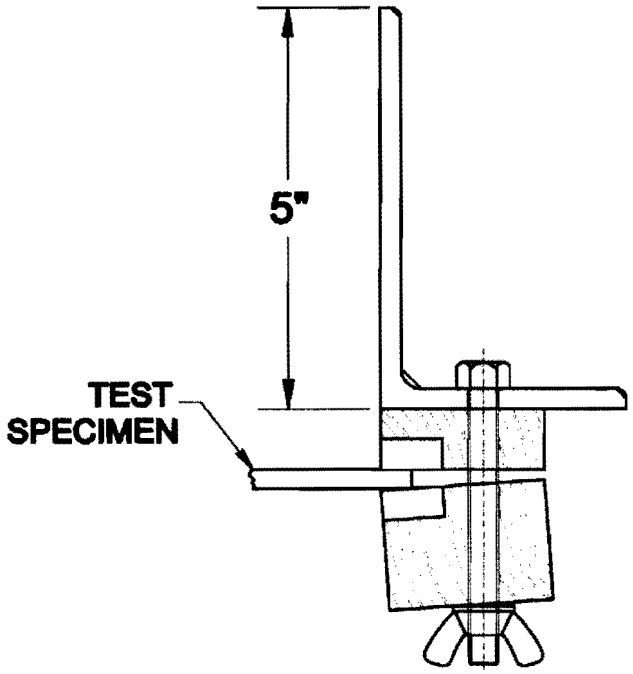

Figure 2.2: Detail of Section A-A IMPROPERLY Clamped Test Specimen (>1/8 inch (3 mm))

