



# Standard Safety Specification for Components, Assembly, Use, and Labeling of Consumer Trampolines<sup>1</sup>

This standard is issued under the fixed designation F381; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This safety specification covers the components, the assembly, and the use of consumer trampolines.

1.2 This specification is delimited in its application to trampolines of (1) a minimum bed size of 3300 in.<sup>2</sup> (21 300 cm<sup>2</sup>), (2) a minimum height of 20 in. (51 cm), (3) intended for the purpose of continuous, vertical jumping activities and (4) intended for consumer use.

1.3 This specification is intended (1) to reduce the demonstrated hazards associated with the use of trampolines by consumers; (2) for trampolines used in a home environment by a single user; and (3) not to apply to institutional trampolines or trampolines intended for use on water. Trampolines that adhere to this specification are not recommended for use by children under six years of age.

1.4 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.

1.5 *This standard does not purport to address all of the hazards associated with trampolines. The standard's existence alone will not necessarily prevent injuries. Like other physical activities, trampoline use involves the risk of injury, particularly if the equipment is used improperly.*

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

1.7 This specification includes the following sections and selected subsections.

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<sup>1</sup> This safety specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.17 on Trampolines and Related Equipment.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- B117 Practice for Operating Salt Spray (Fog) Apparatus**
- D638 Test Method for Tensile Properties of Plastics**
- D2240 Test Method for Rubber Property—Durometer Hardness**
- F355 Test Method for Impact Attenuation of Playing Surface Systems and Materials**
- F1487 Consumer Safety Performance Specification for Playground Equipment for Public Use**

<sup>2</sup> 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.

**F2225** Safety Specification for Consumer Trampoline Enclosures

**F2774** Practice for Manufacturing Quality Control of Consumer Trampoline Bed Material

2.2 *AATCC Standard*.<sup>3</sup>

**AATCC Method 169**

2.3 *ANSI Standard*.<sup>4</sup>

**ANSI Z535.4** Product Safety Signs and Labels

2.4 *Federal Standards*.<sup>5</sup>

**16 CFR 1500.48** Technical Requirements for Determining a Sharp Point in Toys and Other Articles Intended for Use by Children Under 8 Years of Age

**16 CFR 1500.49** Technical Requirements for Determining a Sharp Metal or Glass Edge in Toys and Other Articles Intended for Use by Children Under 8 Years of Age

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *access device, n*—device used for access to or egress from a trampoline bed including, but not limited to, trampoline ladders.

3.1.2 *bed, n*—flexible surface which the user contacts in the course of bouncing on a trampoline.

3.1.3 *bouncing, n*—action considered as normal use of a trampoline consisting of continuous, vertical jumping wherein each landing is in near proximity to the previous landing.

3.1.4 *consumer trampoline, n*—trampoline intended for use in a home environment.

3.1.5 *folding-type trampoline, n*—trampoline whose frame can be folded when not in use. See *portable*.

3.1.6 *frame, n*—framework constructed of rigid supportive materials from which the bed is suspended.

3.1.7 *frame padding, n*—shock-attenuating protective device(s) that attaches to the frame to cover the frame and suspension system in the plane of the bed.

3.1.8 *institutional trampoline, n*—trampoline intended for use in a commercial or institutional facility.

3.1.9 *ladder, n*—see *trampoline ladder*.

3.1.10 *legs, n*—the framework constructed of rigid materials which support the frame above the ground or floor.

3.1.11 *mat, n*—common, though non-preferred term referring to bed.

3.1.12 *portable, adj*—able to be easily moved without disassembly, though usually requiring the assistance of devices such as roller stands. Folding-type trampolines are often intended to be portable.

3.1.13 *roller stand, n*—device that is used to assist in rolling/moving a folding-type trampoline frame.

<sup>3</sup> Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709, <http://www.aatcc.org>.

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

<sup>5</sup> Available from U. S. Government Accountability Office (GAO), 441 G St., NW, Washington, DC 20548, <http://www.gao.gov>.

3.1.14 *suspension system, n*—bed-supporting system made up of elastic devices that connect the bed to the frame, for example, steel extension springs.

3.1.15 *trampoline, n*—rebound device activated by vertical jumping, upon which gymnastics skills and exercises are performed.

3.1.16 *trampoline ladder, n*—ladder-like device specifically designed for use with a trampoline and designed to be easily removable.

