



Standard Performance Requirements for Plastic Chairs for Outdoor Use¹

This standard is issued under the fixed designation F1561; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These requirements establish nationally recognized performance requirements for Class A (residential) and Class B (nonresidential) plastic chairs intended for outdoor use.

1.2 These requirements do not address conditions that affect the performance of the chair beyond the manufacturing site.

1.3 These requirements are not applicable to chaises, multipositional chairs, upholstered chairs, or other types of furniture.

1.4 These requirements cover the physical performance of product regarding the aspects of outdoor weathering, impact, static load, and rear leg testing.

1.5 Products may be manufactured from recycled plastics as long as the performance requirements are met.

1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D638 Test Method for Tensile Properties of Plastics

D2565 Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

D4329 Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics

D5033 Guide for Development of ASTM Standards Relating

¹ These performance requirements are under the jurisdiction of ASTM Committee F15 on Consumer Products and are the direct responsibility of Subcommittee F15.33 on Outdoor Plastic Lawn Furniture.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

to Recycling and Use of Recycled Plastics (Withdrawn 2007)³

G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000)³

3. Terminology

3.1 *Definitions:*

3.1.1 *plastic chair, n*—for the purposes of these requirements, a molded, upright piece of furniture with or without arms, having a back in a fixed position with no moving parts, intended for seating one person, and having a seat height not less than 15 in. (381 mm) and not greater than 19 in. (483 mm); for a chair with arms, having a seat width not less than 16 in. (406 mm) and not greater than 30 in. (762 mm); and for a chair without arms, having a seat width not less than 14 in. (356 mm) and not greater than 30 in. (as shown in Fig. 1).

3.1.1.1 *Discussion*—Class A (residential) plastic chairs are intended for use by the customer in and around the home.

3.1.1.2 *Discussion*—Class B (nonresidential) plastic chairs are intended for use by the customer in all other areas, including those defined as Class A.

4. Significance and Use

4.1 Tests and criteria as outlined determine the overall usability and stability of chairs in an environment simulating the conditions of use.

4.2 Tests simulate two types of surfaces:

4.2.1 Smooth surfaces such as linoleum, wet pool decks, etc. The glass testing base (Fig. 2) is used to simulate this surface.

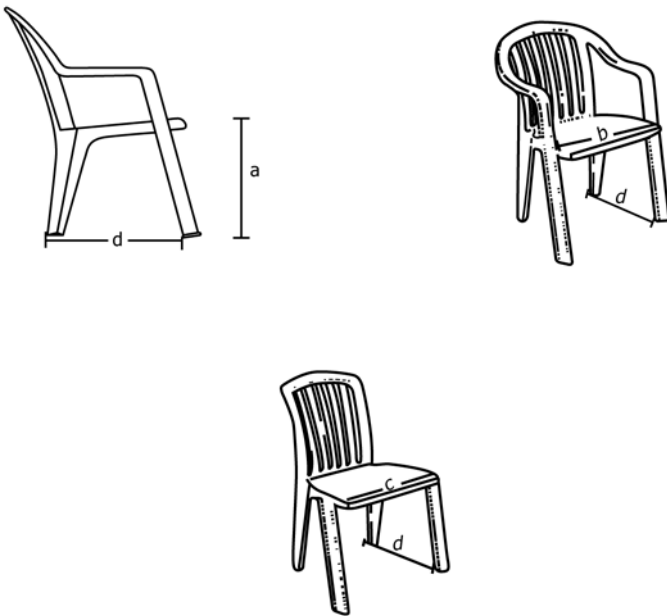
4.2.2 Rough surfaces such as wooden decks, outdoor grassed areas, etc. The plywood testing base (Fig. 3) is used to simulate this surface.

5. Apparatus

5.1 *Plastic Chairs*, which have been inspected and met a manufacturer's internal quality standards.