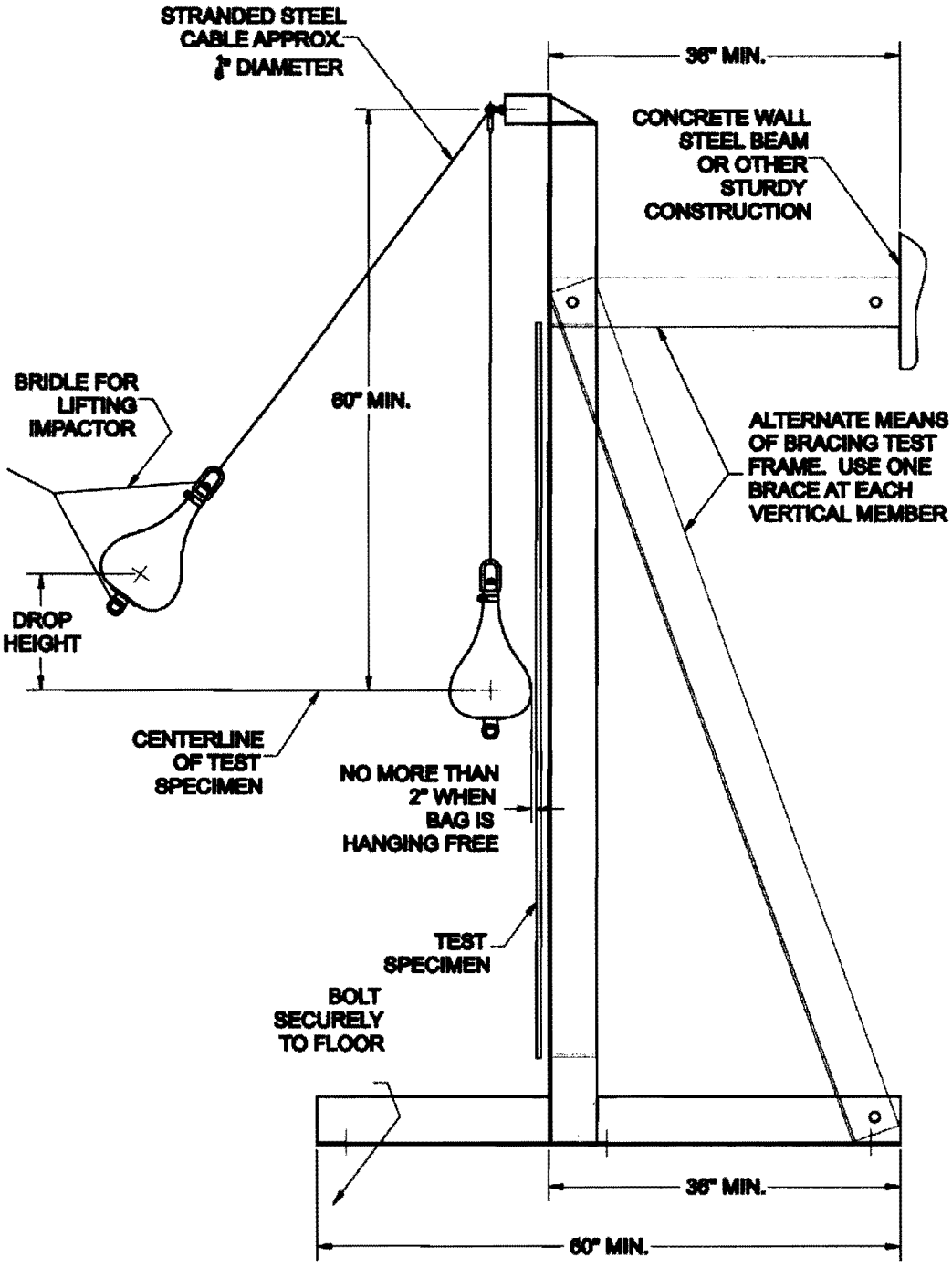

Figure 3: Impact Test Frame – Side View

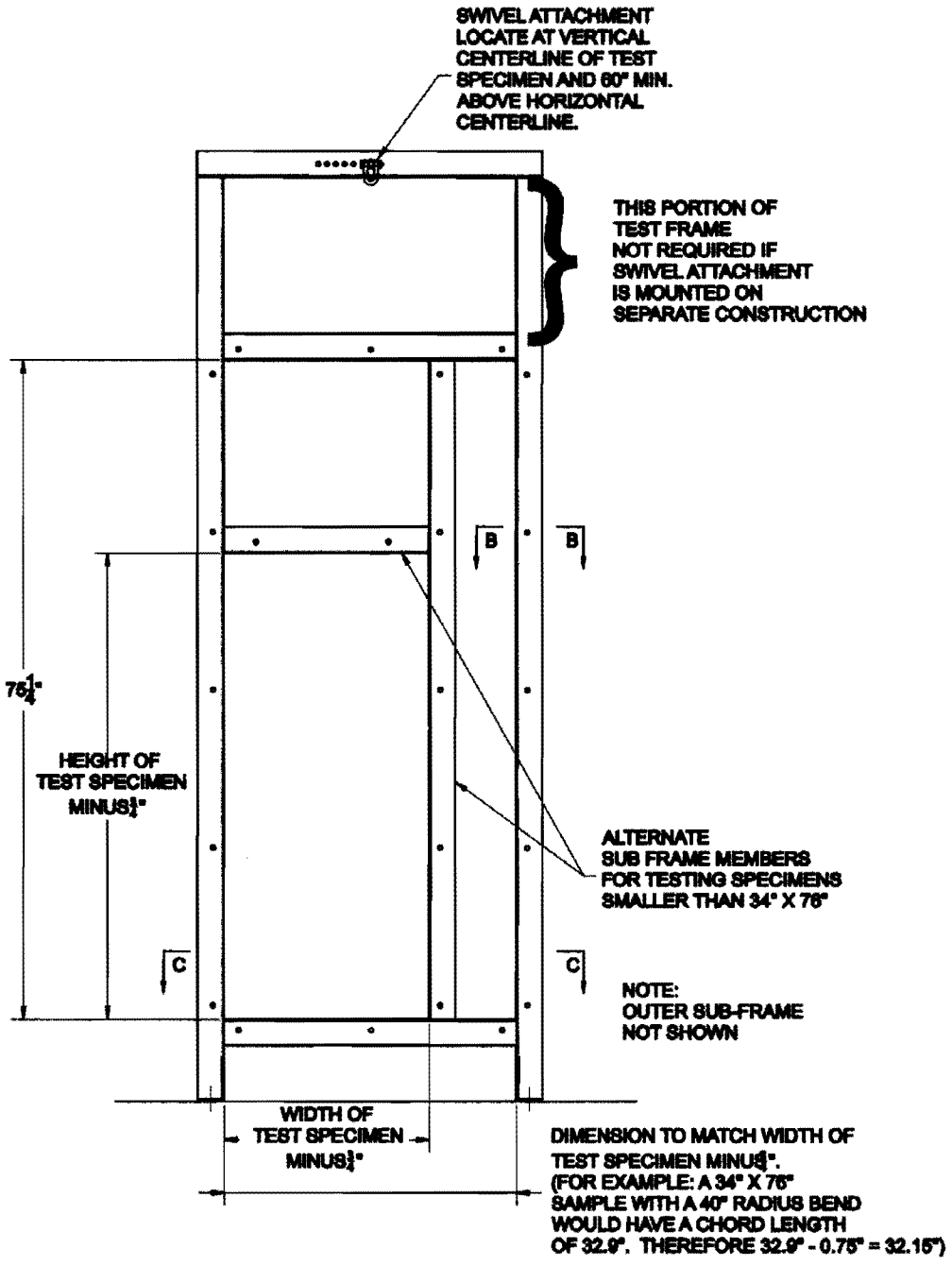

Figure 4: Impact Test Frame – Bent Glazing – Front View

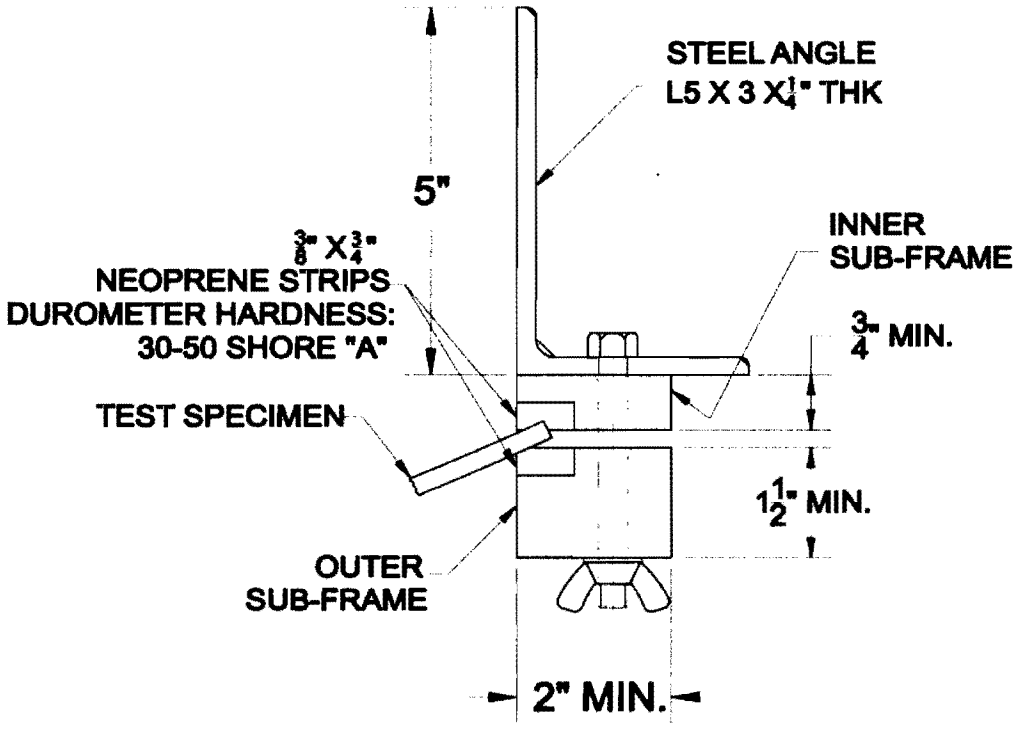

Figure 4.1: Detail of Section B-B

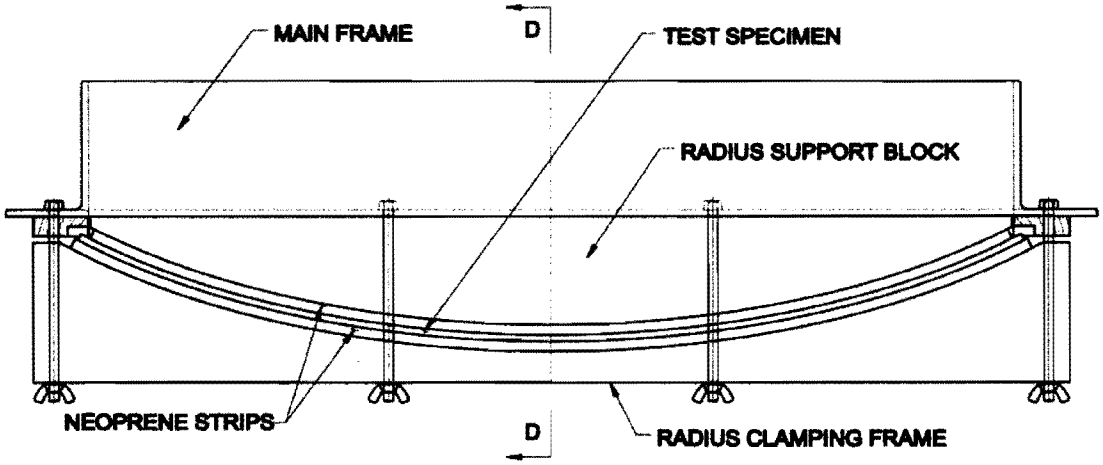

Figure 4.2: Detail of Section C-C

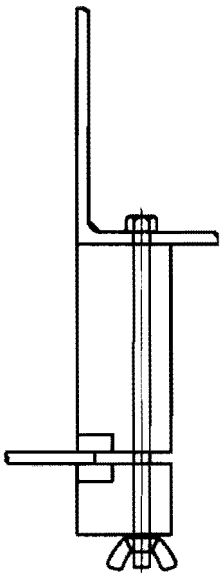

Figure 4.3: Detail of Section D-D

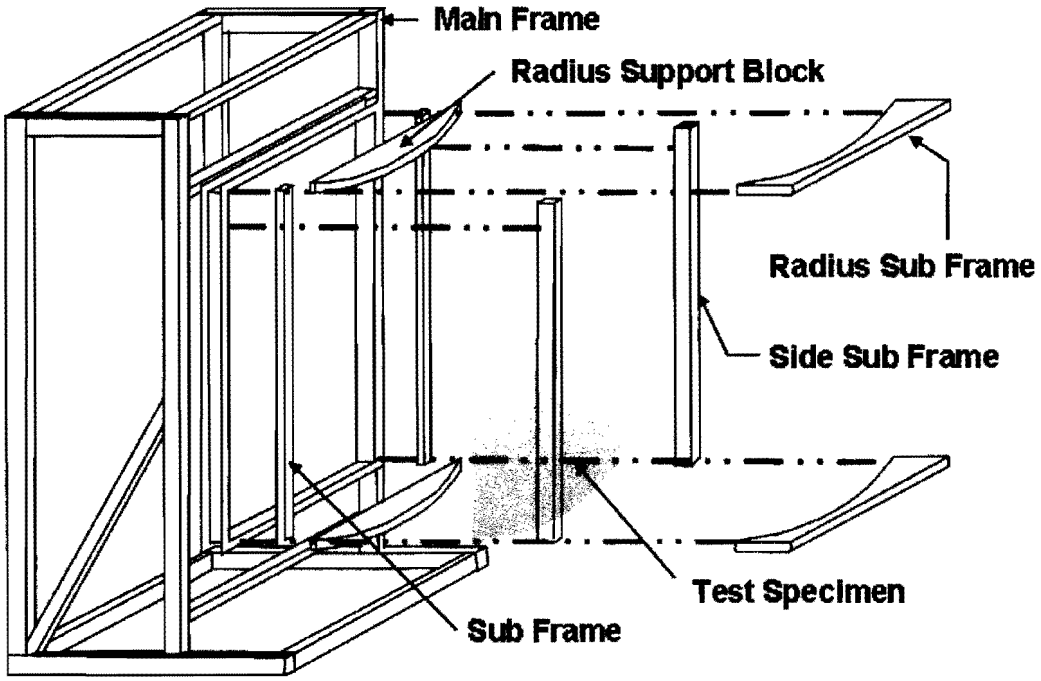

Figure 5: Bent Glass Impact Test Frame (Exploded View)