### 4. Included Components

4.1 When a trampoline is offered for sale, it shall include the following: (1) a frame, (2) a bed, (3) a suspension system, (4) frame padding (where the frame is in the plane of the bed), (5) an enclosure in compliance with Safety Specification **F2225**, (6) an information packet, and (7) suitable markings.

4.2 When a trampoline is offered for sale, a trampoline ladder shall not be included as a component part or within the same packaging.

4.3 When a portable trampoline is offered for sale, it shall include all of the components in **4.1** plus appropriate roller stands.

4.3.1 For folding-type trampolines, the information in **7.5.1** and **8.3.3** shall also include the following:

4.3.1.1 Use two or more strong people to open and close folding-type trampolines.

### 5. Materials and Manufacture

5.1 The provisions in Section **5** shall apply to a trampoline assembled as instructed in the owner's manual. All performance tests shall be conducted on a fully assembled trampoline and enclosure (if sold as a unit) unless otherwise directed in the test requirements.

5.2 *Design Requirements:*

5.2.1 The trampoline shall be designed such that no part of the frame or legs can be contacted by the bed while bouncing. All frame and leg assemblies shall be joined or fastened together so that it requires either two distinct motions to separate those parts or tools to remove fasteners, to avoid unintentional separation.

5.2.2 The frame padding shall be of a color which contrasts with the color of the trampoline bed.

5.2.3 The suspension system shall be designed so as to protect the performer from injury due to contact with the sharp ends of the trampoline springs.

5.3 *Performance Requirements:*

5.3.1 The frame padding, where required, shall be designed to remain securely attached to the frame when tested to the requirements of **6.2** and **6.3**. All tests shall be conducted at ambient temperatures (nominally  $68 \pm 5^\circ\text{F}$  ( $20 \pm 3^\circ\text{C}$ )).

5.3.2 Materials used in any pad cover, frame padding, cover attachments, tie down(s), and pad seams normally exposed to sunlight shall be made from ultraviolet (UV) resistant materials and meet the performance requirements of **6.6**.

5.3.3 Material used in the trampoline mat shall meet the requirements specified in Practice **F2774**.

5.3.4 Except for necessary seams, the frame padding, where required, shall cover the entire top surface of the frame and be wide enough to completely cover the entire top surface of the suspension system and frame when subjected to the tests specified in 6.2.

5.3.5 Height of the bed from the ground or floor shall be sufficient to prevent the bed from contacting the ground or floor while bouncing when tested to the requirements of 6.7.

5.3.6 All information, instructions, and warnings shall be provided in English in addition to any other formats used, for example, graphical, video, multilingual, etc.

5.3.7 When installed in accordance with the manufacturer’s instructions, fasteners, lock washers, self-locking nuts, or other locking means shall be provided for all nuts and bolts to protect them from unintentional loosening; self-locking nuts must fully engage with the bolt. Hardware in moving joints shall also be secured against unintentional loosening. Any other fastening systems shall comply with the requirement that effective locking requires two separate and distinct motions for release.

5.3.8 There shall be no accessible sharp points or edges on fasteners when tested in accordance with 16 CFR 1500.48 and 16 CFR 1500.49.

5.3.9 Bolt ends projecting beyond the face of the nut shall be free of burrs, sharp points, and sharp edges when tested in accordance with 16 CFR 1500.48 and 16 CFR 1500.49. An accessible bolt end shall not extend more than the diameter of the bolt beyond the face of a nut when the nut is tightened to a torque between 20 and 25 lbf-in (2.3 to 2.8 N-m).

5.3.10 If the exposed bolt end is not free of burrs, sharp points, or sharp edges, or a combination thereof, then the threaded ends of bolts may be covered by smooth, tight-fitting caps that shall resist a torque of 4 lbf-in (0.45 N-m) and a tensile force of 15 lbf (67 N) without loosening.

5.3.11 All fasteners shall be corrosion resistant to a level where no rust is evident after a 24-h salt spray test to Practice B117.

5.3.12 No welds shall be made to any steel frame or accessory component with a thickness of less than 0.059 in. (1.5 mm).

5.3.13 No “saddle” welds shall be made to any steel frame or accessory component with a thickness of less than 0.071 in. (1.8 mm). An example of a saddle-welded tee fitting is shown in Fig. 1.