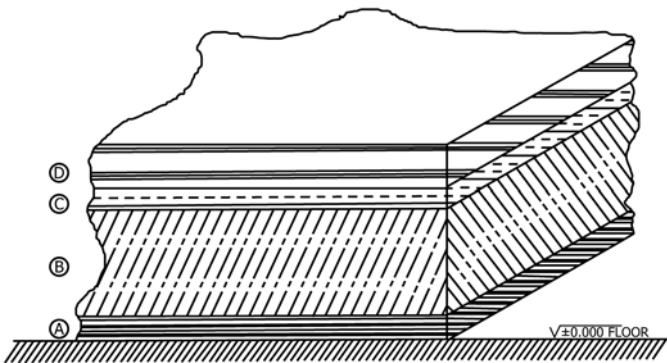
5.2 *One Heavy-Weight Canvas or Leather Bag*, 16 ± 0.2 in. (406 ± 4 mm) in diameter, which shall be measured prior to

³ The last approved version of this historical standard is referenced on www.astm.org.



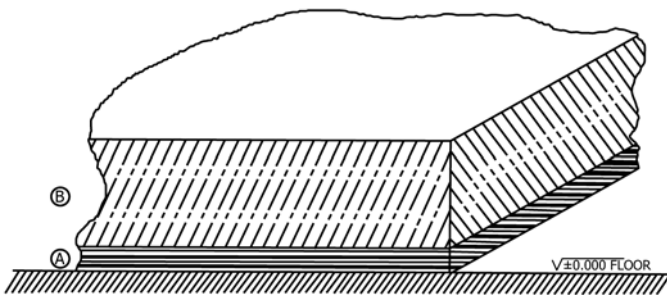
NOTE 1—*a* = seat height, chair with or without arms; *b* = seat width, chair with arms; *c* = seat width, chair without arms; and, *d* = leg stance, measured from back of front leg to back of rear leg.

FIG. 1 Measurements of a Chair



NOTE 1—*A* = poly(methyl methacrylate) sheet (see standard specifications); *B* = AC exterior glue fir plywood (see standard specifications); *C* = polypropylene microfoam sheet (see standard specifications); *D* = glass/tempered (see standard specifications).

FIG. 2 Glass Testing Base



NOTE 1—*A* = poly(methyl methacrylate) sheet (see standard specifications); *B* = AC exterior glue fir plywood (see standard specifications).

FIG. 3 Plywood Testing Base

(0.09 to 0.12 in. (2.3 to 3.0 mm) in diameter) to a total weight of 150 ± 1.5 lb (68 ± 0.7 kg). The bag shall be fitted with a safety cable to prevent it from hitting the glass testing base but should not interfere with the test.

5.3 *One Heavy-Weight Canvas or Leather Bag*, identical to the bag in 5.2; however, the weight is increased by addition to the bag of 150 ± 1.5 lb (68 ± 0.7 kg) of either (1) additional steel or lead shot, or (2) barbell weights distributed evenly on top of the steel or lead shot, for a total weight of 300 ± 3 lb (136 ± 1.4 kg).

5.4 *One Heavy-Weight Canvas or Leather Bag*, identical to the bag in 5.2; however, the weight is increased by addition to the bag of 250 ± 2.5 lb (114 ± 1.1 kg) of either (1) additional steel or lead shot or (2) barbell weights distributed evenly on top of the steel or lead shot, for a total weight of 400 ± 4 lb (182 ± 1.8 kg).

5.5 *Tempered Sheet Glass (as Base)*, one piece 36 ± 0.4 -in. (914 ± 10 -mm) square and clean, 0.38 ± 0.04 -in. (10 ± 0.1 -mm) thickness.

5.6 *AC Exterior Glue Fir Plywood (as Base)*, one piece 36 ± 0.4 -in. (914 ± 10 -mm) square sheet, 1.0 ± 0.1 -in. (25 ± 0.3 -mm) thickness.

5.7 *Poly(Methyl Methacrylate)*, one piece 36 ± 0.4 -in. (914 ± 10 -mm) square sheet, 0.25 ± 0.03 -in. (6 ± 0.1 -mm) thickness.

5.8 *Polypropylene Microfoam*, one piece 36 ± 0.4 -in. (914 ± 10 -mm) square sheet, 0.7 ± 0.01 -lb/ft³ density and 0.13 ± 0.01 -in. (3 ± 0.03 -mm) thickness.

5.9 *Rear Leg Testing Block*—One block of suitable wood material, 36 in. (914 mm) in length, and 3 ± 0.03 in. (76 ± 0.8 mm) in height, and 6 in. (150 mm) or greater in width.

5.10 *Rear Leg Testing Block*—One block of suitable wood material, 36 in. (914 mm) in length, and 3.75 ± 0.04 in. (95 ± 0.95 mm) in height, and 6 in. (150 mm) or greater in width.

5.11 *Rear Leg Testing Block*—One block of suitable wood material, 36 in. (914 mm) in length, and 4.5 ± 0.05 in. (114 ± 1.1 mm) in height, and 6 in. (150 mm) or greater in width.

6. Conditioning

6.1 Precondition all chairs for a minimum of 48 h at 65 to 75°F (18 to 24°C) and a relative humidity of 50 ± 5 % and test subsequently under the same conditions.

7. General Requirements

7.1 All plastic chairs meeting the performance requirements shall be made from polymeric materials that meet the requirements for outdoor weathering in Section 8 for Class A (residential) or Section 9 for Class B (nonresidential).

8. Test Procedure—Class A (Residential)

8.1 *Initial Inspection*—Inspect each chair thoroughly for breaks, fractures, cracks, or other structural damage prior to testing. Any chairs exhibiting structural damage shall not be tested.

testing to determine stretching, having a total measurement not to exceed 17.5 in. (445 mm) and filled with steel or lead shot

8.2 Test each chair in the sequence listed in 8.4, 8.5, and 8.6 and is to comply with 11.1 and 11.2.

8.3 Weatherability Test

8.3.1 Polymeric material used outdoors shall be exposed for weatherability using accelerated weathering chambers and shall retain at least 70 % of its original testing strength.

8.3.2 Specimens to be tested shall be normal 0.125 ± 0.01-in. (3.2 ± 0.03-mm) thick Type 1 tensile test bars injection molded from the same material used in finished chairs or tensile bars cut from finished parts. as described in Test Method D638.

8.3.3 *Tensile Test*—Test exposed and non-exposed (control samples) tensile bars, in accordance with Test Method D638, at a testing rate of 2 in./min (51mm/min).

8.3.4 The specimens are to be exposed according to one of the following procedures: (1) 1000 h in accordance with Procedure B of Practice D2565, using Type B or BH xenon-arc apparatus, (2) 720 h in accordance with Practice G23 using a Type E carbon-arc weathering device, (3) 1000 h in accordance with Cycle A of Practice D4329, using UVB-313 bulbs, or (4) 2000 h in accordance with Cycle A of Practice D4329, using UVA-340 bulbs. For Practice D2565 or Practice G23, the test cycle shall consist of 102 min of light followed by 18 min of light and spray. For Practice D4329, the test cycle shall consist of 8 h of light followed by 4 h or dark with condensation. If Practice G23 is used, the Blackbody temperature shall be 145 ± 5°F (63 ± 3°C).

8.4 Static Load Test:

8.4.1 Position the chair on the glass testing base (Fig. 2) as near as possible to the center of the glass.

8.4.2 Apply the 300 ± 3-lb (136 ± 1.4-kg) bag at a speed not to exceed 6 in. (152 mm)/s to the geometrical center of the seat.

8.4.3 Withdraw the weight from the seat after 10 ± 1 s.

8.4.4 Allow 10 ± 1 s of recovery time.

8.4.5 Repeat 8.4.2 – 8.4.4 eight additional times.

8.4.6 Repeat 8.4.2 one time, allowing the weight to remain on the seat for 30 min ± 10 s, and then withdraw the weight from the seat.

8.4.7 Observe and report any breaks, cracks, fractures, or other structural damage.

8.4.8 Position the chair on the plywood testing base (Fig. 3) and as near as possible to the center of the plywood.

8.4.9 Repeat 8.4.2 – 8.4.7.

8.5 Impact Test:

8.5.1 Position the chair on the glass testing base (Fig. 2) as near as possible to the center of the glass.

8.5.2 Position the 150 ± 1.5-lb (68 ± 0.7-kg) bag at a height of 6 ± 0.1 in. (152 ± 2.5 mm) above the center of the chair seat, at rest.