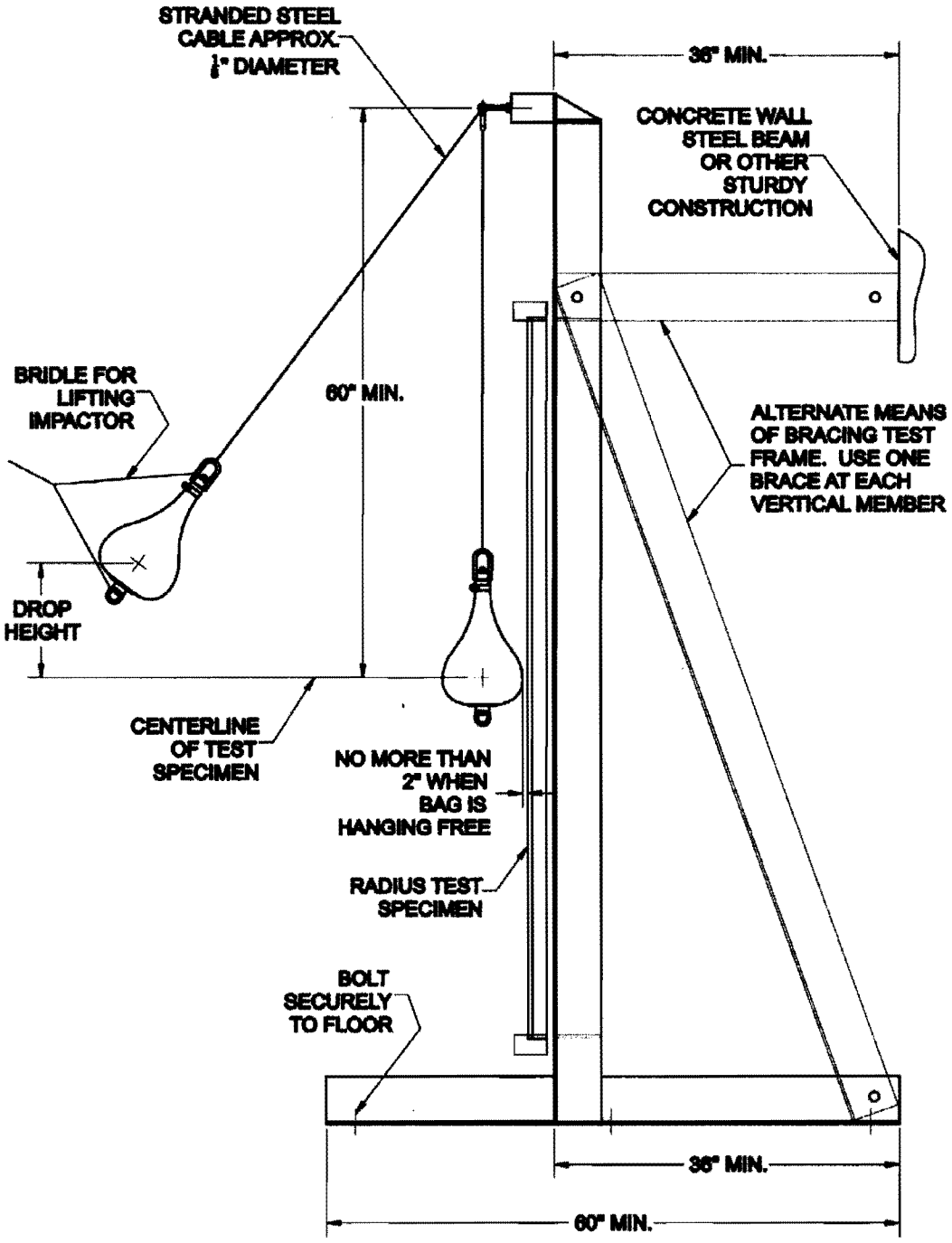

Figure 6: Impact Test Frame - Bent Glazing - Side View

(2) Sub-frame. (Test Specimen Mounting Frame). (See **Figure 1** and **Figure 2**) The sub-frame for securing the specimens on all four edges consists of two parts made from wood or other material which is hard enough to withstand the pressure exerted by the clamping forces. Each part shall be provided with a groove or rebate in which a strip of elastomeric rubber is laid; the specimen shall only contact the elastomeric rubber strips.

The inner sub-frame (**Figure 2.1** and **Figure 2.2**), which is in contact with the specimen, is 2-inches by 0.75 inch (50 mm by 19 mm) minimum. The outer part of the sub-frame holds the specimen and is 2 inches by 1.5 inches (50 mm by 38 mm) minimum.

The sub-frame is fixed to the main frame by at least twelve bolts (M10 bolts, scissors clamps or equivalent). These shall be fixed at the points marked on **Figure 1** and **Figure 2**, with no fewer than two on any edge and spaced no more than 18 inches (450 mm) apart.

To provide and limit elastomeric rubber compression and avoid sub-frame distortion, non-compressible shims appropriate to glazing thickness shall be used to separate the inner and outer parts of the sub-frame (See **Figure 2.1**).

The elastomeric rubber strip, the only element of the sub frame that the test specimen shall come into contact with, shall be 0.8 inch (20 mm) wide by 0.4 inch (10 mm) thick and have a Shore-A hardness of 40 ± 10. (ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness).

NOTE: Modifications that clearly do not alter the function or performance of the main frame or sub-frame are acceptable. Any reasonable means may be used to secure the sub-frame to the main frame provided the mounting is secure and the pressure on the glazing specimen in the sub-frame is controlled.

(3) Impactor. The impactor shall consist of the leather bag described in **Figure 7**, a commercial punching bag[5] with its bladder left in place, or any other leather bag of nominally identical shape and size. The bag shall be filled with lead shot of 2.4 mm + 0.1 mm diameter (nominal USA No. 71/2 or European No. 7 lead shot) and taped. After filling with lead shot, the top shall be either pulled over the metal sleeve and tied with a cord; or twisted around the threaded eyebolt shaft and tied below the metal sleeve, or both. To reduce bag damage during testing, the exterior of the leather bag surface shall be completely covered with glass filament reinforced pressure sensitive polyester adhesive tape[6], 0.5 inch to 0.6 inch (12 mm to 15 mm) in width and 0.006 inch (0.15 mm) thick. Tape the entire bag, using three (3) rolls or 180 yards (165 m) total length, and taping in a diagonal-overlapping manner. Tape the neck of the bag separately, with additional glass filament reinforced tape of the same kind. The total mass of the impactor assembly shall be 100 lb +4 oz (45.4 kg + 0.2 kg), excluding traction system attachments.

[5] Such as 9 inch (229 mm) diameter by 14 inch (356 mm) high Everlast 4207 (raw, full grain 3 ounce (85 grams) cowhide) or Everlast 4212 (split 3 ounce (85 grams) cowhide) available from Everlast Sports, Bronx, New York, USA. These are trade names. This information is given for the convenience of users and does not constitute an endorsement of any product named. Equivalent products may be used if they can be shown to lead to the same results.
[6] Such as 3M No. 898 (a trade name), or equal. (See footnote5 regarding trade name).

To reduce bag deformation during testing, the bag shall be rotated about the axis of its suspension device before each specimen or sample set, by no less than 30 degrees, and by no more than 90 degrees.

NOTE: To reduce bag damage during testing, a thin homogeneous or non-woven plastic film no more than 0.005 inch (0.13 mm) thick or a loosely draped woven cloth towel weighing no more than 0.05 g/cm2 (0.0113 oz./in2) shall not be attached to the impactor, but rather may be suspended vertically in front of the surface of the specimen at a distance no more than 0.4 inch (10 mm).

The impactor shape shall be maintained constant during testing. To reduce visible deformation of the impactor, it shall be removed from the suspension device and pummeled with a rubber mallet into its approximate original shape.

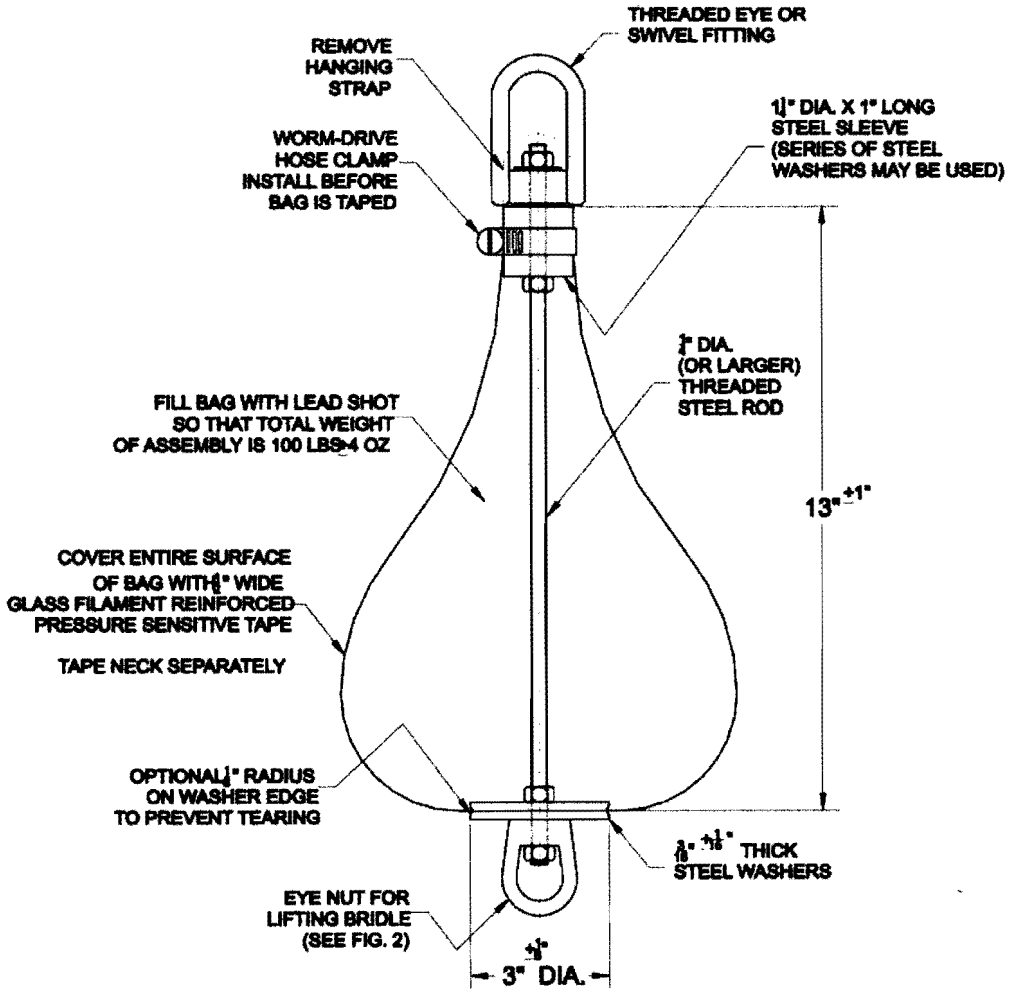

Figure 7: Impactor

(4) Suspension Device. The impactor is suspended by means of a single, stranded steel cable, approximately 0.125 inch (3 mm) diameter, from an upper swivel-fixture above the head of the main frame at an elevation of which the minimum distance between the swivel-fixture and impactor centerline is 60 inches (1,524 mm). The upper swivel-fixture must be rigid to ensure the point of suspension remains stationary. The lower swivel(s) or equivalent shall be provided on the bag for rotation of the impactor about its suspension device axes between impact events.