5.3.14 All welded joints shall be rendered corrosion resistant to a level where no rust is evident after a 24-h salt spray test to Practice B117.

5.3.15 No component shall be capable of presenting a protrusion hazard during foreseeable use.

NOTE 1—Test requirements that define a protrusion are in Specification F1487, Subsection 6.3.

5.3.16 There shall be no accessible burrs, sharp points, or sharp edges on tubing when tested in accordance with 16 CFR 1500.48 and 16 CFR 1500.49. End caps or plugs that cannot be removed without the use of tools on tubing may be used to meet this requirement.

**6. Performance Requirements**

6.1 *Shock Attenuation*—Where padding is required, the shock-attenuating material used in the frame padding, as measured to include the frame and a minimum of 2 in. from the inside edge of the frame, shall limit the severity index to less than 450, when the same thickness as used in the frame padding is tested in accordance with Test Method F355 using a 20-lb (9-kg), 20-in.<sup>2</sup> (129-cm<sup>2</sup>) round, flat head dropped from a distance of 2 ft (61 cm).

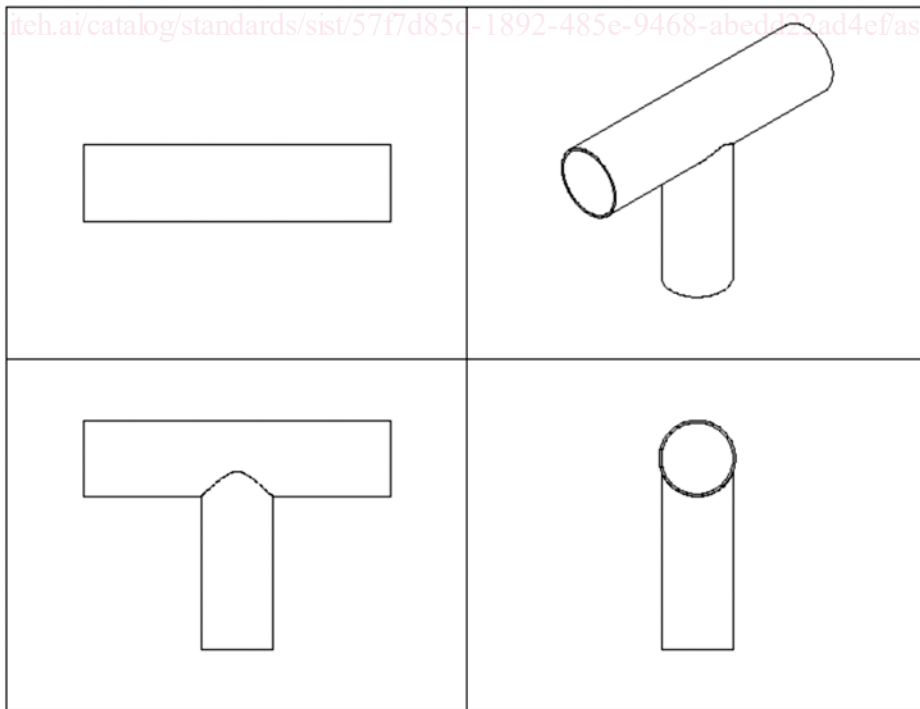


FIG. 1 Saddle Welded Tee Fitting

6.1.1 Where padding is not required, the shock attenuating properties of any part of the trampoline edge shall limit the severity index to less than 450, when tested on a fully assembled trampoline in accordance with Test Method F355 using a 20-lb (9-kg), 20-in.<sup>2</sup> (129 cm<sup>2</sup>) round, flat head dropped from a distance of 2 ft (61 cm).

6.2 *Drop Test*—A drop test will be performed on the frame padding attached to a trampoline and assembled in accordance with the manufacturer’s instructions. The drop test shall use the equipment and procedures described in 6.2.5 and 6.2.6. As a result of the test:

- 6.2.1 The impactor shall not tear the cover or completely penetrate the padding;
- 6.2.2 Seams of the padding shall not separate;
- 6.2.3 The pad attachments shall not separate from the pad or frame; and
- 6.2.4 The padding shall continue to cover the frame, springs, and frame hardware when the impactor is removed from the surface of the padding.