8.5.3 Allow the bag to free-fall onto the center of the chair seat.

8.5.4 Repeat 8.5.2 and 8.5.3 nine additional times.

8.5.5 Observe and report any breaks, cracks, fractures, or other structural damage.

8.5.6 Position the chair on the plywood testing base (Fig. 3) as near as possible to the center of the plywood.

8.5.7 Repeat 8.5.2 – 8.5.5.

8.6 Rear Leg Test:

8.6.1 Place the chair on the glass testing base (Fig. 2) as near as possible to the center of the glass.

8.6.2 Position the chair with the rear legs unrestrained and the front legs resting on a rear leg testing block of a width suitable to accommodate the chair legs. Height of the wooden block is determined by the distance of leg stance (see Fig. 1):

Leg Stance	Block Height
Under 15 in. (381 mm)	3 ± 0.03 in. (76 ± 0.8 mm)
15 to 17 in. (381 to 432 mm)	3.75 ± 0.04 in. (95 ± 0.95 mm)
Over 17 in. (432 mm)	4.5 ± 0.05 in. (114 ± 1.1 mm)

8.6.3 Lower the 300 ± 3-lb (136 ± 1.4-kg) bag slowly onto the front of the seat of the chair, and slide the bag to the rear of the seat, to a position touching the back of the chair. It may be necessary to temporarily stabilize the chair, but this is permitted only during placement of the bag.

8.6.4 Remove the load after 60 ± 1.0 s.

8.6.5 Observe and report any breaks, cracks, fractures, or other structural damage.

8.6.6 Place the chair on the plywood testing base (Fig. 3).

8.6.7 Repeat 8.6.2 – 8.6.5.

9. Test Procedure—Class B (Nonresidential)

9.1 *Initial Inspection*—Inspect each chair thoroughly for breaks, fractures, cracks, or other structural damage prior to testing. Any chairs exhibiting structural damage shall not be tested.

9.2 Each chair is to be tested in the sequence listed in 9.4 – 9.6 and is to comply with 11.1 and 11.3.

9.3 *Weatherability Test*—Repeat the steps given in 8.3.1 and 8.3.2.

9.4 *Static Load Test*—Repeat 8.4.1 – 8.4.9 using a 400 ± 4-lb (182 ± 1.8-kg) bag.

9.5 *Impact Test*—Repeat 8.5.1 – 8.5.7 using a drop height of 8 ± 0.1 in. (203 ± 2.5 mm).

9.6 *Rear Leg Test*—Repeat 8.6.1 – 8.6.6 using a 400 ± 4-lb (182 ± 1.8-kg) bag.

10. Report

10.1 Report the following information:

10.1.1 Manufacturer's name and manufacturing lot number.

10.1.2 Number of chairs tested.

10.1.3 Initial observations (8.1 or 9.1).

10.1.4 Dimensions (see Fig. 1).

10.1.5 Observations and noted structural damage, if any.

10.2 For Class A (residential), also include the results obtained following the weatherability test (see 8.3), the static load test (8.4), impact test (8.5), and rear leg test (8.6) in the test report.

10.3 For Class B (nonresidential), also include the results obtained following the weatherability test (see 9.3), the static load test (9.4), impact test (9.5), and rear leg test (9.6) in the test report.

11. Performance Criteria

11.1 If the chair collapses at any point during the testing procedure, it shall be reported as a failure whether it recovers or not, and no further testing is required.

11.2 *Class A (Residential)*—There shall be no collapse or any visible evidence of structural damage such as breaks, fractures, or cracks after all of the chairs have been tested in accordance with 8.4 – 8.6.

11.3 *Class B (Nonresidential)*—There shall be no collapse or any visible evidence of structural damage such as breaks, fractures, or cracks after all of the chairs have been tested in accordance with 9.4 – 9.6.

12. Precision and Bias

12.1 Insufficient data are currently available to determine the interlaboratory and intralaboratory reproducibility of these test procedures. Following publication of these requirements, it is expected that sufficient laboratories will become involved and a round robin will be initiated.

13. Keywords

13.1 casual furniture; outdoor furniture; patio furniture; performance requirements; plastic chair; resin furniture

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