When at rest, the surface of the impactor, at it's maximum diameter, shall be located no more than 2 inches (51 mm) from the surface of the specimen and no more than 2 inches (51 mm) from the center of the specimen.

(5) Traction and Release System. A traction system shall be used which enables the impactor to be brought into its launch position. The launch position depends on the drop height selected. The traction cable is connected to the impactor traction system by a release mechanism, with provisions for rotating the impactor.

To position the impactor at the selected drop height, a traction force shall be applied to raise the impactor such that the axis of the impactor shall be aligned with the suspension cable, with the cable remaining taut. To ensure this, the top and bottom ends of the impactor shall be connected to the release device by a suitable link.

5.1.2 Impact Classification.

Glazing materials shall be submitted for impact testing to a selected drop height class.

5.1.2.1 Drop Height Class.

Glazing materials conforming to this standard are classified by their performance under the impact test at the selected drop height.

Class A - glazing material that complies with the requirements of section 5.1.4 when tested by the procedure of section 5.1.3 at a drop height between 48 inches and 48.5 inches (1219 mm and 1232 mm) using an impact specimen appropriate to the size classification.

Class B - glazing material that complies with the requirements of section 5.1.4 when tested by the procedure of section 5.1.3 at a drop height of between 18 inches and 18.5 inches (457 mm and 470 mm) using an impact specimen appropriate to the size classification.

Class C - shall apply only for fire-resistant wired glass. It is a material that complies with the requirements of section 5.1.4 when tested by the procedure of section 5.1.3 at a drop height of between 12 inches and 12.5 inches (305 mm and 318 mm) using an impact specimen size of 34 inches by 76 inches (863 mm by 1930 mm).

5.1.2.2 Drop Height Qualification.

Glazing material qualified for classification at the higher impact drop height level "Class A", shall be deemed to comply with the lower impact drop height level "Class B".

5.1.3 Procedure.

(1) Place and center each specimen in the sub-frame so each edge is encased in the elastomeric rubber strip to a depth of at least 0.4 inch (10 mm). With the specimen mounted, the elastomeric rubber strip shall not be compressed by more than 15% of its thickness. For bolts, torque shall be 15 ft-lb. + 4 ft-lb (20Nm+ 5Nm).

(2) Select a drop height classification from section 5.1.2.1. Rotate the impactor as required. Raise the impactor to the selected drop height intended for classification and stabilize it. At the selected drop height, the suspension device shall be taut and the axes of the impactor and cable shall be in line.

(3) The impactor, stabilized in the launch position in a vertical plane normal to the test specimen, is released and falls without initial velocity or axial rotation. At least one impact shall occur on each test specimen. Unbroken specimens may be reused for higher classification impact testing.

(4) Classify the test specimen according to the Glazing Types in Table 2. Inspect each test specimen after impact and record and report whether it complied or did not comply with the Applicable Interpretation of Results contained in Table 2. If classified as Tempered Glass, open the sub frame to allow any particles to be released and fall free.

(5) If any of the required specimens fail to comply with the requirements of section 5.1.4, the material shall not be classified for impact.

(6) For asymmetric materials, the test shall be carried out on both sides using equal numbers of separate specimens.

(7) When the required number of specimens are impacted and inspected, report the impact classification as described in section 5.1.2. If all specimens tested by impact either do not break, or break according to the requirements of section 5.1.4, the glazing material shall be classified as described in section 5.1.2, at the impact level tested. Classification shall comprise the word "Class", followed by a letter designation ("A" or "B" or "C") for drop height class.

(8) If it is required to test the material to a higher impact classification level, repeat the test on the required number of undamaged specimens of the same material at the higher impact level. At the fabricator's discretion, previously tested but unbroken specimens may be used for higher impact classification testing.

(9) Each specimen of bent glass will be impacted on the convex surface at the center of the specimen perpendicular to the frame from the selected drop height (see **Figure 6**).

Note: The convex surface is tested due to the realistic constraints of the test set-up in impacting the concave surface. Additionally, as of the date of this publication no data was available that showed one surface is more or less likely to break during impact.

Table 2: Applicable Interpretation of Results for Shot Bag Impact

Interpretation of Results	Laminated Glass	Tempered Glass	Plastic Glazing	Organic Coated Glass	Fire Resistant Wired Glass
5.1.4 (1)	X			X	X
5.1.4 (2)		X			
5.1.4 (3)			X		
5.1.4 (4)	X	X	X	X	X

5.1.4 Interpretation of Results.

Evaluation after impact shall occur whether the specimen remains fully engaged in the frame, partially engaged in the frame, or is entirely disengaged from the frame. A glazing material shall be judged to pass the impact test if any one of the applicable criteria below is met by each of the required number of impact specimens tested.

(1) When breakage occurs with appearance of numerous cracks and fissures, but remains substantially in one piece and no tear or shear or opening develops within the vertical specimens through which a 3.0 inch (76 mm) diameter sphere can pass using a horizontally applied force of 4.0 lb. (18 N) or less.

(2) When breakage occurs, the 10 largest crack-free particles shall be selected within 5 minutes subsequent to the impact and shall weigh no more than the equivalent weight of 10 square inches (640 square millimeters) of the original specimen. For purposes of impact test evaluation when breakage occurs, the average thickness of a tempered glass specimen containing grooves, bevels, or other thickness altering fabrication shall be considered the average of the thinnest measurement of each of the ten (10) geometrically largest crack-free particles. This average thickness will then be used to determine the maximum allowable weight of the ten (10) largest crack-free particles.

NOTE: The weight in ounces of 10 square inches of glass is equal to 14.5 times the glass thickness in inches. The weight in grams of 10 square inches of glass is equal to 412 times the glass thickness in inches (16.18 grams/mm).

(3) When breakage occurs due to impact, the stiffness and hardness of the specimens shall be determined. A modulus of elasticity (see ASTM D790) less than 550,000 psi (3.9 Gpa) and a Rockwell hardness (see ASTM D785) less than M or R 140 shall indicate satisfactory compliance.

(4) The specimen does not break after impact. See section 5.2 for all specimens of tempered glass that do not fracture.

5.2 Center Punch Fragmentation Test

This test is to be performed in addition to the test described in section 5.1. Specimens for testing shall previously have been tested per section 5.1. Specimens temperature shall be between 65°F and 85°F (18.3°C and 29.4°C) prior to testing.

5.2.1 Equipment

The following equipment is required:

(1) A sharp impactor such as a pointed hammer of about 2.65 ounces (75 g) mass, or a spring loaded center punch (such as Starrett No. 18C automatic center punch) or similar appliance can be used.

(2) A means of specimen support consisting of a flat base with adjustable horizontal curbs to prevent scattering of fragments.

(3) A calibrated scale suitable for accurately weighing selected particles to the nearest 0.004 ounce (0.1 gram).

(4) A calibrated micrometer similar to Starrett No. 230, 0 inch – 1 inch (0 mm to 25 mm) capable of measuring the thickness of the selected specimen / particle.

5.2.2 Procedure

(1) Place the specimen on the flat base and place the curb lightly along the specimen edges so the sample can elongate slightly yet the fragments remain interlocked.

(2) Strike the test specimen 1 inch (25-mm) inboard of the longest edge at its midpoint until fracture occurs.

5.2.3 Particle Weight Determination

(1) Within five minutes after fracture collect and weigh the ten (10) largest crack-free particles. In the event any of the ten (10) largest particles cracks after original selection, all pieces shall be weighed.

(2) For transparent flat glass, measure the thickness of the largest particle. For patterned glass thickness measurement, see ASTM C1036 for thickness measurement technique. Record the thickness.

5.2.4 Center Punch Fragmentation Interpretation of Results

(1) The total weight of the ten (10) largest crack-free pieces shall weigh no more than the equivalent weight of 10 square inches (6452 mm2) of the original test sample. (The weight in ounces of 10 square inches of glass is equal to 14.5 times the glass thickness in inches. The weight in grams of 10 square inches of glass is equal to 412 times the glass thickness in inches (16.18 grams/mm)).

(2) No one particle shall be longer than 4 inches (102 mm).