6.2.5 *Drop Test Weight and Impactor Shape*—The drop weight will consist of a 23-kg (50-lb) mass with a wooden impacting surface. See Fig. 2. The edges of the impact surface are radiused and the heel and toe of the surface are contoured as shown in Fig. 2.

6.2.6 *Drop Test Procedure*—The impactor shall be dropped in a guided free-fall to contact the surface of the padding. The surface of the impactor shall be flat and parallel (within 5°) to the surface of the padding on the initial contact with the pad. The impactor shall be dropped on the portion of the padding covering the springs. The impactor shall be centered to impact at a location midway between the inner edge of the frame rail and the edge of the trampoline bed. The impactor shall be raised to a height of 12 in. (tolerance -0/+5 in.) (305 mm [-0/+13 mm]) above the surface of the padding. The impactor shall be dropped at a minimum of two times near each of the following locations, consistent with the required spacing centered between the springs:

- 6.2.6.1 Midway between attachment points,
- 6.2.6.2 Adjacent to an attachment point,
- 6.2.6.3 At a pad seam, and
- 6.2.6.4 Above a leg.

6.2.7 After the first impact, the impactor shall be raised to its initial drop height. The results of the test with regard to pad integrity and coverage will be assessed. The padding shall not be disturbed after removal of the impactor. The impactor is dropped a second time and the results recorded.

6.3 *Padding Attachment System Tests*—The test described in 6.3.1 is intended to measure the ability of the padding