5.2.5 If any of the required specimens fail to comply with the requirements of section 5.2.4, the material shall not be classified for impact.

5.3 Boil Test for Laminated Glass.

This test shall be made to determine the probable effect of exposure to high temperature and humidity conditions for a long period of time.

5.3.1 Procedure.

Three 12 inch by 12 inch (305 mm x 305 mm) flat specimens, as submitted, shall be immersed, vertically, in water at 150°F ± 10°F (65.6°C ± 6°C) for 3 minutes and then quickly transferred to and similarly immersed in boiling water. The specimens shall be kept in the boiling water for 2 hours and then removed.

5.3.2 Interpretation of Results.

The glass itself may crack in this test, but no bubbles or other defects shall develop more than 0.5 inch (12 mm) from the outer edge of the specimen or from any crack that may develop. Any specimen in which the glass cracks to an extent confusing the results shall be discarded without prejudice, and another specimen shall be tested instead.

5.4 Weathering Tests for Laminates, Organic-Coated Glass and Plastics.

The purpose of these tests is to determine whether these safety-glazing materials will successfully retain their safety characteristics after exposure to weathering conditions for an extended period of time. The weathering methods described in section 5.4.1 shall be used for all materials subjected to exterior exposure. After weathering, organic-coated glass shall be tested as described in sections 5.4.2.1 and 5.4.2.2; laminates shall be tested as described in sections 5.4.2.1 and 5.4.2.3, and plastics shall be tested as described in section 5.4.2.4 in order to evaluate whether or not the safety glazing meets the weathering requirements. Plastic and Organic coated materials intended for interior use only shall be subjected to the requirements of section 5.4.3.

5.4.1 Weathering Methods.

The specimens shall be subjected to one of the following two weathering exposure alternatives. For laminated and organic-coated glass, three (3) specimens with the side marked for exterior exposure shall be exposed to the energy source. Three (3) additional specimens shall be controls and shall be held in darkness at 73.4°F ± 3.6°F (23°C ± 2°C) until needed (see sections 5.4.2.2 and 5.4.2.3). For the plastics, see section 4.6.1.

5.4.1.1 Natural Exposure.

5.4.1.1.1 Procedure.

The specimens shall be exposed in accordance with ASTM D1435 using a 26° North latitude, direct exposure, facing South, open-backed mounting.

5.4.1.1.2 Location.

The specimens shall be exposed in South Florida, United States

5.4.1.1.3 Duration.

The specimens shall be exposed for one year. On average, a one year exposure approximates a Total Ultraviolet (TUV) exposure of 300 ± 25 MJ/m2 at 295-385 nm.

5.4.1.2 Accelerated Exposure.

5.4.1.2.1 Apparatus.

The specimens shall be subjected to exposure in a Xenon-Arc Type Operating Light Apparatus as specified in ASTM G155.

5.4.1.2.2 Procedure.

The specimens shall be exposed 3,000 hrs in accordance to ASTM D2565 (or ISO 4892.2) and the following conditions:

5.4.1.2.3 Filter Type.

Borosilicate inner and outer (or equivalent)

5.4.1.2.4 Cycle.

Utilize Cycle 1 of ASTM D2565. (102 minutes of irradiation, 18 minutes of irradiation and water spray.)

5.4.1.2.5 Black Panel Temperature.

145° ± 4°F (63° ± 2°C)

5.4.1.2.6 Relative Humidity.

50% ± 5%

5.4.1.2.7 Spray Water.

Deionized

5.4.1.2.8 Level of Irradiance.
0.35 ± 0.02 watts/m2@ 340 nm, or 41.5 ± 2.5 w/m2 from 300 – 400nm.

5.4.1.2.9 Exposure.
3000 hours. On average, 3000 hour Xenon arc exposure approximates a TUV exposure of 300 ± 25 MJ/m2 equivalent to one year South Florida exposure at 26° North Latitude direct exposure facing South.

5.4.2 Tests after Weathering

Specimens exposed in accordance with section 5.4.1.1 and/or section 5.4.1.2 shall be tested after weathering according to the procedures outlined in sections 5.4.2.1 and 5.4.2.2. For organic-coated glass, section 5.4.2.1; for laminates, section 5.4.2.3; and for plastics section 5.4.2.4.

5.4.2.1 Tests after Weathering for Laminated and Organic Coated Materials

Assessment of optical changes after weathering are included for Laminated and Organic Coated materials as significant changes can be indicative of product degradation which may have an affect on impact and safety performance.

5.4.2.1.1 Specimens shall be measured at a point more than 10 mm inward from any edge.

5.4.2.1.2 When compared to control (unexposed) samples, no weathered specimen shall exhibit more than the allowable change, as specified, for the following properties:

(1) **Visible Light Transmittance** change not greater than 5 percentage units (e.g.: 91% control ± 5% = 96% or 86%) as measured according to ASTM D1003; Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

(2) **Yellowness Index** (for clear products only) change not greater than 0.5 YI units (e.g.: 0.70 YI control + 0.5 = 1.20) as measured according to ASTM E313; Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates.

(3) **Haze** change not greater than 0.5 percentage units (e.g.: 0.70 control ± 1.20 or 0.20) as measured according to ASTM D1003; Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

(4) **Delta E** less than or equal to 5 units as measured according to ASTM E308; Practice for Computing the Colors of Objects by Using the CIE System.

5.4.2.2 Tests after Weathering for Organic-Coated Glass Only.

Organic-Coated Glass specimens shall be judged satisfactory if they pass the requirements of section 5.4.2.1, adhesion test (see section 5.4.2.2.1) and the tensile strength test (see section 5.4.2.2.2).

5.4.2.2.1 Adhesion Test.

5.4.2.2.1.1 Specimens.

Six specimens, (nominally 2 inch by 6 inch (52 mm by 152 mm)) prepared as described in section 4.6.2 shall be tested. The specimens shall be conditioned just prior to the performance of the adhesion test at 73.5°F ± 3.5°F (23°C ± 2°C) and 50% ± 2% relative humidity for 24 hours.

5.4.2.2.1.2 Apparatus.

The test apparatus shall be (a) a tensile tester of the constant-rate-of-extension (CRE) type with the moving crosshead set to move at 12 inches (305 mm) per minute and the load range set so that the average peel force will fall at 30%-50% of full scale and (b) a cutting device containing new razor blades for cutting 1 inch (25 mm) wide specimens (use each blade one time only).

5.4.2.2.1.3 Procedure.

Using the 1 inch (25 mm) razor cutting device, cut a straight strip of the organic coating in the lengthwise direction of the glass sample. Peel back about 2 inches (52 mm) of one end of the 1 inch (12 mm) wide organic strip. Attach a strip of pressure-sensitive tape to the side of the organic strip opposite the adhesive to extend this free end to about 8 inches (203 mm) in length. Place the end of the glass panel from which the organic strip was removed in the lower clamp of the tensile tester and the free end of the tape in the upper clamp. Peel the remainder of the organic strip from the glass mechanically and obtain a record of the peel value. Determine the average pull for each specimen from the chart record.

5.4.2.2.1.4 Interpretation of Results.

The organic-coated glass adhesions shall be judged satisfactory if the average adhesion value of the three exposed specimens is no less than 75% of the average adhesion value of the three control (unexposed) specimens.

5.4.2.2.2 Tensile Strength Test.

5.4.2.2.2.1 Specimens.

The samples for this test are the same specimens used in the adhesion test (see section 5.4.2.2.1) and conditioned as in section 5.4.2.2.1.1.

5.4.2.2.2.2 Apparatus.

The test apparatus shall be (a) a CRE tensile tester set as follows: gage length - 2 inches (52 mm); crosshead speed - 2 inches (52 mm) per minute; load range - set full-scale load so that specimens will break at 30%-60% of full scale and (b) a cutter containing new razor blades for cutting 1/2 inch (12 mm) wide specimens (use each blade one time only).

5.4.2.2.2.3 Procedure.

Using the 1/2 inch (12 mm) razor cutting device, cut a straight strip of the organic coating in the lengthwise direction of the glass sample for the full 6 inch (152 mm) length. Carefully peel this strip from the glass panel and test it for breaking strength in the tensile strength tester.

5.4.2.2.2.4 Interpretation of Results.

The organic-coating tensile shall be judged satisfactory if the average tensile value of the three exposed specimens is no less than 75% of the average tensile value of the three control specimens.

5.4.2.3 Tests after weathering for laminated glass only.

5.4.2.3.1 Specimens.

After exposure, the test specimens may be cleaned, if necessary, using a procedure recommended by their manufacturer to remove any residues present.

5.4.2.3.2 Conditioning.

Both the unexposed and exposed specimens shall be conditioned prior to examination or further testing for a minimum of 48 hours at 71°F to 75°F (22°C to 24°C) and 50% ± 2% relative humidity.

5.4.2.3.3 Viewing.
When irradiated and conditioned, the exposed specimens shall be examined and compared visually with the unexposed controls. Specimens shall be placed in a vertical position. The viewer shall look through the specimen using daylight without direct sunlight, or using a background light suitable for observing blemishes. View at 36 inch (910 mm).

5.4.2.3.4 Interpretation of Results.
Any improvement in clarity or discoloration is acceptable. When examined after ultraviolet exposure, each exposed test specimen shall be substantially free of noticeable decomposition as defined by absence of the following specific kinds of developed defects or blemishes, when observed by this inspection method in comparison to unexposed control specimen(s):

(1) No bubbles or delamination shall be visible more than 0.4 inch (10 mm) from any outer edge of the specimen, and

(2) No crazing or cracking is allowed.

(3) If no noticeable decomposition and no other defects develop upon exposure, the glazing material shall be reported as visually acceptable. Otherwise, unacceptable glazing material shall be reported as visually blemished.

5.4.2.4 Tests after Weathering for Plastics Only.

5.4.2.4.1 Specimens shall be evaluated before and after exposure in accordance with ASTM D6110, Charpy Impact Test, method B, with the following exceptions:

(1) The specimens shall not be notched.

(2) The specimens shall be tested with the exposed surface in tension.

(3) The specimens shall be exposed and tested flatwise.

(4) The span shall be reduced to 2 inches (52 mm) for thin material that may slip through the supports without breaking.

(5) The average of five (5) samples take from the weathered specimens shall be reported.

5.4.2.4.2 Interpretation of Results.
Plastic materials shall be acceptable for use as safety glazing if the impact strength as measured by the Charpy Impact Test is not reduced by more than 25% as a result of the natural or accelerated exposure. No bubbles or other physical degradation shall develop in the exposed portion.

5.4.3 Aging Tests for Plastics and Organic-Coated Glass Used in Indoor Applications Only[7].

The purpose of these tests is to determine whether plastic and organic-coated glass for indoor use only will successfully retain their safety characteristics after exposure to simulated aging conditions for an extended period of time. The specimens described in 4.4 for impact test after aging shall be used.

5.4.3.1 Aging Tests for Plastics used in Indoor Applications Only

Specimens passing the requirements of natural or accelerated exposure (section 5.4.1) and subsequent testing (section 5.4.2) are deemed qualified for indoor applications.

5.4.3.1.1 Apparatus.

A non-corroding container with a shelf suitable to support the test specimen above the solution used for maintaining the required humidity. The container shall be tightly sealed except for a small capillary which permits release of vapor pressure that might otherwise lift the top off the container. Each test specimen shall be tested preferably in a separate container.

5.4.3.1.2 Testing Procedures.

The plastic shall be subject to exposure to warm, humid and dry cycles. Four plastic specimens shall be subjected the following procedures:

5.4.3.1.2.1 Test Conditions.

Conduct tests in the standard laboratory atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity.

5.4.3.1.2.2 Conditioning.

Condition the test specimens at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 40 hours prior to test in accordance with Procedure A of Practice ASTM D618.

5.4.3.1.2.3 Cycle.

Ten (10) complete humid/dry test cycles (480 total hours – not including Conditioning from 5.4.3.1.2.2) where one cycle includes 24 hours at 140°F ± 5°F (60°C ± 3°C) and 88 % relative humidity, followed by 24 hours at 140°F ± 5°F (60°C ± 3°C) in an oven.

[7] Test procedure excerpted from discontinued standard. Reprinted, with permission, from ASTM D756-93 Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions, copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428 (Discontinued 1998)[1]

5.4.3.1.3 Weight and dimensions of specimens.

5.4.3.1.3.1 Weight.

Measure and record the weight within 0.05 % if the specimen weighs 3.4 oz (100 g) or less, and within 0.1 % if the specimen exceeds 3.4 oz (100 g) in weight.

5.4.3.1.3.2 Dimensions of Directionally Formed Specimens.

Measure and record the thickness to 0.001 in (0.025 mm), the plane dimension in the direction of injection or transfer to 0.001 in (0.025 mm), and the plane dimension across the direction of injection or transfer to 0.001 in (0.025 mm).

5.4.3.1.3.3 Dimensions of Compression Molded Specimen.

Measure and record the thickness to 0.001 in (0.025 mm), and the perpendicular dimensions in the plane at right angles to the direction of molding to 0.001 in (0.025 mm).

5.4.3.1.3.4 Conditioning of Specimens for Weight and Dimension

Specimens shall be brought to room temperature in a clean, empty, sealed container, which will require 10 to 30 min. Then the specimen shall be weighed in less than 10 min after exposure to room conditions. The dimensions shall be measured immediately after weighing the specimen.

5.4.3.1.4 Visual Inspection.

Noticeable qualitative changes in surfaces, outline, and general appearance of the test specimen shall be recorded after each stage of the testing procedure. These changes include color, surface irregularities, odor, and splits, in accordance with ASTM D883. Changes shall also be noted as they occur, especially those which alter the shape so that intended dimensions are no longer significant.

5.4.3.1.5 Specimen Exposure.

(1) Prior to exposure, condition the specimen according to section 5.4.3.1.2.2. Weigh, measure and inspect the conditioned specimen in accordance with sections 5.4.3.1.3 and 5.4.3.1.4.

(2) Expose the specimen for 24 h on the shelf of a container maintained at 140 ± 1.8°F (60 ± 1°C) in the oven, and containing a saturated solution of sodium sulfate to maintain a relative humidity of 85 to 89 %.

(3) Remove the specimen from the container, place it in a clean, empty, sealed container, and bring to room temperature in accordance with section 5.4.3.1.3.4.

(4) Wipe the specimen with the absorbent cloth, and then weigh, measure dimensions, and examine visually in accordance with sections 5.4.3.1.3 and 5.4.3.1.4 respectively.

(5) Within 2 hours after completion of the operation described in section 5.4.3.1.5(2), expose the specimen for 24 hours in a dry oven at 140 ± 1.8°F (60 ± 1°C).

(6) Remove the specimen from the oven, place it in a clean, empty, sealed container, and bring to room temperature in accordance with section 5.4.3.1.3.4.

(7) Wipe the specimen with the absorbent cloth, and then weigh, measure dimensions, and examine visually in accordance with sections 5.4.3.1.3 and 5.4.3.1.4 respectively.

(8) Recycle the specimen in accordance with section 5.4.3.1.2.3. Weigh and measure dimensions in accordance with section 5.4.3.1.3 and perform visual inspection in accordance with section 5.4.3.1.4. Continue recycling, weighing and measuring until the total hours of exposure are completed. Weigh and measure specimens at completion of total hours after conditioning according to section 5.4.3.1.2.2.

5.4.3.1.6 Physical Testing.

5.4.3.1.6.1 The specimen shall be subjected to physical tests in accordance with section 5.4.4.

5.4.3.1.6.2 One additional specimen shall be retained unexposed as a control for the effects of the exposure cycling. Then, all specimens shall be tested as described in section 5.4.4.

5.4.3.2 Aging Tests For Organic-Coated Glass used in Interior Applications Only

5.4.3.2.1 Apparatus.

A conditioning chamber of sufficient size to hold up to 34 inch by 76 inch (864 mm x 1930 mm) panels vertically and capable of maintaining conditions of 140°F ± 5°F (60°C ± 3°C), 100°F ± 5°F (38°C ± 3°C) and 95% ± 5% relative humidity, and 0°F ± 5°F (18°C ± 3°C).

5.4.3.2.2 Procedure.

Place four of the organic-coated glass specimens positioned vertically and spaced at least 1 inch (25 mm) apart in the chamber. Raise the temperature to 140°F ± 5°F (60°C ± 5°C) within 3 hours and maintain for 21 hours. Change the chamber conditions to 100°F ± 5°F (38°C ± 3°C) and 95% ± 5% relative humidity in 3 hours and maintain for 21 hours. This represents one complete cycle. Expose the specimens to 10 complete cycles. At the completion of the tenth cycle, change the chamber conditions to 0°F ± 5°F (18°C ± 3°C) in 3 hours and maintain for 21 hours. The fifth specimen shall be retained unexposed as a control for the effects of the exposure cycling. Upon completion of the required number of exposure cycles, all specimens shall be tested as described in section 5.4.4.

5.4.4 Impact Test after Aging for Plastics and Organic-Coated Glass

5.4.4.1 Apparatus.

The apparatus described in section 5.1.1 shall be used.

5.4.4.2 Procedure.

All the specimens exposed as described in section 5.4.3 shall be conditioned as described in section 5.1 and evaluated by the procedure in section 5.1.2.

5.4.4.3 Interpretation of Results.

The exposed specimens shall again satisfactorily complete the impact test in accordance with section 5.1.3. Milkiness may develop but defects other than these shall be cause for rejection.

6 Marking of Safety Glazing Material

After having successfully passed the appropriate tests in this standard, like products and materials produced in the same manner as specimens submitted per test shall be legibly and permanently marked with a label.

6.1 Label Content.

The label shall contain the following information:

(1) Supplier's name, distinctive mark or designation.

(2) The words "American National Standard Z97.1-2009" or the characters "ANSI Z97.1-2009."

(3) Classification of test size (L or U) and drop height class (A, B or C). Plastic glazing does not require drop height.

(4) Place of fabrication (if fabricator has more than one location fabricating the product).