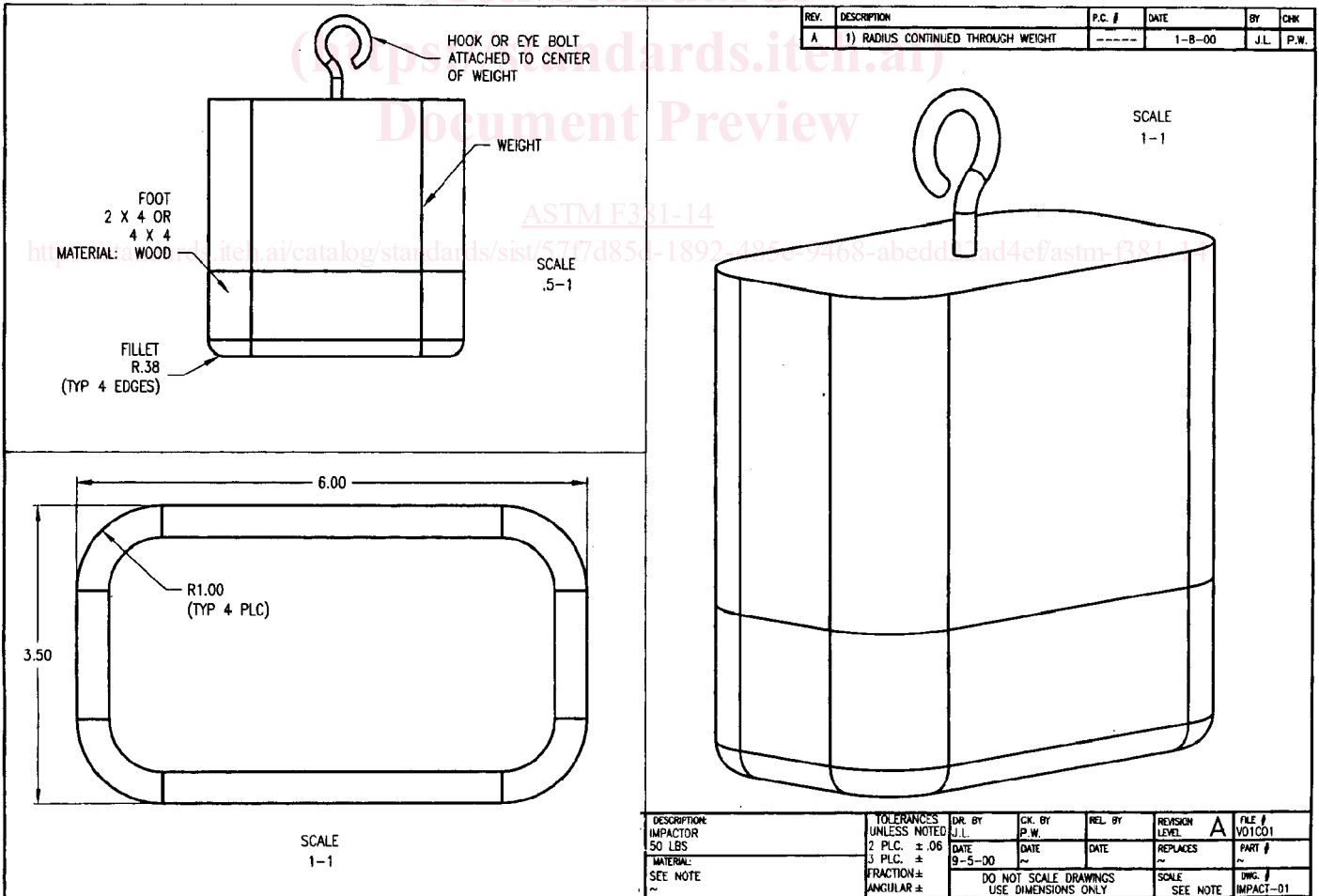


FIG. 2 Drop-Test Impactor Shape

attachment system to keep the frame pad in place when subjected to typical forces imposed by users. The test in 6.3.1 simulates a user climbing onto the trampoline by holding on to the edge of the padding and climbing onto the bed of the trampoline. The test is conducted on a fully assembled trampoline with padding attached, according to the manufacturer's instructions.

6.3.1 Padding Retention:

6.3.1.1 Secure the fully assembled trampoline to the floor or brace it to prevent movement of the trampoline as a result of the applied forces.

6.3.1.2 Place the trampoline pad pull fixture shown in Fig. 3 with the fixture hooks facing down on the trampoline pad. The fixture hook opening may be either of fixed thickness, adjustable to the padding thickness, or V-shaped.

6.3.1.3 Fixed thickness hooks shall be the thickness of the padding  $\pm 1/8$  in. ( $\pm 3$  mm). Adjustable fixture hooks shall be adjusted to the thickness of the pad. Adjustable hooks shall be

adjusted to the thickness of the padding  $\pm 1/8$  in. ( $\pm 3$  mm). V-shaped hooks shall not compress the padding thickness more than  $1/8$  in. (3 mm).

6.3.1.4 Attach the fixture to the pad. Grasp the inside diameter edge of the frame pad as shown in Fig. 4.

6.3.1.5 Using the outboard hook of the fixture, gradually apply a horizontal force of  $85 \pm 5$  lbf ( $380 \pm 20$  N) parallel to the plane of the mat and radially outward from the center of the trampoline. Apply the force at each of three locations shown in Fig. 4 such that: (1) a pad attachment tie down is centered between the fixture arms, (2) the fixture is centered between adjacent pad attachment tie downs, and (3) a pad seam is centered between the fixture arms

6.3.1.6 Immediately release the force after it reaches 85 lbf (380 N). Repeat the force application two additional times at the same location. After the third application of the force, release the force and remove the fixture without adjusting the position of the pad.