NOTE: Additional details and information, such as thickness and date of manufacture, are permitted.

6.2 Application of Label.

The appropriate party using the following guidelines shall apply the permanent label:

(1) Laminated and fire-resistant wired glass stock sheets (i.e., size produced by the manufacturer) shall be labeled by the manufacturer of the stock sheet.

(2) All glazing products including cut size laminates, fire-resistant wired glass and tempered glass shall be labeled by the company producing the finished cut to size glass product.

(3) The fabricator or manufacturer shall label plastic glazing materials.

(4) The installer of the safety film shall label field-applied organic coatings (films).

6.3 Special Application Labeling.

Certain types of glazing material shall also be marked with additional information as appropriate.

6.3.1 Safety Glazing Materials Used in Indoor Applications Only.

After having successfully passed the appropriate tests (see section 5.4.3), like products and materials produced in the same manner as specimens submitted for testing shall be legibly and permanently marked with the words - "Indoor Use Only".

6.3.2 Organic-Coated Glass Only.

Organic-coated glass materials shall be legibly and permanently marked with the words "Glaze This Side In," to indicate to the installer, inspector, or user which side of the organic-coated glass should be exposed to the elements if there is a specific side that should be exposed.

7 ANNEX

(This Annex is a mandatory part of American National Standard Z97.1-2009^{e} and indicates the publication year of the applicable standard referenced in ANSI Z97.1-2009^{e}.)

ANNEX X

Table X1
ASC Z97.1-2009^{e}
Reference Standards

As listed in ANSI Z97.1-2009^{e}	Location Referenced Section(s)	Current Edition
ASTM C1036	4.2 5.2.3	2006
ASTM C1048	3	2004
ASTM C1172	3	2009
ASTM C1349	3	2004
ASTM C1464	4.4	2006
ASTM D618	5.4.3.1.2.2	2008
ASTM D756	5.4.3.1[f]	1993
ASTM D785	4.7.2 5.1.4(3)	2008
ASTM D790	4.7.1 5.1.4(3)	2007e1
ASTM D883	5.4.3.1.4	2008
ASTM D1003	5.4.2.1.2(1) 5.4.2.1.2(3)	2007e1
ASTM D1435	5.4.1.1.1	2005
ASTM D2240	5.1.1(2)	2005
ASTM D2565	5.4.1.2.2 5.4.1.2.4	1999(2008)
ASTM D6110	4.6.1 Note 5.4.2.4.1	2008
ASTM E308	5.4.2.1.2(4)	2008
ASTM E313	5.4.2.1.2(2)	2005
ASTM G155	5.4.1.2.1	2005a
CPSC 16 CFR Part 1201	1.3.2	1977
ISO 4892.2	5.4.1.2.2	2006

8 APPENDIX

(This Appendix is not part of American National Standard Z97.1-2009ε, but is included for information only.)

Basis of Safety Performance Specifications and Methods of Test

A1. General

One purpose in the development of this standard is to provide a single functional test that will simulate such human contact as normally results in cutting and piercing injuries. The performance of each safety glazing material is evaluated by impacting in the normally installed position. The test should be conducted from the direction that human impact would occur. Only such auxiliary tests as are considered necessary to evaluate the continued performance level, are used in the case of glazing containing organic material.

A2. Safe Performance Criteria (See section 5.1.2)

The performance criteria are directly related to the reduction of cutting and piercing injuries to persons who impact the glazing used in buildings.

The 100-ft. lbf (445 N) and 150-ft. lbf (667 N) energy levels were established as practically related to those situations in which the limited acceleration path precluded, in most cases, the possibility of an individual developing their full kinetic energy (ke) potential (see section 1.3).

The 400-ft. lbf (1779 N) impact level was established for relatively unlimited acceleration paths in which it might be reasonable to expect that an energetic teenager might develop something approaching his or her full impact velocity.

As section A3 of this Appendix indicates, the independent safety experts who considered the matter judged that these values were practical. (See section A3 and **Figure A1**.)

A3. Development of Human Engineering Data Chart

Safety experts indicate that a 100-lb (45 kg) person is representative of glass breakage accident victims. From Figure A1 it is apparent that a 100-lb (45 kg) person running at the rate of a 4-minute mile has about 755 ft. lbf (3358 N) of kinetic energy. The amount of this energy a person might deliver to a glazed opening would depend upon the way the glazed surface was impacted. A "straight-arm" would transmit more energy to the glazing material than an arm that flexes with the impact.

For test purposes, Accredited Standards Committee Z97 decided, after extensive evaluation, to use a readily available leather punching (speed) bag filled with 100 pounds of lead shot to simulate the running (person). The test impact values were selected as representative of energy

levels likely to be delivered by humans in practical situations involving interior doors and patio doors. These test levels were set considerably below the 755-ft. lbf (3358 N) kinetic energy level of the typical victim, since the impact energy delivered to the glazing material - perhaps first by the hands, then by the head, and then by the knees - is much less than the kinetic energy of the running (person). Also, the impact will be at less than normal (90-degree) incident angle in most cases.

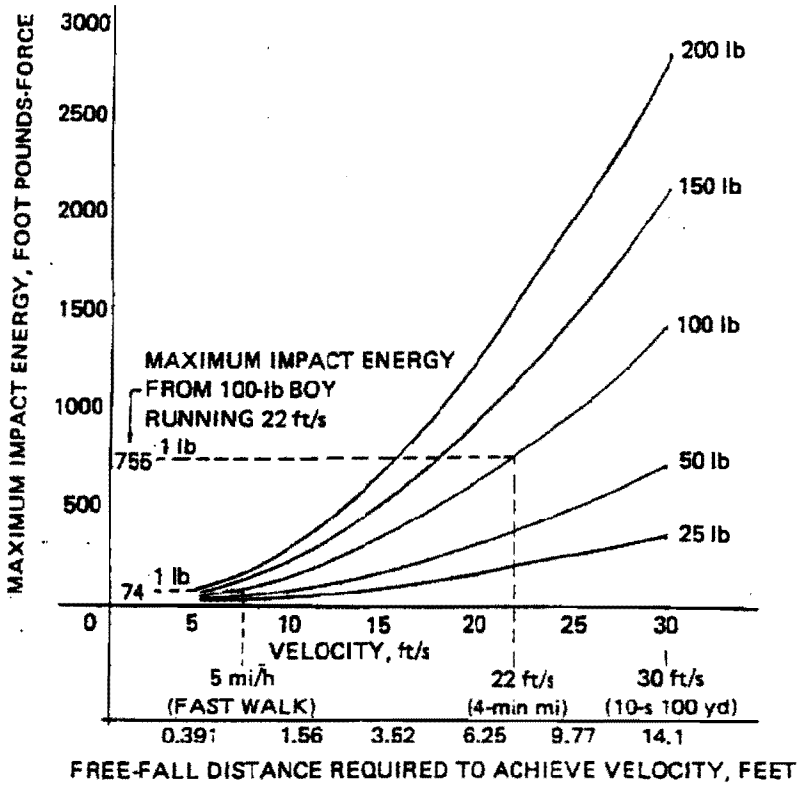

Figure A1: Human Engineering Data

Figure A1 was developed to assist ASC Z97 committee in establishing performance criteria for safety glazing materials subject to human impact. It is based on the following kinetic energy formula:

ke = 1/2mv2

where
ke = kinetic energy in foot pounds-force
m = mass of missile
= weight of missile in pounds/ (32.2 ft/s2)
v = velocity of missile in feet per second

Maximum impact energy equals the kinetic energy of the person in motion at the moment of impact. Actual impact energy (that which the person delivers) is considerably less, except perhaps in the case of a person falling on a non-vertical surface.

A4. Interpretation of Results (See section 5.1.4)

Within the scope of this standard, which has as its objective reducing the frequency of cutting and piercing injuries, it is evident that a material that does not break under impact is safe from these types of injuries.

"Break safe" criteria were developed largely as a matter of judgment based on observation of available glazing materials breaking under the test conditions. It is intended that any material that meets any one of the criteria in section 5.1.4 be considered safe within the scope of this standard.

To allow for practical interpretation of results, which admittedly may appear loosely defined to the uninitiated, rather severe impact levels were selected. The safety experts and the members of the original drafting committee who observed the many tests conducted in developing the standard were confident that laboratory personnel will quickly develop an ability to apply objective judgments using these criteria.

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Address:
Headquarters
1819 L Street, NW
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New York Office *
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New York, NY 10036
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Throughout its history, ANSI has maintained as its primary goal the enhancement of global competitiveness of U.S. business and the American quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems and promoting their integrity. The Institute represents the interests of its nearly 1,000 company, organization, government agency, institutional and international members through its office in New York City, and its headquarters in Washington, D.C.

National Standardization

ANSI facilitates the development of American National Standards (ANS) by accrediting the procedures of standards developing organizations (SDOs). These groups work cooperatively to develop voluntary national consensus standards. Accreditation by ANSI signifies that the procedures used by the standards body in connection with the development of American National Standards meet the Institute's essential requirements for openness, balance, consensus and due process.

ANSI is often asked about the total number of standards (and standards setting bodies) in the United States. It is estimated that in the U.S. today there are hundreds of "traditional" standards developing organizations - with the 20 largest SDOs producing 90% of the standards - and hundreds more "non-traditional" standards development bodies, such as consortia. This means that the level of U.S. participation is quite expansive as the groups themselves are comprised of individual committees made up of experts addressing the technical requirements of standards within their specific area of expertise.

At year-end 2006, about 200 of these standards developers were accredited by ANSI; there were more than 10,000 American National Standards (ANS).
In order to maintain ANSI accreditation, standards developers are required to consistently adhere to a set of requirements or procedures known as the "ANSI Essential Requirements," that govern the consensus development process. Due process is the key to ensuring that ANSs are developed in an environment that is equitable, accessible and responsive to the requirements of various stakeholders. The open and fair ANS process ensures that all interested and affected parties have an opportunity to participate in a standard's development. It also serves and protects the public interest since standards developers accredited by ANSI must meet the Institute's requirements for openness, balance, consensus and other due process safeguards.

That is why American National Standards are usually referred to as "open" standards. In this sense, "open" refers to a process used by a recognized body for developing and approving a standard. The Institute's definition of openness has many elements, but basically refers to a collaborative, balanced and consensus-based approval process. The content of these standards may relate to products, processes, services, systems or personnel.

In its role as the only accreditor of U.S. voluntary consensus standards developing organizations, ANSI helps to ensure the integrity of the standards developers that use our ANSI Essential Requirements: Due process requirements for American National Standards. A separate process, based on the same principles, determines whether standards meet the necessary criteria to be approved as American National Standards. Our process for approval of these standards (currently numbering approximately 10,000) is intended to verify that the principles of openness and due process have been followed and that a consensus of all interested stakeholder groups has been reached.
The hallmarks of this process include:

- Consensus must be reached by representatives from materially affected and interested parties
- Standards are required to undergo public reviews when any member of the public may submit comments
- Comments from the consensus body and public review commenters must be responded to in good faith
- An appeals process is required

ANSI's use of the terms "open" and "openness" to describe standards is meant to characterize documents that have undergone this kind of consensus-based, transparent process. All ANSI-accredited standards developers follow the Essential Requirements which embrace globally-accepted principles of standardization implemented by well-recognized, international standards bodies such as the International Telecommunication Union (ITU), International Organization for Standardization (ISO), and International Electrotechnical Commission (IEC).

The terms and conditions used in the development of "open standards" should balance the interests of those who will implement the standard with the interests and voluntary cooperation of those who own intellectual property rights that are essential to the standard. Such terms and conditions should readily promote, and not unreasonably burden, accessibility to the standard for the communities of interested implementers. To achieve such balance, the payment of reasonable license fees and/or other reasonable and nondiscriminatory license terms may be required by the intellectual property rights holders.

This balance of licensing rights (rather than waiver thereof) is consistent with an open standard. The word "open" does not imply "free" from monetary compensation or other reasonable and nondiscriminatory license terms. Further, an open standard may involve the payment of a fee to obtain a copy of the standard. Such fees are sometimes used to offset the costs associated with managing open standards development process.
The ANSI process serves all standardization efforts in the United States by providing and promoting a process that withstands scrutiny, while protecting the rights and interests of every participant. In essence, ANSI standards quicken the market acceptance of products while making clear how to improve the safety of those products for the protection of consumers.

International Standardization

ANSI promotes the use of U.S. standards internationally, advocates U.S. policy and technical positions in international and regional standards organizations, and encourages the adoption of international standards as national standards where they meet the needs of the user community.

The Institute is the sole U.S. representative and dues-paying member of the two major non-treaty international standards organizations, the International Organization for Standardization (ISO), and, via the U.S. National Committee (USNC), the International Electrotechnical Commission (IEC). As a founding member of the ISO, ANSI plays a strong leadership role in its governing body while U.S. participation, via the USNC, is equally strong in the IEC.

Through ANSI, the U.S. has immediate access to the ISO and IEC standards development processes. ANSI participates in almost the entire technical program of both the ISO and the IEC, and administers many key committees and subgroups. Part of its responsibilities as the U.S. member body to the ISO include accrediting U.S. Technical Advisory Groups (U.S. TAGs), whose primary purpose is to develop and transmit, via ANSI, U.S. positions on activities and ballots of the international Technical Committee. U.S. positions for the IEC are endorsed and closely monitored by the USNC Technical Management Committee (TMC).

In many instances, U.S. standards are taken forward to ISO and IEC, through ANSI or the USNC, where they are adopted in whole or in part as international standards. For this reason, ANSI plays an important part in creating international standards that support the worldwide sale of products, which prevent regions from using local standards to favor local industries. Since volunteers from industry and government, not ANSI staff, carry out the work of the international technical committees, the success of these efforts often is dependent upon the willingness of U.S. industry and government to commit the resources required to ensure strong U.S. technical participation in the international standards process.

Conformity Assessment

Conformity Assessment, the term used to describe steps taken by both manufacturers and independent third parties to determine fulfillment of standards requirements, also remains a high priority for the Institute. ANSI's program for accrediting third-party product certification have experienced significant growth in recent years, and the Institute continues its efforts to obtain worldwide acceptance of accredited certifications performed in the U.S.

One of the best indicators of the strength of the U.S. system is the government's extensive reliance on, and use of, private sector voluntary standards. Pursuant to OMB Circular A119, federal government agencies are required to use voluntary standards for regulatory and procurement purposes when appropriate. State and local governments and agencies have formally adopted thousands of voluntary standards produced by ANSI, and the process appears to be accelerating.

In summary, ANSI continues to be fully involved in its support of the goals of U.S. and global standardization and remains committed to enhancing of the quality of life for all global citizens.

ANSI Z97.1 -2009

Approved by Accredited Standards Committee November 2009

EXHIBIT C

Comparison Chart of CPSC 16 CFR 1201 and ANSI Z97.1

Item	CPSC 16CFR 1201	ANSI Z97.1-2009	Comments
1-Number of Samples Impact Tested	No direction	4.4: Four (4) samples required for testing	CPSC does not specify the number of samples required for testing and this has allowed some to test only 1 sample. ANSI's requirement for 4 samples is a statistically more viable number and adds to the credibility of the test.
2-Categories and Classes	1201.4(c)(2) and (d)(1): test largest size manufactured up to max of 34X76-inch. Category I impacted at 18-inches. Category II impacted at 48 inches.	4.3, 5.1.2.1: Unlimited Size (U) = test of 34X76-inch. Limited Size (L) = largest size produced < 34X76-inch. Class A = 48-inch impact Class B = 18-inch impact Class C = 12-inch impact (apply to wired glass with restrictions, see section1.3.2 and 1.3.6)	CPSC establishes a relationship between size and impact distance. With the U and L and A, B, C designators in ANSI Z97.1, this size impact distance is detailed and communicated more clearly, thus reducing the possibility of testing or market confusion.
3-Center Punch Fragmentation Test	No direction	5.2: All Tempered samples that do not break in the impactor test are required to be center punch tested.	The ANSI test brings all samples to failure, allowing for more complete evaluation of break characteristics. This additional test will screen out some products that might pass CPSC but would be fail an ANSI test.
4-Bent Glass Testing	No direction	4.4: Direction provided for test	Direction provided in the ANSI standard 1) delineates that bent glass is different than flat and must be tested separately and 2) will result in a standardized test for better evaluation of the product. This will improve product evaluation.
5-Laminated glass evaluation after impact	1201.4(e)(1)(i): Horizontally	5.1.4(1): Vertically	Samples are tested vertically and normally would be installed vertically in the market place. The act of moving the sample to a horizontal position as required by CPSC can damage or alter the sample and creates less of an approximation of market place conditions.
6-Weathering requirements for Laminated Glass	No direction	Table 1, 4.6: Weathering tests are required for laminated glass.	By ANSI testing and evaluating laminated glass for weathering, product long term performance and retention of safety characteristic are better able to be evaluated.

7-Details for weathering and aging testing (environmental durability)	1201.4(b)(3)(ii) and (d)(2) Reference to environmental durability test equipment and procedures	5.4 Reference to weathering tests	The references made in CPSC have not been maintained, reference obsolete equipment and standards, and are limited in applicability. By contrast, the ANSI standard has been regularly updated and maintained to reflect current industry practices creating a more appropriate and comprehensive product evaluation.
8-Specific exclusion for non-safety products	1201.1(a) applies the standard only to glazing materials in certain uses; 1201(c) exempts wired glass & certain other products from Part 1201.	1.3.6 provided that certain monolithic glass products including wired glass are not considered safety glazing materials.	ANSI has identified certain products that might comply with testing procedures but are known not to be safety glazing materials. This provides a supplemental assurance of safe products represented by ANSI testing.
9-Guidance, direction, clarity, tolerances	Limited direction	Increased direction	Throughout the ANSI standard, by virtue of regular maintenance and review, guidance and clarity is incorporated that provides increased direction to test operators thus resulting in a more consistent and standardized evaluation of products over CPSC.