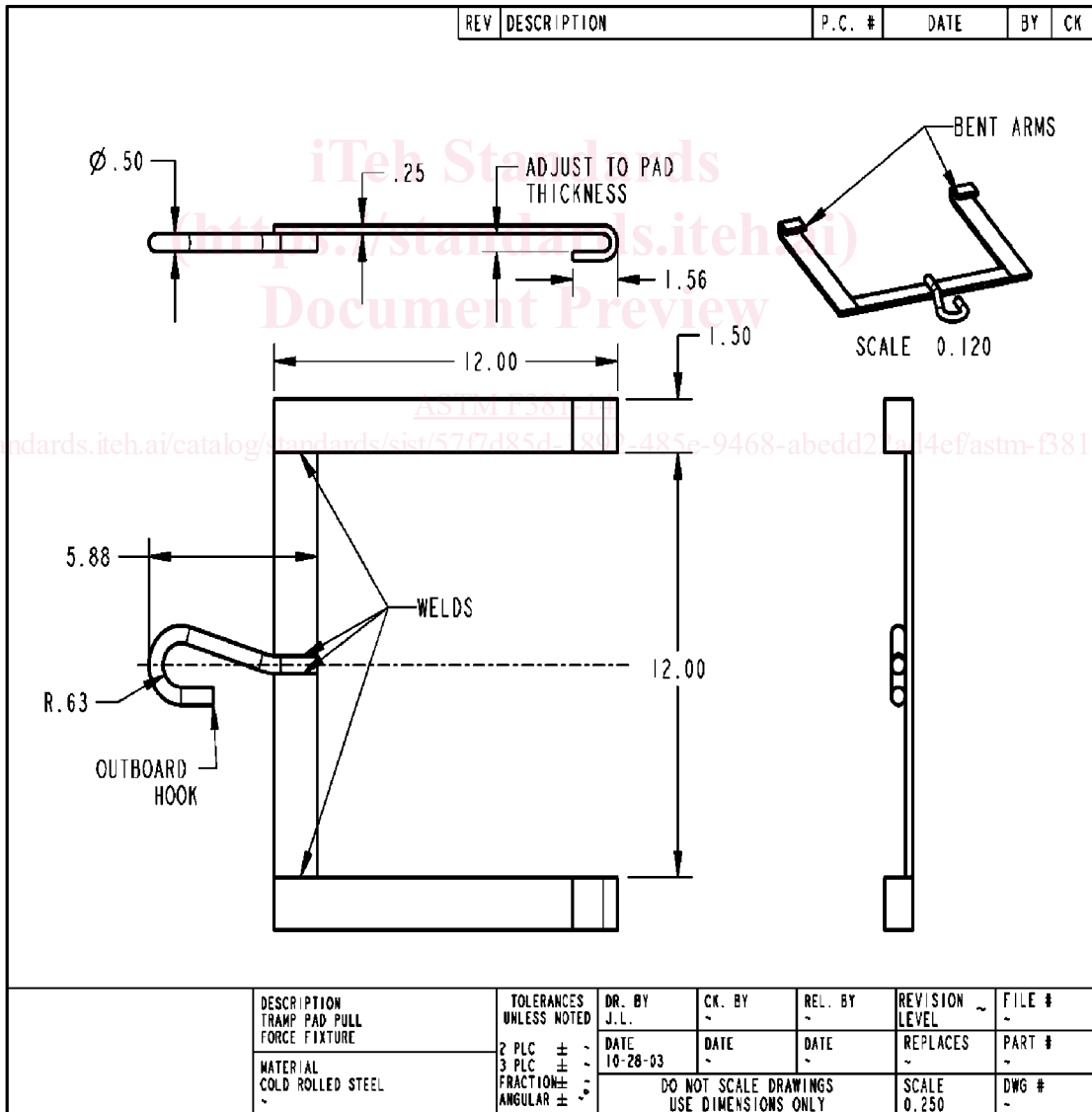


FIG. 3 Trampoline Pad Pull Fixture

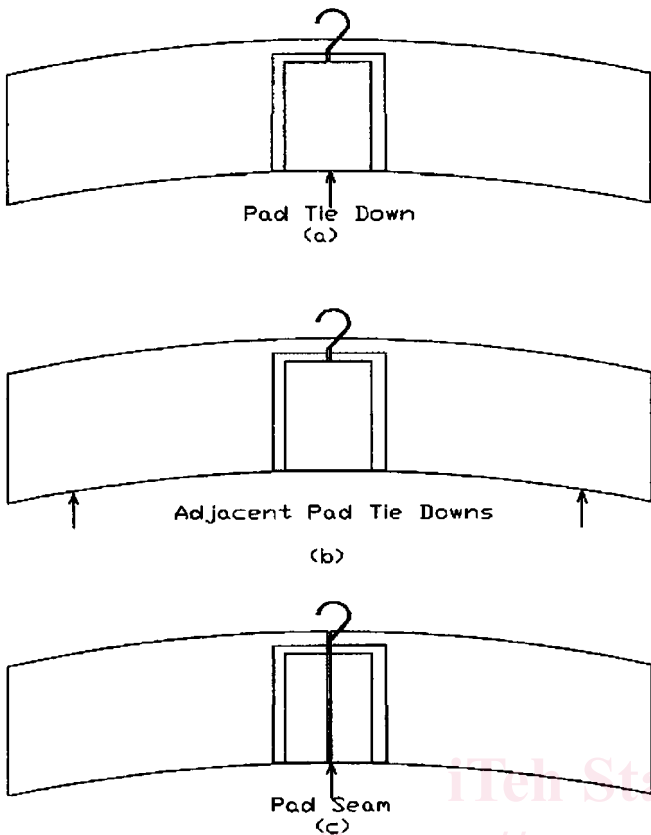


FIG. 4 Force Locations

6.4.1.1 Midway between the two suspension element attachment points, with the impactor long axis oriented perpendicular to the bed edge;

6.4.1.2 Centrally on a suspension element attachment point, with the impactor long axis oriented perpendicular to the bed edge; and

6.4.1.3 With the impactor edge aligned to any structural stitch line.

6.4.2 After the first impact, the impactor shall be raised to its initial drop height. The results of the test with regard to system integrity will be assessed. The impactor guides shall not be moved between impacts. The impactor shall be dropped a second time and the results recorded.

6.5 *Crush and Shear Points*—There shall be no crush or shear points caused by junctures of two components moving relative to one another, or at an opening present in any location on the assembled trampoline in normal use that could cause a contusion, laceration, abrasion, amputation, or fracture. A crush or shear point is any point that allows a  $\frac{3}{16}$  in. (5 mm) diameter neoprene rod to enter at one or more positions and entraps at one or more positions a  $\frac{1}{2}$ -in. (13-mm) diameter neoprene rod. Entrapment shall mean that a force of more than 2 lbf (9 N) is required to pull out the rod. The neoprene rods shall have a hardness reading between 50 and 60 as determined by a Type A durometer in accordance with Test Method D2240.

6.6 *Ultraviolet (UV) Resistant Materials Test:*

6.6.1 Any pad cover, frame padding, cover attachments, tie down(s), and pad seams normally exposed to sunlight shall be exposed for ultraviolet (UV) resistance using accelerated weathering chambers and shall retain at least 80 % of its original tensile strength.

6.6.2 Specimens to be tested shall be normal tensile test samples from the finished material.

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

6.6.4 The specimens are to be exposed according to the following procedures: Accelerated Weathering Procedure (Xenon Lamp Exposure). The test procedure shall be in accordance with AATCC Method 169, except the following deviations shall apply:

(1) The apparatus shall be equipped with an automatic light monitor and shall be capable of automatically controlling irradiance, temperature, and humidity.

(2) The exterior (face) side of the cloth shall be exposed to the light source. The weathering test cycle shall be 40 min of light, 20 min of light with water spray on the fabric face, 60 min of light, 60 min of darkness. The test cycle shall be repeated until the total energy exposure is equal to 500 kJ/m<sup>2</sup> at 340 nm (or 61 MJ/m<sup>2</sup> at 300 nm – 400 nm), which is approximately 500 h exposure in the test apparatus.

(3) The irradiance level shall be either:  $0.40 \pm 0.01$  W/m<sup>2</sup> bandpass at 340 nm, or  $46 \pm 1.0$  W/m<sup>2</sup> at 300 nm – 400 nm.

(4) The glass filter combination shall be a borosilicate type “S” filter in the inner position and a borosilicate type “S” in the outer position. Alternate filter combinations are acceptable, provided that the equipment manufacturer provides a letter

6.3.1.7 The padding attachment system passes this test if after removal of the force and test fixture:

- (1) The padding continues to cover the trampoline’s frame, springs, and associated hardware,
- (2) The pad attachment is not broken or separated from the pad or frame, and
- (3) The pad cover (material or seams) is not torn.

6.4 *Drop Test for Trampoline Edge Survivability*—Where a system other than frame padding is used for impact attenuation, a survivability drop test will be performed on the edge system. The trampoline shall be assembled in accordance with the manufacturer’s instructions. The drop test shall use the equipment and procedures described in 6.2 and 6.4.1. As a result of the test there shall be no evidence of permanent damage or deformation to the edge system.

6.4.1 *Drop Test Procedure for Trampolines Where Frame Padding Is Not Required*—The impactor shall be dropped in a guided free-fall to contact the surface. The surface of the impactor shall be flat and horizontal (within 5°) on initial contact with the surface. The impactor shall be dropped on any portion of the edge system, such that the impactor footprint does not extend into space beyond the edge of the edge system. The impactor shall be raised to a height of 12 in. (tolerance  $\pm 0.5$  in.) (305 mm ( $\pm 13$  mm)) above the surface. The impactor shall be dropped a minimum of 2 times on each chosen location. At least the following three locations shall be tested: