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Standard Consumer Safety Performance Specification for Home Playground Equipment[1]

This standard is issued under the fixed designation F1148; 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 consumer safety specification provides safety requirements for various types of home playground equipment intended for use by children aged from over 18 months through 10 years. It further provides such requirements for swings intended specifically for toddlers. Different age limits for various requirements are found in this specification. These limits reflect the nature of the hazards and the expected mental or physical ability, or both, of the child to cope with the hazards.

1.2 Home playground equipment is defined as any product in which the support structure remains stationary while the activity is taking place and is intended for a child to perform any of the following activities: climbing, swinging, sliding, rocking, spinning, crawling, or creeping, or combination thereof. Fitness equipment is specifically excluded unless attached to the play equipment. This specification is not intended to apply to juvenile care products such as, but not limited to, infant swings, playpens/enclosures, beds, or furniture (including outdoor furniture, such as picnic tables, cradle rockers, activity centers being used as walker substitutes, bouncers, jumpers, infant carriers, and products specifically designed for therapeutic use). This specification is not intended to apply to equipment to be used in places of public assembly such as schools, nurseries, day-care centers, and parks. Equipment intended to be in child-care centers in private homes is not exempt from the requirements of this specification. Such centers are defined as situations in which the child-care provider does not care for more than six children under the age of ten that are not residing in the household of the caregiver, and the total number of children under the age of ten does not exceed ten, including the caregiver's own children. Electrically operated constant air inflatable devices are exempted from the requirements of this specification. Free standing play houses are exempt from this standard where the intent is that the child is standing or seated with their feet on the ground with no climbing, sliding, or swinging activities.

1.3 Methods of identifying products that comply with this consumer safety specification are given. The illustrations of home playground equipment shown in Figs. A1.1-A1.4 are for informational purposes only and are not intended to limit or endorse certain types of playground equipment or equipment features. These illustrations are not intended to limit the variety or various combinations of equipment that are covered by this consumer safety specification.

1.4 The purpose of this specification is to reduce the likelihood of life-threatening or debilitating injuries.

1.5 If toy accessories or toy chests are attached to home playground equipment, they are applicable to this consumer safety specification and to any other applicable safety standards.

NOTE 1—See Annex A1 for figures referenced throughout this consumer safety performance specification.

1.6 *General Measures, Tolerances, and Conversions:*

1.6.1 The general tolerances for this specification (unless otherwise specified) are as follows:

Dimension	Tolerance
X in.	±0.5 in.
X.X in.	±0.05 in.
X.XX in.	±0.005 in.
Angle: ± 1°	
Force in N:	±1.125 lbf (±5 N)
Weight in lbs:	<220 lb (100 kg) ±1 lb (.45 kg)
Weight in lbs.	>220 lb (100 kg) ±2 lb (.90 kg)

These tolerances apply to all dimensions unless otherwise stated or when listed using terms like greater than, less than, minimum, or maximum are used.

1.6.2 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.

1.6.3 The metric conversion factors:

inch (in.) to millimetre (mm):	1 in. = 25.4 mm
pound (lb) to kilogram (kg):	1 lb = 0.45359 kg
pound-force (lbf) to newton (N):	1 lbf = 4.4482 N

1.6.4 See Annex A1 for figures referenced throughout this specification.

1.6.5 *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] This specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.09 on Home Playground Equipment.

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1.7 This consumer safety performance specification includes the following sections:

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2240 Test Method for Rubber Property—Durometer Hardness

F1292 Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment

2.2 *Federal Standards:*

16 CFR 1303 Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint[3]

16 CFR 1500 Hazardous Substances Act Regulations, including sections:[3]

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

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

1500.52 and .53 Test Methods for Simulating Use and Abuse of Toys and Other Articles Intended for Use by Children

16 CFR 1501 Method for Identifying Toys and Other Articles Intended for Use by Children Under 3 Years of Age Which Present Choking, Aspiration, or Ingestion Hazards Because of Small Parts[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *accessible, adj*—relating to a part or portion of the playground equipment that can be contacted by any body part.

3.1.2 *anchors, n*—accessories used to minimize possible tipping of the equipment, or lifting of the support legs.

3.1.3 *completely bounded opening, n*—any opening in a piece of play equipment that is totally enclosed by boundaries on all sides so that the perimeter of the opening is continuous.

3.1.4 *completely bounded non-rigid opening, n*—any opening in a piece of play equipment that is completely enclosed by boundaries, part or all of which can deform or deflect during normal use (for example, the openings in a flexible net or lattice of webbing).

3.1.5 *conspicuous, adj*—describes a label that is visible, when the unit is in the manufacturer's recommended use position, to a person standing near the unit at any one position around the unit but not necessarily visible from all positions.

3.1.6 *continuous surface, n*—a surface smooth to the extent that no hazard such as a catch point for clothing or sharp edge/sharp point is created.

3.1.7 *crush and shear point, n*—juncture at which the user could suffer contusion, laceration, abrasion, amputation, or fracture during use of the playground equipment.

3.1.8 *designated playing surface, n*—any elevated surface intended for standing, walking, sitting, or climbing.

3.1.9 *edge, sharp*[4], *n*—an edge that can cut a user's skin.

3.1.9.1 *Discussion*—An edge is judged as sharp pursuant to the provisions of 16 CFR Section 1500.49.

3.1.10 *entanglement, n*—condition in which the user's clothes or something around the user's neck becomes caught or entwined on a component of playground equipment.

3.1.11 *entrapment, n*—any condition which impedes withdrawal of a body or body part that has penetrated an opening.

3.1.12 *fall height, n*—vertical distance between a designated play surface and the protective surfacing beneath it.

3.1.13 *g*—the acceleration due to Earth's gravity at sea level, having a standard value of 386.088 in./s^2 (9807 mm/s^2). The standard value may be approximated as 32.174 ft/s^2 (9.807 m/s^2). Accelerations may be expressed in units of g, where 1 g = the acceleration due to gravity.

3.1.14 *g-max*—the maximum acceleration of a missile during an impact, expressed in g units.

3.1.15 *guardrail, n*—a guardrail is a device around an elevated surface that is intended to prevent inadvertent falls from the elevated surface.

3.1.16 *hand grasping component, n*—a component intended to be grasped by the hand to steady a user (such as a handrail).

3.1.17 *hand gripping component, n*—a component intended to be gripped by the hand to support the full body weight (such as a rung of a horizontal ladder or trapeze bar).

3.1.18 *handrail, n*—the structural member that helps a child steady himself. As used in this consumer safety performance

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

[3] Available from Consumer Product Safety Commission, Washington, DC 20207.

[4] A sharp edge tester suitable for conducting tests in accordance with the Federal regulation at 16 CFR Section 1500.49 is available from U.S. Testing Co., Inc., 1415 Park Avenue, Hoboken, NJ 07030. Engineering drawings from which a sharp edge tester may be fabricated are available from the Office of the Secretary, Consumer Product Safety Commission, Washington, DC 20207.

specification, a handrail is the structural member at the top of a slide that helps a child steady himself while he sits down (see Fig. A1.1).

3.1.19 *head injury criteria (HIC), n*—a measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of deceleration.

3.1.20 *lawn swing, n*—a multi-user occupant enclosed swing where children sit on opposite sides facing one another with their feet resting on a platform and their back against a backrest.

3.1.21 *platform, n*—any elevated horizontal surface intended to be used by children as a place for play or as a transition between components. Slide transition areas <200 in.^{2} (1290 cm^2) are not considered platforms.

3.1.22 *point, sharp*[5], *n*—point that can puncture or lacerate a user's skin.

3.1.22.1 *Discussion*—A point is judged as sharp pursuant to the provisions of 16 CFR Section 1500.48.

3.1.23 *projection, n*—a condition that due to its physical nature must be tested to the requirements of this standard to determine whether it is a protrusion or entanglement hazard, or both.

3.1.24 *protective barrier, n*—enclosing device around an elevated surface that prevents both inadvertent and deliberate attempts to pass through the device.

3.1.25 *protrusion, n*—a projection which, when tested in accordance with requirements of this standard, is found to be a hazard having the potential to cause serious bodily injury to a user who impacts it.

3.1.26 *rung, n*—a cross-piece in a ladder or other climbing equipment used for supporting the user's feet or grasping by the user's hands, or both. A rung must comply with 6.10 for hand-gripping components.

3.1.27 *small part, n*—a component that may become detached during use of the playground equipment and presents a choking, aspiration, or ingestion hazard to a child. Such a component is determined to be a hazard pursuant to the provisions of 16 CFR 1501.

3.1.28 *swing, n*—an element or seat suspended from an elevated support structure so as to allow users to move freely in one or more planes and possesses a pivot arm greater than 24 in. (610 mm) when measured vertically from the top of the suspended element to the pivot point.

3.1.28.1 *Discussion*—Swings include the following types: single axis (to-fro), multiple axis (rotating), or swings with multiple motions consisting of a combination of single axis and multiple axis (combination swings).

3.1.29 *toddler swing, n*—a fully enclosed single occupant swing intended for young children who can sit upright unaided. A seat is considered fully enclosed when a containment system is employed that supports the child on all sides and in between the legs (see Fig. A1.5).

3.1.30 *toy accessory, n*—an article that provides certain play value separate from, but attached to or sold with, home playground equipment intended for play-time use by a child. Such articles include miniature imitations for play use of objects intended primarily for a specific purpose (for example, a toy telephone or a toy gas pump).

3.1.31 *turnbar, n*—the horizontal bar between the supporting legs of a swing set, such as the one shown in Fig. A1.1.

3.1.32 *use zone, n*—the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment, and on whose surface it is predicted that a user would land when falling or exiting the equipment.

4. Materials and Manufacture

4.1 *General*—Home playground equipment shall be manufactured and constructed only of materials that have a demonstrated durability in an outdoor setting. Any new materials shall be documented or tested accordingly for durability by the playground equipment manufacturer or their agent.

4.1.1 Metals subject to structural degradation such as by rust or corrosion shall be painted, galvanized, or otherwise treated. Woods shall be naturally rot- and insect-resistant or treated to avoid such deterioration. Creosote, pentachlorophenol, tributyl tin oxide, and surface coatings that contain pesticides shall not be used for playground equipment. Wood treaters and playground equipment manufacturers shall practice technologies and procedures that minimize the level of dislodgeable toxin. Plastics and other materials that experience ultraviolet (UV) degradation shall be stabilized against ultraviolet light.

4.1.2 Regardless of the material or the treatment process, the manufacturer shall ensure that the users of the playground equipment cannot ingest, inhale, or absorb any potential hazardous amounts of substances through body surfaces as a result of contact with the equipment.

4.1.3 *Lead in Paint*—All paints and finishes used on playground equipment shall be in accordance with 16 CFR 1303.

5. General Requirements

5.1 *Applicable to All Home Playground Equipment*—Playground equipment represented as complying with this voluntary consumer safety performance specification shall meet all applicable requirements specified herein. Anyone representing compliance with this consumer safety performance specification shall keep such essential records as are necessary to document his claim that the requirements within this consumer safety specification have been met.

5.1.1 No item of playground equipment shall indicate, by label or other means, conformance with this specification unless it conforms to all requirements contained herein. The following statement is suggested for use in identifying a product that conforms to all requirements in this specification:

5.1.2 "This conforms to ASTM F1148, Consumer Safety Performance Specification for Home Playground Equipment."

[5] A sharp point tester for conducting tests in accordance with the Federal regulation at 16 CFR Section 1500.48 is available from U.S. Testing Co., Inc., 1415 Park Avenue, Hoboken, NJ 07030. An engineering drawing from which a sharp point tester may be fabricated is available from the Office of the Secretary, Consumer Products Safety Commission, Washington, DC 20207.

5.2 *Small Parts*—When installed in accordance with the manufacturer's instructions, equipment for children under 3 years of age shall meet the requirements of 16 CFR 1501.

NOTE 2—A rationale for provisions in this consumer safety performance specification is given in Appendix X1.

6. Performance Requirements

6.1 *Head and Neck Entrapment*—Home playground equipment shall be designed and constructed so that when assembled any accessible opening shall meet the following performance requirements to reduce the risk of accidental head or neck entrapment by either a head first or feet first entry into the opening. Openings between the ground and the bottom edge of the equipment (such as rails, platforms, steps, etc.) are exempt from this requirement as illustrated in Fig. A1.6.

6.1.1 *Accessible Openings*—Any completely bounded opening that completely accepts the torso test probe. A completely bounded opening is accessible when a torso test probe may be inserted into the opening to a depth greater than or equal to 4 in. (100 mm) using the following test method (see Fig. A1.7).

(1) Test Procedure and Performance Criteria for Completely Bounded Openings—Place the torso probe in the opening, tapered end first, with the plane of its base parallel to the plane of the opening; rotate the probe while keeping its base parallel to the plane of the opening. If the base of the probe passes through the opening when it is rotated about its own axis in any orientation, place the head probe (see Fig. A1.8) in the opening, tapered end first, while its plane is parallel to the plane of the opening.

(2) An opening can pass this test when tested in accordance with 6.1.1(*1*) in one of two ways: (*1*) the opening does not admit the torso probe when it is rotated to any orientation about its own axis, or (*2*) the opening admits the torso probe and also admits the head probe.

(3) An opening fails the test under the following conditions: The opening admits the torso probe but does not admit the head probe.

6.1.2 Completely bounded openings that are accessible must also meet requirements for angles as outlined in 6.2.

6.1.3 *Nonrigid Completely Bounded Openings*—A nonrigid opening such as, but not limited to, flexible nets, tarps, and plastic enclosures is considered accessible if a torso probe will penetrate the opening to a depth greater than or equal to 4 in. (100 mm) when tested in accordance with 6.1.1(*1*) (see Fig. A1.7). Flexible restraining systems on toddler swings are exempt from this requirement unless they form leg openings.

(1) Test Procedure for Entrapment in Nonrigid Openings—Place the torso probe in the opening, tapered end first, with the plane of its base parallel to the plane of the opening; rotate the probe while keeping its base parallel to the plane of the opening; apply 50 lbf (222 N) ± 1.125 lbf (5 N) while attempting to push the probe through the opening. If the base of the probe passes through the opening when it is rotated about its own axis in any orientation and 50 lbf (222 N) is applied, place the head probe in the opening, tapered end first, while its plane is parallel to the plane of the opening and 50 lbf (222 N) is applied.

(2) A nonrigid opening can pass the test when tested in accordance with 6.1.3(*1*) in one of two ways: (*1*) the opening does not allow the torso probe to be inserted so deep that the opening admits the base of the probe when it is rotated to any orientation about its own axis, or (*2*) the opening allows full passage of the torso probe and also allows the head probe to pass completely through.

(3) A nonrigid opening fails the test under the following conditions: the opening allows full passage of the torso probe but does not admit the head probe.

6.2 *Acute Angles*—There shall be no acute angles, or group of acute angles, formed by two or more members in which the legs point upward from the apex so that the configuration approximates a "V" with an interior angle less than 55° (0.96 rad).

6.2.1 *Exemptions to 6.2:*

(1) Inverted Angle or "V" Condition—Those "Vs" that are inverted. A "V" is considered inverted if the lower adjacent leg forming the "V" is horizontal or slopes downward from the apex (see Fig. A1.9).

(2) Filled Apex Condition—"V" angles less than 55° (.95 rad) where the apex of the angle is filled to the point that will not allow the head probe to contact both surfaces of the angle simultaneously (see Fig. A1.9). The angle shall be covered with a shield that is made of a rigid material. The shield shall be capable of withstanding impact of at least 20 ft·lbf (27 J) imparted to a spot within 1 in. (25 mm) of the geometric center of the shield by a 5 in. (127 mm) diameter steel ball. The shield shall be tested while secured to the members of the playground equipment by the hardware provided. During the test, the equipment or portions thereof, if required, shall be oriented so that the surface of the shield is horizontal.

(3) Rope, Chain, and Cable—"V" angles less than 55° (.95 rad) where the apex of the angle is formed by an inclined or vertical climbing surface and a rope, chain, or cable. To be exempt, the point of the formed "V" angle must be no greater than 1.5 in. (38 mm) above the protective surfacing. See Fig. A1.9.

6.3 *Protrusions*—When tested in accordance with 6.3.1 – 6.3.6.1, no protrusion shall extend beyond the face of the appropriate test gauge as defined in 6.3 and shown in Fig. A1.11 and Fig. A1.12.

6.3.1 Perform protrusion tests by successively placing each test gauge shown in Fig. A1.11 to determine if the protrusion extends beyond the face of the smallest gauge that can be successfully placed over the protrusion (for example of test gauge use, see Fig. A1.13).

6.3.2 *Upright Protrusions*—Protrusions that fit within any of the gauges and that project upwards from a horizontal plane shall have no projection extending greater than .125 in. (3 mm) perpendicular to the plane of the initial surface (see Fig. A1.14).

6.3.3 *Motion Rides*—Protrusions on the front and rear surfaces of suspended members of swinging elements and those on the interior surface of slides shall not protrude beyond the face of the test gauge shown in Fig. A1.12. Conduct the test with the suspended member in its rest position. Place the gauge shown in Fig. A1.12 over any protrusions on the front and rear surfaces of the suspended member such that the axis of the hole

is parallel to both the intended path of the suspended member and a horizontal plane.

6.3.4 *Slides*—Slides, including protective barriers and their method of attachment and transition areas, pose a greater risk of entanglement than other areas of play equipment. Therefore, the following requirements apply to slides and sliding devices:

6.3.4.1 Any accessible protrusion that allows the 3.00 in. (76 mm) protrusion gauge (see Fig. A1.11) to pass over it shall have no projection extending perpendicular from the initial surface greater than .125 in. (3 mm). The area that is subject to this requirement is outlined in Fig. A1.16. The outside surface of tunnel slides that are completely enclosed are not subject to the requirements of this section.

6.3.4.2 Slides shall be constructed in such a manner as to provide a smooth continuous sliding surface with no gaps or spaces that might create an entanglement hazard such as, but not limited to, the space created between sidewalls when two single slides are combined to create a double wide slide or the point where a hood attaches to the sidewalls of a slide. Roller slides are exempt from the requirements of this section.

6.3.5 No protrusion may terminate in a dimension greater than that of the base dimension (see Fig. A1.17). In the case of hardware as defined in 6.8, the base dimension shall be defined as the major dimension of the attachment nut or bolt head.

6.3.6 *Exclusions*—Protrusions are exempt from the requirements of 6.3.2 and may be considered inaccessible if the protrusion cannot be placed within the 3.0 in. diameter test gauge (see Fig. A1.18).

6.3.6.1 Rope protrusions are specifically exempted from the requirements of 6.3.

6.4 *Edges, Points, and Surfaces*—Following assembly of the unit in accordance with the instructions to be provided to the consumer, there shall be no sharp edges, points, or surfaces on any portion of the home playground equipment capable of inflicting a cut on a child.

6.4.1 All equipment shall be packaged in a manner that will preclude any sharp edges from being exposed during transit or storage.

6.5 *Open Tubing*—All open tubing ends that are not resting on the ground, or otherwise covered, shall be provided with caps or plugs that have a smooth finish and are tight-fitting. They shall be subjected to a torque of 4 lbf-in. (0.45 N-m) ± 5 lbf-in. (0.056 N-m) and a force of 15 lbf (67 N) ± 1.125 lbf (5 N) when tested in accordance with Title 16 CFR Section 1500.53(e and f).

6.6 *Crush and Shear Points*—There shall be no crush or shear points caused by junctures of two components moving relative to each other that could cause a contusion, laceration, abrasion, amputation, or fracture. A crush or shear point is any point that allows a .187 in. (5 mm) diameter neoprene rod to enter at one or more positions and entraps at one or more positions a .50 in. (13 mm) +0/–.005 in. (+0/–.127 mm) diameter neoprene rod. Entrapment shall mean that a force greater 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.

6.7 *Holes and Slots*—If a circular hole or slot in any rigid material with a thickness less than .375 in. (10 mm) is accessible and can admit a .25 in. (6 mm) +.005 in./–0 (+0/–.127 mm) diameter rod to a depth of .375 in. (10 mm) or greater, it shall also admit a .50 in. (13 mm) +0/–.005 in. (+0/–.127 mm) diameter rod. Chains are exempt except as described in 8.1.7.2.

6.8 *Hardware:*

6.8.1 Upon final assembly, bolt ends shall not protrude beyond the nuts greater than the diameter of the bolt when the nuts are tightened to a torque between 20 and 25 lbf·in. (2.3 and 2.8 N·m).

6.8.2 Threaded bolt ends that are recessed such that the end of the bolt lies at or below a surrounding surface located within 1.0 in. (25 mm) +0/–.05 in. (+0/–1.3 mm) of the centerline of the bolt are exempt from the requirements of 6.8.1 (see Fig. A1.19). Recessed threaded bolt ends that are free from hazardous sharp edges and burrs are exempt from the requirements of 6.8.3.

NOTE 3—The surrounding surface shall be blended wherever possible to create smooth contours without abrupt changes in shape that could pose a potential impact hazard.

6.8.3 If the threaded ends of exposed bolts or rods protrude from adjacent surfaces in areas of normally expected play, or if the thread is not free of exposed hazardous sharp edges or burrs, or both, then the threaded ends shall be covered by smooth finish caps.

6.8.4 Any caps that are used shall be tight-fitting when installed in accordance with the manufacturer's instructions. They shall be subjected to a torque of 4 lbf·in. (0.45 N·m) ± .5 lbf-in. (0.056 N-m) and a tensile force of 15 lbf (67 N) ± 1.125 lbf (5 N). These components shall comply with the requirements of 16 CFR 1500.48, 1500.49, 1500.53 (e and f), and 1501.

6.8.5 Lock washers, self-locking nuts, or other locking means shall be provided for all bolts.

6.9 *Hooks*—Open-ended hooks may be used for the uppermost suspension point of suspended elements provided that they have openings, or entry to an opening, in the area inside the boundaries represented by a line that is adjacent to the outer extremity of the uppermost portion of the hook, and parallel to the normal plane of suspension. Some examples of hooks that are acceptable and unacceptable are shown in Fig. A1.20.

6.9.1 Hooks used for attachment of rides, or swing elements at any point other than at the uppermost suspension point, shall be designed to allow full closure, or be otherwise protected (for example, protective coverings). A hook is considered closed when the gap or space cannot admit a 0.04 in. (1 mm) +0/–.005 in. (+0/–.125 mm) feeler gauge.

6.10 *Hand Gripping/Grasping Components:*

6.10.1 *Hand Gripping Components* intended to be gripped by the hands to support body weight, such as rungs of horizontal ladders, climbing bars, handles, and the like, shall not exceed 1.55 in. (39.4 mm) in diameter or in the maximum cross-sectional dimension. When structural requirements cannot reasonably be met by the 1.55 in. diameter components,

care must be exercised in selecting alternate components and designs, or both, to ensure that hand-gripping potential is not seriously impaired.

6.10.2 Hand grasping components intended to be grasped by the hand to steady the user, such as a handrail, shall have a maximum diameter or width of 1.75 in. (44.5 mm) and a minimum graspable depth of 1.5 in. (38 mm) to allow the fingers to pass over the object to be grasped. See Fig. A1.21.

7. Requirements for Access

7.1 *Rung Ladders, Stepladders, and Stairways:*

7.1.1 Rungs, steps, and stairs shall be evenly spaced within a tolerance of ±0.25 in. (±6 mm) and horizontal within a tolerance of ±2°. The even spacing will include the distance between the top rung, step, or stair and the top surface of the platform.

7.1.2 Rung ladders, stepladders, and stairways shall comply with the requirements found in Table 1.

7.1.3 Tread depth, width, and rise shall be measured as illustrated in Fig. 1.

7.2 *Handrails:*

7.2.1 Continuous handrails shall be provided on both sides of stairways and stepladders that have more than one tread. Handrails or other means of hand support shall be available for use at the beginning of the first step. The handrail shall be between 0.95 and 1.55 in. (24 and 39 mm) in diameter. The handrail height (the vertical distance between the top front edge of a step and the handrail above it) shall be between 22 and 38 in. (559 and 965 mm).

TABLE 1 Access Requirements for Rung Ladders, Stepladders and Stairways

Type of Access	
Rung Ladder:	
slope	60 to 90° (1.047 to 1.570 rad)
total ladder width	≥12 in. (304.8 mm)
vertical rise (top of rung to top of rung)	≤12 in. (304.8 mm)
Stepladders:	
Slope	≥50 to 75° (0.872 to 1.309 rad)
Tread width:	
single file access	12 to 21 in. (304.8 to 533.4 mm)
two-abreast access	not recommended
Tread depth:	
open riser	≥3 in. (76.2 mm)
closed riser	≥7 in. (177.8 mm)
vertical rise (top of step to top of step)	≤11 in. (279.4 mm)
Stairways:	
Slope	<50° (0.872 rad)
Tread width:	
single file access	≥12 in. (304.8 mm)
two-abreast access	≥30 in. (762 mm)
Tread depth:	
open riser	≥7 in. (177.8 mm)
closed riser	≥7 in. (177.8 mm)
vertical rise (top of step to top of step)	≤9 in. (228.6 mm)

7.2.1.1 Stairways with a tread surface area of ≥200 in.^{2} (1290 cm^2) must have a continuous handrail that complies with the requirements for guardrails and barriers in 7.3.

7.2.2 Open riser step ladders with a slope between 65° and 75° may be considered a climber and do not require handrails as long as a means of hand support is provide while climbing. Climbers and rung ladders must provide a means of hand support at the transition from climber to the platform. Open riser step ladders with a slope between 50° and <65° must meet the requirements of 7.2.3.

7.2.3 Rung ladders and step ladders with closed risers must provide handgripping components or other means of continuous hand support beginning at the first step of a step ladder or first rung of a rung ladder that conform to the requirements of 6.10 hand gripping/grasping components.

7.2.3.1 Rung ladders shall have hand-gripping support above the platform to facilitate the transition from the ladder to the platform.

7.3 *Guardrails and Protective Barriers*—Guardrails or protective barriers shall be provided on elevated surfaces such as platforms, landings, walkways, ramps and similar transitional play surfaces, in accordance with the following subsections. Guardrails and protective barriers shall be designed to discourage climbing and must have a top surface less than 3 in. (76 mm) wide or having greater than a 30° (.52 rad) angle from horizontal.

7.3.1 Elevated surfaces less than or equal to 30 in. (76 cm) above the surfacing do not require guardrails. Guardrails shall be provided on elevated surfaces greater than 30 in. (76 cm) but less than or equal to 48 in. (122 cm) above the surfacing. Protective barriers shall be provided on elevated surfaces greater than 48 in. (122 cm) above the surfacing.

7.3.2 Guardrails shall completely surround the elevated surface except for entrance and exit openings necessary for each event. Guardrail overall height shall be equal to or greater than 25 in. (635 mm). The maximum vertical opening between the lowermost member of a guardrail and the elevated surface it surrounds shall be 24 in. (610 mm). Openings between guardrail members or between a guardrail and the elevated surface it surrounds shall conform to the requirements addressing head and neck entrapment. If the top surface of the guardrail creates a completely bounded opening which presents a head and neck entrapment hazard, it is permissible to lower the guardrail to below the 25 in. (635 mm) height requirement to eliminate the head and neck entrapment hazard (see example in Fig. A1.22).

7.3.3 Elevated surfaces that are greater than 48 in. (1219 mm) above the surfacing but less than or equal to 72 in. (1829 mm) above the surfacing shall have protective barriers equal to or greater than 27 in. (686 mm) high. Elevated surfaces greater than 72 in. (1829 mm) above the surfacing shall have protective barriers equal to or greater than 33 in. (838 mm) high.

7.3.3.1 Protective barriers shall completely surround the elevated surface except for entrance and exit openings necessary for each event. Protective barriers shall be designed to minimize the likelihood of climbing. Openings within barriers

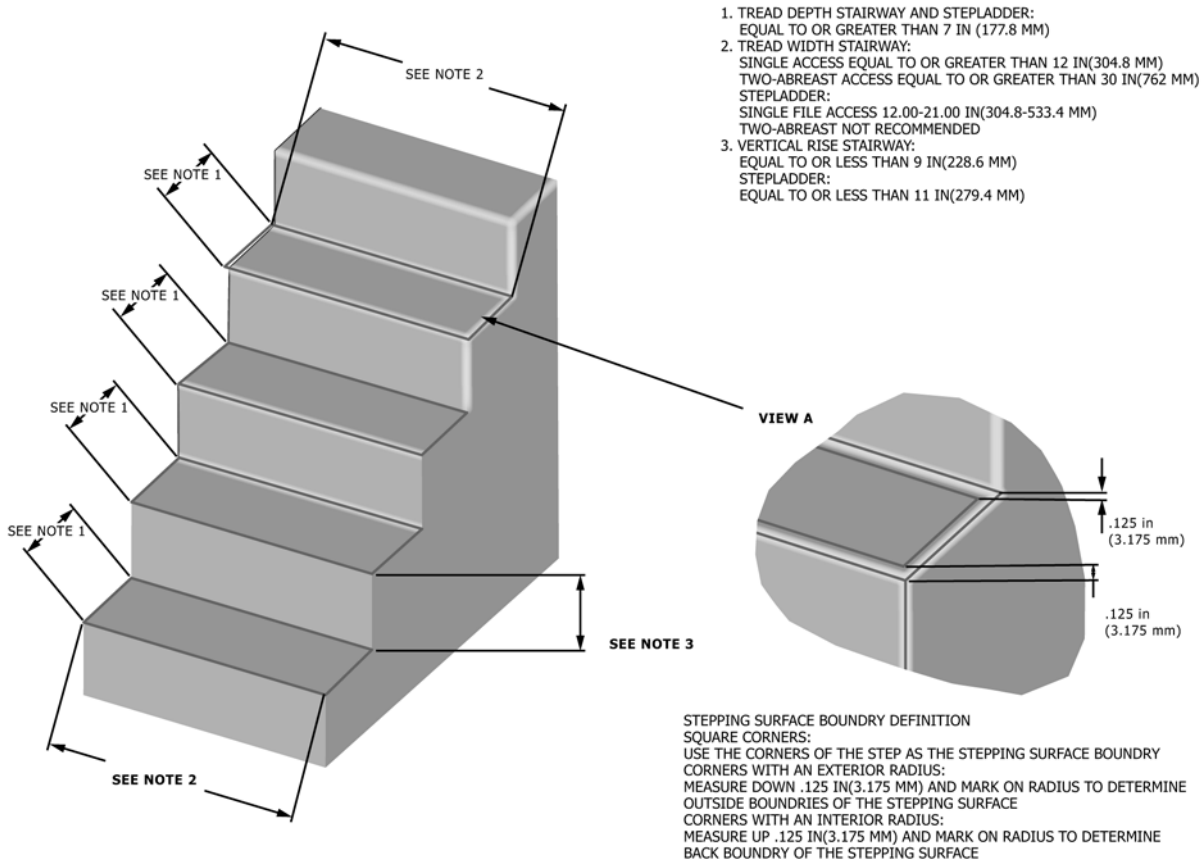


FIG. 1 Tread Depth, Width, and Rise

or between the platform surface and lower edge of protective barriers shall preclude passage of the torso probe (see Fig. A1.7).

8. Equipment

8.1 *Swings:*

8.1.1 To-fro swinging components such as, but not limited to, swings, trapeze bars, trapeze rings, and gliders shall not be attached to upper body components such as horizontal ladders.

8.1.2 *Hangers*—All swing elements shall have hanger arrangements whose durability shall be determined by either of the following dynamic cycling tests. At the completion of the test there shall be no loosening or structural failure of the hanger.

8.1.2.1 Each type of swing element shall be attached to its support member in accordance with the installation instructions and mounted in a suitable test fixture. Flexible components of the swing element may be replaced by rigid components of at least the same size and weight as long as the alternate components do not affect the swing element's moving parts. The appropriate test weight shall be secured to each occupant position to be tested. This suspended unit shall then be oscillated through an arc with an included angle as specified in Table 2 for a total of 180 000 cycles (forward and backward).

8.1.2.2 As an alternative to the test in 8.1.2.1, swing hangers may be tested individually in a laboratory test fixture as follows: Secure the hanger to a portion of its support member in accordance with the manufacturer's installation instructions.

TABLE 2 Swing Hanger Arc and Test Weight

Swing Type	θ_o, degrees (rad)	Test Weight, lb (kg)
Single-occupancy swing (two hangers)	90 (1.57)	80 (37)
Multiple-occupancy exposed swing (two hangers, two occupants)	60 (1.05)	130 (60)
Multiple-occupancy enclosed swing (four hangers, two occupants)	45 (0.79)	60 (27)
Multiple-occupancy enclosed swing (four hangers, four occupants)	45 (0.79)	120 (54)

Install the support member and hanger in the test fixture shown in Fig. A1.23, ensuring that the pivot axis of the test fixture and the pivot point of the hanger are aligned. In accordance with Table 2, attach the appropriate test weight to the hanger and oscillate the hanger support member 180 000 cycles (forward and backward) through the appropriate arc.

8.1.3 *Minimum Ground Clearance*—When the assembled swing set is installed according to the manufacturer's instructions, the minimum clearance between the ground surface and the underside of any suspended unit shall be 8 in. (200 mm).

8.1.4 *Suspended Swinging Elements:*

8.1.4.1 Suspended elements shall be smoothly finished with blunt or rounded edges and shall conform to 6.4.

8.1.4.2 Suspended elements shall not impart a peak acceleration in excess of 100 g (980 m/s^2) and shall have an HIC score not to exceed 500 when tested in accordance with impact attenuation requirements in 8.1.11.

8.1.4.3 Any part of a swing that is a minimum of 84 in. (2134 mm) above the protective surface at its lowest point in use is exempt from the impact requirements.

8.1.5 *Lawn Swings*—These swings shall be provided with platforms or footrests and seats meeting the criteria given in 8.1.5.1 – 8.1.5.4.

8.1.5.1 Seats intended for individual or dual passengers that include a backrest shall be designed so that any opening between the seat and the backrest shall prevent entry of the test fixture (see Fig. A1.24 and Fig. A1.25) when it is located at any point in the opening and a force of 45 lbf (200 N) ± 1.125 lbf (5 N) is applied to the fixture in a direction perpendicular to the entrance plane of the opening. The force shall be applied gradually and maintained for 5 min.

8.1.5.2 The platform or footrest shall extend no less than 1 in. (25 mm) behind the forward leading edge of the seat (see Dimension A, Fig. A1.24). This dimension shall be measured horizontally with the swing in its at-rest position. The space between any slats in the platform shall be no greater than 1.5 in. (38 mm).

8.1.5.3 The area of the platform that extends beyond the vertical supports of the swing shall be angled upwards not less than 30° from the horizontal (see Angle C, Fig. A1.24).

8.1.5.4 The bottom edge of the seat skirt shall not be greater than 10 in. (254 mm) above the top surface of the platform or footrest when the swing is in its at-rest position (see Dimension B, Fig. A1.24).

8.1.6 *Pendulum See-Saws*—Pendulum seesaws shall be provided with footrests. There shall be no openings with internal dimensions of which both the length and width are greater than 3.5 in. (89 mm) and less than 9 in. (229 mm). The spacing between the two support bars shall not decrease toward the seat supports. In the case of a pendulum seesaw designed with formed handles providing a greater opening, the minimum spacing below the formed handles shall be greater than 9 in. (229 mm).

8.1.7 *Toddler Swings:*

8.1.7.1 *Restraining System*—Toddler swings shall have a child restraining system. Fully enclosed flexible bucket seats are exempt from this requirement. (See Fig. A1.5.)

(1) Toddler swings shall be equipped with a crotch restraint. A crotch restraint designed to work with a lap belt shall be designed such that its use is mandatory when the restraint system is in use.

8.1.7.2 *Chains*—Chains on swing seats that support the weight of a child, intended for children 36 months or less in age, shall be shielded if the chain is accessible and if a 0.19 in. (4.8 mm) +0/–.005 in. (+0/–.127 mm) diameter rod can be inserted between two links, as in Fig. A1.26, with the chain in a slack configuration. A chain is considered accessible when it is less than or equal to 33 in. (840 mm) from the top of seating surface.

NOTE 4—The 33 in. (838 mm) is based on a Netherlands anthropometry study showing the seated vertical reach height of a 97 % three-year-old male to be 32.7 in. (831 mm).

8.1.7.3 *Toddler Swing Stability*—Toddler swings shall remain stable when tested in accordance with the stability test method in 8.1.7.5. A swing is considered unstable and fails this requirement if, during any of the 6 swing attempts, the pendulum test apparatus (see Fig. A1.27) tips or falls forward or backward and causes the horizontal reference line of the toddler swing to hang at an angle greater than 30° (.52 rad) from its original position (see Fig. A1.28).

8.1.7.4 *Toddler Swing Stability Test Setup:*

(1) Toddler swings shall be tested for stability utilizing a pendulum test apparatus constructed in accordance with the dimensions and materials specified in Fig. A1.27. The pendulum test apparatus consists of a 10 lb (4.5 kg) barbell weight at the top of a freely pivoting bar and a 10 lb (4.5 kg) barbell weight affixed to the bottom of the test apparatus. The barbell weights shall have a maximum diameter of 8.25 in. (210 mm). The total weight of the pendulum test apparatus shall not exceed 24.0 lb (10.9 kg).

(2) Suspend the toddler swing seat in accordance with the manufacturer's instructions. If the swing height is adjustable, perform the test at both the highest and lowest settings. With the swing at rest, establish a horizontal reference line on the swing seat.

(3) Secure the complete pendulum test apparatus within 0.5 in. (13 mm) of the geometric center of the swing seating surface with the direction of travel of the pendulum arm the same as the swing direction.

(4) If the seating area of the toddler swing is made of a flexible material, additional bracing material may be added to the exterior bottom of the swing seat to aid in securing the pendulum test apparatus. Care should be taken to assure the additional bracing material does not influence the test results.

(5) The center of gravity (cg) of the top weight of the pendulum test apparatus shall be at a height of 16 in. (406.4 mm) –0.5 in./+0 (–13 mm/+0) from the top of the seating surface when the pivot arm is positioned vertically.

NOTE 5—The 16 in. height is based on field testing of swings that were recalled because of tipover and swings that have performed without tipping over.

8.1.7.5 *Toddler Swing Stability Test Method:*

(1) While holding the pendulum test apparatus to the rear of the seat, raise the swing seat in the rear direction to an angle of 60º (1.05 rad) +5/–0 (+.087/–0) as measured from vertical to a line that connects the swing hanger pivot point with the geometric center of the seating surface.

(2) Simultaneously release the swing and pendulum test apparatus and allow it to swing freely until the swing arc is within 15º (.26 rad) from vertical in either direction. At this point, stop the swinging motion by slowly returning the swing to its at-rest condition while being careful not to disturb the position of the pendulum test apparatus. Measure the angle of the reference line on the swing seat from the horizontal.

(3) Perform steps 1 and 2 three times.

(4) Repeat steps 1 through 3, except that the pendulum test apparatus shall be held in the forward direction.

(5) If after any of the 6 swing attempts the angle of the swing in its at-rest condition exceeds 30º (.52 rad), as noted in 8.1.7.3, the swing is considered unstable and fails.

8.1.8 *Swing Set Stability*—With the swing set assembled in accordance with the manufacturers instructions, and installed with a 5° (.087 rad) downward slope in the same direction as

the swinging elements, the swing set shall remain upright when a weight equal to the 95th percentile weight for the maximum age user (see Table 3) is placed in the first two positions of the swing set and a weight equal to the 50th percentile weight is placed in all remaining positions that can be occupied by a child, and the swinging elements are swung freely in unison through the angles as specified in Table 2.

8.1.9 *Spacing Between Adjacent Swing Elements:*

8.1.9.1 Swing sets containing adjacent swing elements shall be designed so that there is a minimum of 8 in. (205 mm) separating elements that are capable of limited lateral motion (where two or more chains, ropes, or poles are used for suspension). The outermost lateral extremities of the swinging elements shall govern the measurement of separation; an example is illustrated by Dimension A in Fig. A1.29.

8.1.9.2 Swing elements that are intended to have unlimited lateral motion such as, but not limited to, a rotating swing or disc swing shall not occupy a swing bay with any other swinging element. There shall be a minimum separation of 15 in. (381 mm) between the outermost extremity of the swinging element and the support structure, as measured in a vertical plane from the outermost extremity from the top bar to the protective surface (see Fig. A1.29).

8.1.9.3 *Lateral Stability of Swing Elements*—All to-fro swings, belt type or rigid, shall have a minimum distance between suspension points as caculated from the following formula:

$$A = 0.04(H) + B \quad (1)$$

where:

A = the center to center distance between uppermost suspension points of the swing assembly,

B = the center to center distance between the swing seat attachment points (in the case of flexible seats, place the weighted test fixture as described in Fig. A1.30 in the seat before measuring dimension B), and

H = the distance between the uppermost suspension point and the protective surfacing.

8.1.10 *Spacing Between Swing Elements and Stationary Frame Members:*

8.1.10.1 *Occupant Enclosed*—Elements with two or more laterally spaced supports where supports are on both sides of the occupant (for example, suspended chain or rope swings and tubularly suspended lawn swings). Minimum spacing between the outer extremity of the swing element and stationary members shall be 7 in. (180 mm) when measured at a height of 28 in. (710 mm) above the seating surface (see Dimension C in Fig. A1.29).

NOTE 6—Twenty-eight inches (710 mm) is the approximate sitting height of a 10-year-old.

8.1.10.2 *Occupant-Exposed Rides*—Examples are: the pendulum seesaw, horse rides, and others where the suspension system is in line with the occupant. Minimum spacing from stationary members shall be 16 in. (405 mm) as measured from the center of the seating surface at a height of 22 in. (560 mm) above the seating surface (see Dimension D in Fig. A1.29).

NOTE 7—Sixteen inches (405 mm) and 22 in. (560 mm) equate to the clearance required for a 10-year-old when leaning to the side at an angle of 30° (0.52 rad).

8.1.10.3 *Occupant-Exposed Single Suspension*—Examples are: suspended ropes or poles. Minimum spacing from stationary members shall be 15 in. (380 mm) to a height of 53 in. (1350 mm) above ground level (see Dimension E in Fig. A1.29).

NOTE 8—Fifty-three inches (1350 mm) is the approximate standing height of a 10-year-old.

8.1.10.4 *Free Swinging Rings*—The distance between the protective surface and the lowest portion of the ring may not be less than 53 in. (1350 mm). The distance from the outermost extremity of the ring to an adjacent swing or support structure shall be a minimum of 8 in. (205 mm) (see Fig. A1.29).

8.1.11 *Suspended Swinging Element Impact Attenuation Testing*—This test is intended to be performed by the manufacturer or test laboratory under controlled conditions.

8.1.11.1 *Principle*—Suspended elements are raised and allowed to swing to strike a test mass. The signal emitted by an accelerometer during each impact is processed to determine the peak value of acceleration and the HIC score.

8.1.11.2 *Test Apparatus:*

(1) Test Device—Components as described below, arranged per Fig. A1.40.

(2) Test Mass—Test mass shall consist of an aluminum sphere or hemisphere with a diameter of 6.3 ± 0.188 in. (160 ± 5 mm), mass 10.1 ± 0.1 lb (4.6 ± 0.05 kg), and surface roughness less than 0.001 in. (25 µm) such that the

TABLE 3 Structural Integrity Loading Chart[A]

Age (years)	50th Percentile, lb (kg)	95th Percentile, lb (kg)	Area Occupied by User for Platforms, ft² (cm²)	Rump to Sole Length for Slides in. (cm)	Area Occupied by User for Climbing Components, ft² (cm²)
1.5	22.7 (10.3)	26.8 (12.2)	0.6 (558)	16 (41.5)	1.4 (1302)
2	28 (12.7)	29 (13.2)	0.7 (651)	21.8 (55.2)	1.6 (1508)
3	32.8 (14.9)	42 (18.9)	0.8 (744)	25.4 (64.5)	1.9 (1760)
4	35.3 (16)	43 (19.7)	0.8 (744)	26 (66.5)	2.2 (2016)
5	39.7 (18)	50 (22.6)	0.9 (837)	29.8 (75.8)	2.3 (2139)
6	44.1 (20)	59 (26.6)	1.0 (930)	30.8 (78.1)	2.6 (2448)
7	50.5 (22.9)	69 (31.2)	1.1 (1023)	32.3 (82.1)	2.9 (2697)
8	56.2 (25.5)	81 (37)	1.2 (1116)	34.8 (88.3)	3.2 (2952)
9	63.1 (28.6)	89 (40.4)	1.3 (1209)	37 (93.6)	3.5 (3231)
10	70.5 (32)	105 (47.9)	1.4 (1302)	40.1 (102)	4.2 (3933)

[A] Values given for boys or girls, whichever is higher.

impacting part between the surface struck and the accelerometer is homogenous and free from voids.

(3) Accelerometer—The accelerometer shall be mounted at the center of gravity of the test mass (8.1.11.2 (*2*)) assembly with the sensitive axis aligned to within 2° (0.35 rad) of the direction of travel of the test mass, capable of measuring acceleration triaxially.

(4) Test Mass Suspension System—Two ¼ in. (6 mm) thick chains, of equal length suspended from pivots 24 in. (610 mm) apart at the approximate height of the bearings of the suspended element (8.1.11.2 (*2*)).

(5) Instrumentation—Specifications for accelerometer, data acquisition, and analysis shall be in accordance with the latest revision of Specification F1292.

8.1.11.3 *Procedure:*

(1) Hang the suspended element using standard attachment methods (chain, cable, etc.) as specified by the manufacturer to produce the most adverse condition in which the product is used. Testing shall be performed at 72 ± 5°F (22.2 ± 2.8°C).

NOTE 9—Higher beam heights, using coated chain or stiffer suspension elements, will produce higher impact results.

(2) Arrangement of Test Device—Arrange the test device so that the most adverse leading edge of the suspended element just touches the leading edge of the test mass in its at-rest position.

(3) Raising Suspended Element for Test:

(a) Raise the suspended element along its arc of travel until the suspension element (that is, chain, etc.) forms an angle of 60° (1.05 rad) (±1° [0.017 rad]) from its at-rest position (see Fig. A1.40).

(b) When the suspended element is suspended from chains, etc., some curvature will be produced in the suspending elements. Adjust the seat position to determine the curvature that provides a stable trajectory.

(c) Some elements of a flexible nature will require a brace to maintain its configuration during the test procedure. Mount this brace between the attachment points and form a dimension of 13.1 in. (333 mm) across at the attachment points. Ensure that the mass of the device does not exceed 10 % of the mass of the seat. (See Fig. A1.41.)

NOTE 10—Exercise caution to prevent damage to the test equipment. Where there is any possibility of the accelerometer range being exceeded, it is recommended that preliminary tests be made at lower angles (for example, 10°, 20°, and 30° [.175, .35, .52 rad]). If there is doubt concerning the suspended element trajectory or stability, the test mass or guidance structure, or both, it is recommended that trial releases be made without impacting the test mass.

(4) Support and Release of the Suspended Element—Support the element in the raised position by a mechanism that provides release without the application of external forces which would disturb the trajectory of the suspended element. Ensure that the seat and suspending elements are motionless. Release the element so that the assembly travels in a smooth downward arc without any visible oscillations or rotations of the element, which would prevent it from striking the test mass at the impact point.

NOTE 11—If a hemisphere test mass is used for testing, ensure rounded part of hemisphere for all ten strikes makes contact with the leading edge.

(5) Collection of Data—Once satisfactory system operation and calibration are obtained, collect data for ten impacts. Measure the peak acceleration and HIC for each impact. Time between each impact shall be 1.5 min ± 30 s.

(6) Peak Acceleration and HIC—Record the peak acceleration and HIC as the mean value from the ten impacts.

8.2 *Slides:*

8.2.1 *Slide Requirements:*

8.2.1.1 A handrail shall be provided on all sides of the transition area (except on entrance and exit areas) that meet the enclosed opening requirements of 6.1. Slide transition areas larger than 200 in.^{2} (1290 cm^2) are considered platforms and shall comply with the requirements for guardrails and protective barriers found in 7.3.

(1) All handrail bend radii shall be a minimum of 2 in. (50 mm).

8.2.1.2 The transition area at the top of a slide shall be at least 10 in. (250 mm) long and shall be at least as wide as the sliding surface. See Fig. A1.16, Fig. A1.31, and Fig. A1.32 illustrating sliding surfaces.

8.2.1.3 With the exception of roller slides, the inclined sliding surface and the exit surface shall be one continuous surface.

8.2.1.4 The slide shall have raised edges that project at least 1 in. (25 mm) above the slide surface when measured perpendicularly to that surface.

8.2.1.5 The slide shall have a reduced-gradient exit surface at least 6 in. (152 mm) in length; the reduced-gradient exit surface shall be at a minimum angle of 18° (.31 rad) from the inclined sliding surface, and the exit surface shall be greater than 0°, but less than 30° (0.52 rad), from horizontal.

(1) Slides having an entrance height of 54 in. (1372 mm) or less and having an inclined angle of 30° (.52 rad) or less from the horizontal are not subject to the reduced gradient requirement.

8.2.1.6 The end of the slide shall be less than or equal to 12 in. (300 mm) off the ground as measured from the sliding surface.

8.2.1.7 Slide exit edges shall be rounded or curved.

8.2.1.8 Slides exceeding 54 in. (1372 mm) in height from platform to ground level shall have a side of not less than 2.5 in. (64 mm) above the slide bed commencing at a point on the slide greater than 54 in. (1372 mm) as measured vertically, from the ground and extending to the top platform on the slide.

8.2.1.9 Fig. A1.31 illustrates these requirements for slides.

8.2.1.10 *Slide Chute/Bedway Clearance Zones*—A clear area, free of equipment, shall surround the slide chute/bedway. This area is defined by Fig. A1.32. Portions of slides containing hoods, roofs, or other devices to channel the user into a seated position, spiral slides and tube slides excepted. The clear area shall extend through the slide exit clearance zone as defined in 9.1.4.3.

(1) Spiral slides with open chutes shall maintain a clear area 20 in. (508 mm) wide, when measured from the inside face of the sidewall along the outer edge of the slide for the entire length of the slide.

8.2.2 *Stability of Free-Standing Slides*—Freestanding slides, when anchored in accordance with the instructions enclosed

with the slide, shall be capable of supporting a sandbag weighing the 95th percentile weight of the maximum age user (see Table 3) completely hanging over the handrail at its highest point without any part of the slide being lifted from a level supporting surface.

8.2.3 *Roller Slides*—There shall be no crush, shear, entrapment, nor catch points between the junctures caused by two or more components that could cause a contusion, laceration, abrasion, amputation, or fracture.

8.2.3.1 A crush, shear, entrapment, or catch point is any point that will admit a .187 in. +0/–.005 in. (+0/–.127 mm) diameter neoprene rod at one or more positions, either between rollers or adjacent segments.

8.3 *Merry-Go-Rounds*—No stationary members of a merry-go-round device that are accessible to the child under normal conditions of use and that present an obstruction to the limbs of the user shall be located within the zone illustrated in Fig. A1.33 (for example, stationary legs within the excluded zone are not acceptable, but a single center pedestal lying within the excluded zone that is free of projections is acceptable).

8.4 *Ropes*—A suspended climbing rope, chain, or cable shall be secured at both ends to prevent the rope, chain, or cable from being looped back on itself creating a loop with an interior perimeter of 5 in. (127 mm). A rope, chain, or cable that is used to support a swing seat is exempt.

9. Equipment Layout

9.1 *Play Structure Use Zone:*

9.1.1 There shall be a use zone for each play structure which shall consist of obstacle-free surfacing that conforms to Specification F1292 appropriate for the fall height of the equipment. The dimensions and configuration of the use zone shall be dependent upon the type of play equipment, as specified in 9.1.2 – 9.1.5. Use zones of certain types of equipment may overlap unless otherwise specified.

9.1.2 *Minimum Use Zone*—The minimum use zone for play equipment shall extend no less than 72 in. (1829 mm) from all sides of the play structure.

9.1.2.1 *Exceptions to the Minimum Use Zone:*

(A) Equipment that requires a user to maintain constant contact with the ground during play has no individual use zone requirements (for example, playhouses, free standing activity panels, ground level sandboxes).

(B) Equipment with a designated playing surface ≤24 in. (607 mm) above the ground.

9.1.3 *Swings:*

9.1.3.1 *To-Fro Swings*—The use zone to the front and to the rear of to-fro swings shall be a minimum distance of 2X on a line extending 90° (1.57 rad) both front and rear from the longitudinal direction of the suspending beam, where X equals the vertical distance from the top of the protective surfacing to the pivot point of the swing. The total horizontal distance from the front to the rear of the use zone shall be not less than 4X. (See Fig. A1.34.)

(1) No component of the attached play structure or separate play structure shall occupy or exit into the ground level protective surfacing area of the front-to-rear use zone of a to-fro swing.

(2) The use zone width for to-fro swings shall be at least as wide as the spacing between swing elements and stationary member as show in Fig. A1.29.

(3) The use zone surrounding the support structure of to-fro swings shall extend equal to or greater than 72 in. (1829 mm) in all directions from the structure (see Fig. A1.34). The use zone of the supporting structure may overlap other use zones.

(4) The front to rear use zone of a trapeze bar or rings, or both, shall be Z + 72 in. (1829 mm), where Z equals the distance from the pivot point to the lowest portion of the swinging component.

9.1.3.2 *Swings Capable of Unlimited Lateral Motion (see Fig. A1.34):*

(1) The use zone for a swing capable of unlimited lateral motion shall be a minimum horizontal distance of Y + 72 in. (1829 mm) in all directions from the pivot point of the swing, where Y equals the vertical distance between the pivot point and the top of the swing seat or suspended member.

(2) No play component of the attached play structure or separate play structure shall be located in the use zone of a swing element capable of unlimited lateral motion.

(a) Exception: Adjacent to-fro swings where the support structure of the swing is designed to minimize the likelihood of the unlimited lateral motion swing intruding into the to-fro use zone.

(b) Exception: The support structure of the swing element capable of unlimited lateral motion.

(c) Exception: The use zone for swings capable of unlimited lateral motion that are attached to the underside of a platform may overlap the use zones of other play components placed on the perimeter of the supporting platform. The swinging component may not be capable of striking a user on an adjacent play component.

(3) The use zone surrounding the support structure of rotating swings shall extend equal to or greater than 72 in. (1829 mm) in all directions from the support structure. The use zone of the supporting structure may overlap other use zones.

9.1.4 *Slides (see Fig. A1.34):*

9.1.4.1 The use zone around the steps or ladder, platform, and chute or slide bed of straight, wavy, and spiral slides shall conform to the minimum use zone requirements for play equipment found in 9.1.2.

9.1.4.2 The use zone at the lower exit end of the chute or slide bed shall extend in the direction of the descent a horizontal distance equal to or greater than 72 in. (1829 mm).

9.1.4.3 *Slide Exit Clearance Zone*—A clear zone, free of equipment, shall extend from the end of the slide to the perimeter of the slide use zone. This area shall have a width as shown in Fig. A1.34. Slide exit clearance zones for two or more slides may overlap if their sliding paths are parallel. Merging slides with converging paths of travel shall not have overlapping clearance zones as shown in Fig. A1.32 and Fig. A1.34.

(1) Exception: The slide itself may encroach into slide exit clearance zone (for example, spiral slides).

9.1.4.4 The clearance area of a slide exit use zone may not overlap the motion use zone of a to-fro or rotating swing.

9.1.5 *Composite Play Structures:*

9.1.5.1 The boundary of the use zone for a composite play structure shall be composed of those use zones that have been established for each individual play structure that, when joined together, comprise the composite play structure.

9.1.5.2 It is impractical to identify and establish assembled use zone standards for all possible configurations of a composite play structure. Therefore, the professional judgment of play equipment manufacturers, designers, and owners shall be used when designing a modular composite play structure to eliminate hazards created by conflicts in circulation use patterns or close proximity of adjacent components, or both.

10. Installation

10.1 *Installation Instructions and Information*—The installation instructions and information shall state the following:

10.1.1 Place the equipment on level ground, not less than 6 ft (1.8 m) from any structure or obstruction such as a fence, garage, house, overhanging branches, laundry lines, or electrical wires.

10.1.2 Do not install home playground equipment over concrete, asphalt, packed earth, grass, carpet, or any other hard surface. A fall onto a hard surface can result in serious injury or death to the equipment user.

10.1.3 Equipment that is required by the manufacturer to be anchored, either in concrete or by ground anchors not provided with the equipment shall have a statement informing the consumer that the product must be anchored and that the anchors are sold separately. This statement shall be prominently displayed: (*1*) on the shipping carton, (*2*) in the instructions, (*3*) on the point of purchase display, and (*4*) on promotional materials, informing the consumer that the product must be anchored. Such equipment shall be accompanied by detailed instructions on how anchoring is to be accomplished to prevent tipping, overturning, or lifting of the support members during anticipated use. The instruction shall include information on anchoring in sandy soil conditions. The instruction shall also state that all anchoring devices must be placed below the level of the playing surface to prevent tripping or injury resulting from a fall.

10.1.4 When the equipment is shipped other than completely assembled, assembly instructions shall be provided including schematic drawings or renderings which, when followed, will enable an unskilled layman to correctly assemble the equipment and to avoid errors that could result in unsafe assembly.

10.1.5 Full-size diagrams of bolts, nuts, and washers and a list and description of all tools required shall be incorporated into the instructions. Lock nuts shall be clearly identified. Cautionary statements shall be included that recommend tightening bolts securely. There shall be instructions advising the owner to tighten the nuts on bolts flush to the tube (or member) and that caps which go over the exposed bolts shall be put on snug to the nut.

10.1.6 To prevent serious injury, cautionary statements shall be included which warn that children must not use the equipment until properly installed.

11. Structural Integrity

11.1 The tests specified in 11.1.1 – 11.1.9 shall be performed on units assembled in accordance with the installation instructions enclosed with the equipment. There shall be no loosening, instability of the equipment, or structural failure[6] of any component or assembly during or immediately upon completion of these tests. Where it is specified that loads on structural members shall be applied through a 3.5 in. (89 mm) ± .5 in. (13 mm) long wood block, the block shall have a width of at least the width of the structural member and it shall be fabricated from lumber with a minimum thickness of .75 in. (19 mm) (see Tables 3 and 4). Where the geometry being tested is either too small or not flat, a loading strap 2 in. (51 mm) wide may be used.

11.1.1 *Handholds, Footholds, and Horizontal Supporting Members*—Rungs, steps, handles, climbing rocks, and other horizontal supporting members 24 in. (610 mm) or less in length, except turnbars and footrests, shall be capable of sustaining a vertical load (gradually applied) of 3 times the 95th percentile weight of the maximum age user applied for 5 min to a 3.5 in. (89 mm) long wood block resting on the center of the member. Turnbars shall be capable of sustaining a vertical load (gradually applied) of 3 times the 95th percentile weight of the maximum age user applied for 5 min to two 3.5 in. (89 mm) long wood blocks. The centerline of the blocks shall be resting at the ⅓ and the other at the ⅔ points between the ends of the turnbar. Footrests shall be capable of sustaining a vertical load (gradually applied) of 1.5 times the 95th percentile weight of the maximum age user applied for 5 min to a 3.5 in. (89 mm) long wood block at the center of one (or the other) footrest. Horizontal members greater than 24 in. (610 mm) in length, except turnbars, shall be capable of sustaining for 5 min a vertical load of 4 times the 95th percentile weight of the maximum age user gradually applied to two 3.5 in. (89 mm) long wood blocks. The centerline of the blocks shall be

[6] Structural failure occurs when the equipment or any component thereof no longer meets the requirement of this consumer safety specification.

TABLE 4 Minimum Test Loads for Individual Suspended Units

Unit	Test Conditions	Simultaneous Minimum Weight Load per Child Position
Swing	in swing set[A]	6 × 95 % weight of maximum age user
2 passenger occupant exposed swing (seats)[B]	in swing set	1.5 × 95 % weight of maximum age user
2 passenger occupant enclosed swing (seats)[B]	in swing set	1.5 × 95 % weight of maximum age user
2 passenger occupant enclosed swing (platforms)[B]	in swing set	1.5 × 95 % weight of maximum age user
4 passenger occupant enclosed swing (seats)[B]	in swing set[A]	1.5 × 95 % weight of maximum age user
4 passenger occupant enclosed swing (platforms)[B]	in swing set[A]	1.5 × 95 % weight of maximum age user
Trapeze	in swing set	3 × 95 % weight of maximum age user
Poles, ropes, chains, "O" rings	in swing set	3 × 95 % weight of maximum age user

[A] Auxiliary support of the top bar during the test shall be permissible.
[B] The seats shall be tested separately from the platforms.

resting at the ⅓ and the other at the ⅔ points between the ends of the horizontal member. The load (or loads) shall be applied to one member at a time, unless otherwise specified for the particular equipment.

11.1.2 *Top Support Bar*—The top support bar of any swing set shall be loaded with a total load applied vertically, without shock, and the total load shall remain for 5 min. This total load shall be the sum of the following loads, as applicable:

11.1.2.1 For swings, ropes, and poles, a load of 1.5 times the 95th percentile weight of the maximum age user for each position normally occupied by a child at play.

11.1.2.2 For pendulum seesaws, a load of 1.2 times the 95th percentile weight of the maximum age user for each position normally occupied by a child at play.

11.1.2.3 For multiple-occupancy swings, a load of 1.1 times the 95th percentile weight of the maximum age user for each position normally occupied by a child at play.

11.1.3 *Individual Suspended Units*—Individual suspended units shall be tested one at a time, as indicated in Table 4, without evidence of structural failure to the unit or its supporting system. The loads shall be gradually applied and each unit shall be loaded for 5 min.

11.1.4 *Slides*—A load of the 95th percentile weight of the maximum age users shall be applied simultaneously at specified locations on the slide.

11.1.4.1 Determine the number of users, n, as follows: n = L/d, where L = length of the slide measure the slide at the center line of the bed way from the entrance to the exit; where d = rump to sole dimension of the 95th percentile user per Table 3. (Round to the nearest whole number.) Place n load distribution devices equally spaced on the slide bed. Load each distribution device with a downward vertical force equal to the 95th percentile weight of the oldest user. The force shall be applied gradually and then maintained for a period of 5 min. See Fig. A1.35.

11.1.5 *Rockers* (See Fig. A1.36)—A load of 1.6 times the 95th percentile weight of the maximum age user shall be applied vertically, without shock, to each position that would normally be occupied by a child at play, and all the loads shall remain in position simultaneously for 5 min.

11.1.6 *Merry-Go-Rounds* (See Fig. A1.37)—A load of 1.5 times the 95th percentile weight of the maximum age user shall be applied vertically, without shock, to each position that would normally be occupied by a child at play, and all the loads shall remain in position simultaneously for 5 min.

11.1.7 *Climbing Towers/Jungle Gyms* (See Fig. A1.38)—A total load of 7.5 times the 95th percentile weight of the maximum age user shall be divided and applied in five equal segments. These five loads shall be applied in the worst possible configuration (that is, in the positions that will most likely cause failure or instability, or both, of the climbing tower or jungle gym). The loads shall be applied by loading horizontal members using 3.5 in. (89 mm) long wood blocks in the center of the member, with the loads remaining simultaneously for 5 min.

11.1.8 *Platforms*—A platform shall be loaded with a total load applied vertically without shock, and the total load shall remain for 5 min. For the purpose of applying the load, the platform shall be divided into four equal area quadrants. The total load shall be located in equal portions, in the center of each quadrant and at the center point of the platform, a total of 5 points (see Fig. A1.39).

11.1.8.1 When the square foot area of a platform is smaller than the square foot area for the maximum intended user, the total load shall be applied at the center point of the platform.

11.1.8.2 For this test, weights shall be placed on load distribution devices. Each device shall be a 6 in. × 6 in. × 2 in. (152 mm × 152 mm × 51 mm) nominal thickness wood block.

11.1.8.3 The total load shall be the sum of the following:

(1) Based on the area of the platform, determine the maximum number of users, as follows:

$$\frac{\text{area of platform } (\text{ft}^2\ (\text{cm}^2))}{X} = N \qquad (2)$$

where:

N = maximum number of users, and
X = area for maximum age user from Table 3.

Round to the nearest whole number.

(2) With the maximum number of users, apply the load for two 95th percentile maximum age users and the balance of the total users, 50th percentile maximum age users mass from Table 3, as follows:

$$N - 2 = N^1 \qquad (\text{If } N^1 \text{ is less than 0, then } N^1 = 0) \qquad (3)$$

$$2 \times 95\text{th percentile lb (kg) of maximum age user} + N^1 \times 50\text{th percentile lb (kg) of maximum age user} = \text{total load} \qquad (4)$$

11.1.9 *Climbing Components*—Components and surfaces intended for climbing shall be loaded by hanging or placing weights, with a total load applied vertically without shock. Total load shall remain for 5 min.

Calculate number of users:

$$\textit{area of climbing surface } (ft^2\ (cm^2)) \ / \ A = N \qquad (5)$$

where:

N = maximum number of users (round to the nearest whole number), and
A = area of climbing surface occupied by maximum age user from Table 3.

Calculate load:

$$B + C = \textit{total load} \qquad (6)$$

where:

B = weight of two 95th percentile maximum age users, and
C = (N – 2) × weight of 50th percentile maximum age user(s).

11.1.9.1 For the purpose of applying the load, the climbing component shall be divided into four equal area quadrants. The total load shall be located in equal portions, in the center of each quadrant and at the center point of the climber, a total of five points. In the event the location lies at an open area on the climber, the load shall be placed as reasonably close to center as possible. If footholds or handholds such as rocks, handles, etc. are attached they must also be tested individually per 11.1.1.

12. Maintenance Instructions

12.1 The maintenance instructions shall include the following checklist as appropriate for specific equipment:

12.1.1 At the beginning of each play season:

12.1.1.1 Tighten all hardware.

12.1.1.2 Lubricate all metallic moving parts per manufacturer's instructions.

12.1.1.3 Check all protective coverings on bolts, pipes, edges, and corners. Replace if they are loose, cracked, or missing.

12.1.1.4 Check all moving parts including swing seats, ropes, cables, and chains for wear, rust, or other deterioration. Replace as needed.

12.1.1.5 Check metal parts for rust. If found, sand and repaint using a nonlead-based paint meeting the requirements of 16 CFR 1303.

12.1.1.6 Check all wood members for deterioration and splinters. Sand down splinters and replace deteriorating wood members.

12.1.1.7 Reinstall any plastic parts, such as swing seats or any other items that were removed for the cold season.

12.1.1.8 Rake and check depth of loose fill protective surfacing materials to prevent compaction and to maintain appropriate depth. Replace as necessary.

12.1.2 Twice a month during play season:

12.1.2.1 Tighten all hardware.

12.1.2.2 Check all protective coverings on bolts, pipes, edges, and corners. Replace if they are loose, cracked, or missing.

12.1.2.3 Rake and check depth of loose fill protective surfacing materials to prevent compaction and to maintain appropriate depth. Replace as necessary.

12.1.3 Once a month during play season:

12.1.3.1 Lubricate all metallic moving parts per manufacturer's instructions.

12.1.3.2 Check all moving parts including swing seats, ropes, cables, and chains for wear, rust, or other deterioration. Replace as needed.

12.1.4 At the end of each play season or when the temperature drops below °F (temperature to be selected by the manufacturer):

12.1.4.1 Remove plastic swing seats and other items as specified by the manufacturer and take indoors or do not use.

12.1.4.2 Rake and check depth of loose fill protective surfacing materials to prevent compaction and to maintain appropriate depth. Replace as necessary.

12.1.5 Owners shall be responsible for maintaining the legibility of the warning labels.

12.2 *Disposal Instructions*—There shall be instructions advising the owner to disassemble and dispose of the playground equipment in such a way that no unreasonable hazards will exist at the time the playground equipment is discarded.

13. Labeling and Signage

13.1 Each whole unit of playground equipment such as a completed play unit, accessory toddler swing, or slide shall be permanently marked in a conspicuous location with the name and address (city, state, and zip code) of the manufacturer, distributor, or seller.

13.1.1 Manufacturer shall provide a warning, either on the product or with the product for the owner to install. This can be a label, sign, or molded into the product. The information shall alert users and supervising adults of the following hazards:

13.1.1.1 Risk of serious head injury or death due to falls from equipment placed over hard surfaces.

13.1.1.2 Risk of using helmets and other items that can wrap around a child's neck, become entangled or entrapped by the equipment, and lead to strangulation or death.

13.2 The following information shall be permanently and prominently conspicuously displayed on the product each whole unit of play equipment:

THIS PRODUCT IS INTENDED FOR USE BY CHILDREN FROM AGES ____ TO ____.

13.3 Toddler Swings shall have the following information permanently and prominently displayed:

(1) Information requiring adult supervision.

(2) If a restraint system is provided, instructions to always use the restraint system should be displayed.

13.4 Signs or labels shall be installed or molded in by manufacturer or installed by owner with the following requirements:

13.4.1 Signs or labels are readily visible to the intended user and alert the user to the potential hazard in time to take appropriate action.

13.4.2 Owner installed signs or labels; manufacturer shall provide written instruction to meet requirements of 13.4.1.

13.4.3 Warning labels shall conform to ANSI Z535.4.

13.5 *Exemptions:*

13.5.1 Portable equipment with fall heights less than 24 in. (61 cm) is exempt from the requirement of 13.1.1.1.

13.5.2 Equipment that has NO elevated playing surface for standing, sitting, climbing, creeping, crawling, or sliding above 24 in. (61 cm) is exempt from the requirement of 13.1.1.2.

14. Information

14.1 *Information on Manufacturer or Distributor*—The instructions shall carry in a prominent place the name and address of the manufacturer or distributor, and the model number of the playground equipment. Also, there shall be an instruction advising the owner to save this instruction and information sheet in the event that the manufacturer has to be contacted.

14.2 *Information on Playground Surfacing Materials:*

14.2.1 The instructions shall include the manufacturers determination of maximum fall height for the product.

14.2.2 Maximum fall height for the product is determined as follows:

(1) Swings = pivot point,

(2) Elevated platforms with guardrails = top surface of the guardrail,

(3) Elevated platforms with protective barriers = the height of the platform,

(4) Climbers and horizontal ladders = top surface of the component, and

(5) Rockers and seesaws = maximum height of the designated play surface normally occupied by a user.

14.2.3 The instructions shall also include the information found in Section 4 of the United States Consumer Product Safety Commission's (USCPSC) Outdoor Home Playground Safety Handbook or specific surfacing guidelines for the product consistent with the USCPSC Handbook. A copy of this section may be found in Appendix X2.

14.3 *Operating Instructions*—The operating instructions shall include the following information, if applicable:

14.3.1 Observing the following statements and warnings reduces the likelihood of serious or fatal injury.

14.3.2 Specifying the number and weight of occupants that may safely use the equipment singly or simultaneously,

14.3.3 Recommending on-site adult supervision for children of all ages,

14.3.4 Warning the owner to instruct children not to walk close to, in front of, behind, or between moving items,

14.3.5 Warning the owner to instruct children not to twist swing chains or ropes or loop them over the top support bar since this may reduce the strength of the chain or rope,

14.3.6 Warning the owner to instruct children to avoid swinging empty seats,

14.3.7 Warning the owner to teach children to sit in the center of the swings with their full weight on the seats,

14.3.8 Warning the owner to instruct children not to use the equipment in a manner other than intended,

14.3.9 Warning the owner to instruct children not to get off equipment while it is in motion,

14.3.10 Warning the owner not to allow children to wear inappropriate items, such as but not limited to, loose fitting clothing, hood and neck drawstrings, scarves, cord-connected items, capes and ponchos. These items can cause death by strangulation.

14.3.11 Warning the owner to instruct children not to climb when the equipment is wet,

14.3.12 Warning the owner to check the openings between rollers and sliding surfaces of roller slides for foreign materials that could be potentially hazardous to users,

14.3.13 Warning the owner to verify that suspended climbing ropes, chain, or cable are secured at both ends, and

14.3.14 Warning the owner to verify that suspended climbing ropes, chain, or cable cannot be looped back on itself.

14.3.15 Warning the owner to instruct children not to attach items to the playground equipment that are not specifically designed for use with the equipment, such as, but not limited to, jump ropes, clothesline, pet leashes, cables and chain as they may cause a strangulation hazard.

14.3.16 Warning the owner to instruct children to remove their bike or other sports helmet before playing on the playground equipment.

14.3.17 Warning the owner to dress children with well-fitting and full foot enclosing footwear. Examples of inappropriate footwear are clogs, flip flops, and sandals.

14.4 The following warning statements shall appear in the instruction manual concerning use of two- or four-passenger lawn swings that have an opening between the seat and the back surfaces:

WARNING: Lawn swings are designed for use by children two years of age and older. The use by children under the age of two can result in entrapment between the seat and back rest because the child's body may pass through the opening, causing entrapment of the child's head. Such entrapment may result in strangulation. NEVER place children in a rearward facing position or with legs between the seat and backrest.

15. Keywords

15.1 consumer safety; playground equipment; residential use

ANNEX

(Mandatory Information)

A1. FIGURES

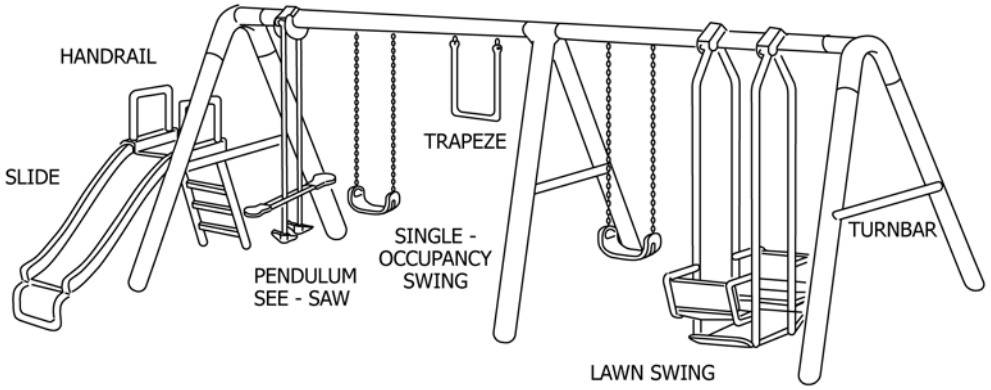


FIG. A1.1 Swing Set (Metal)

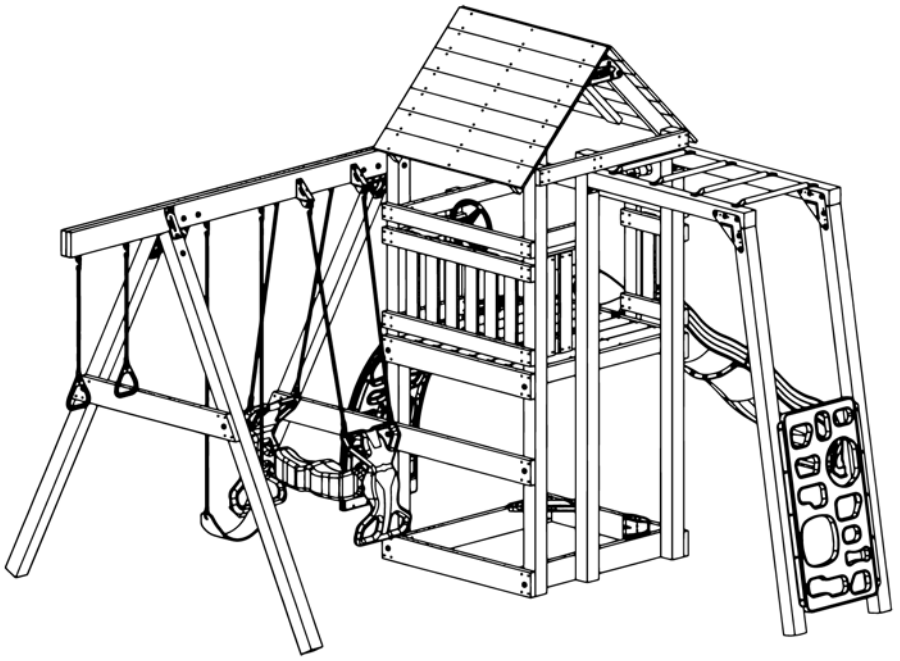


FIG. A1.2 Swing Set (Wood)

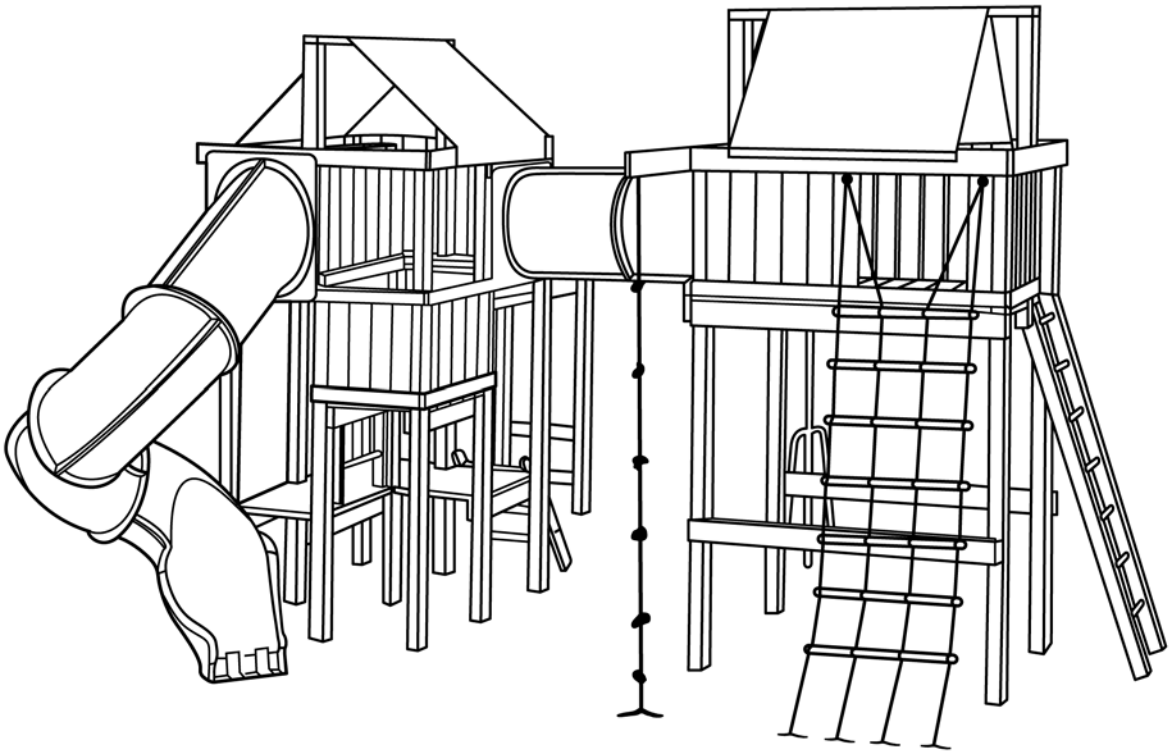


FIG. A1.3 Clubhouse or Fort with Climbers and Slides

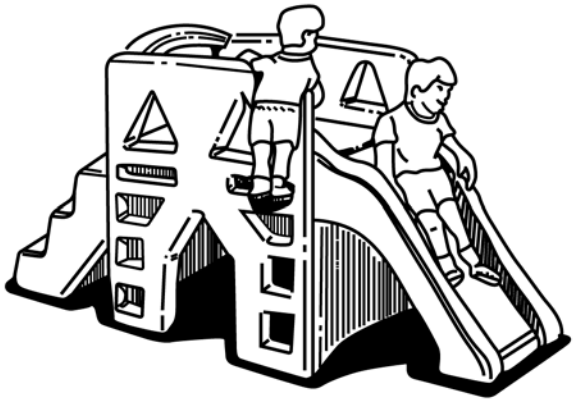


FIG. A1.4 Portable Plastic Play Equipment

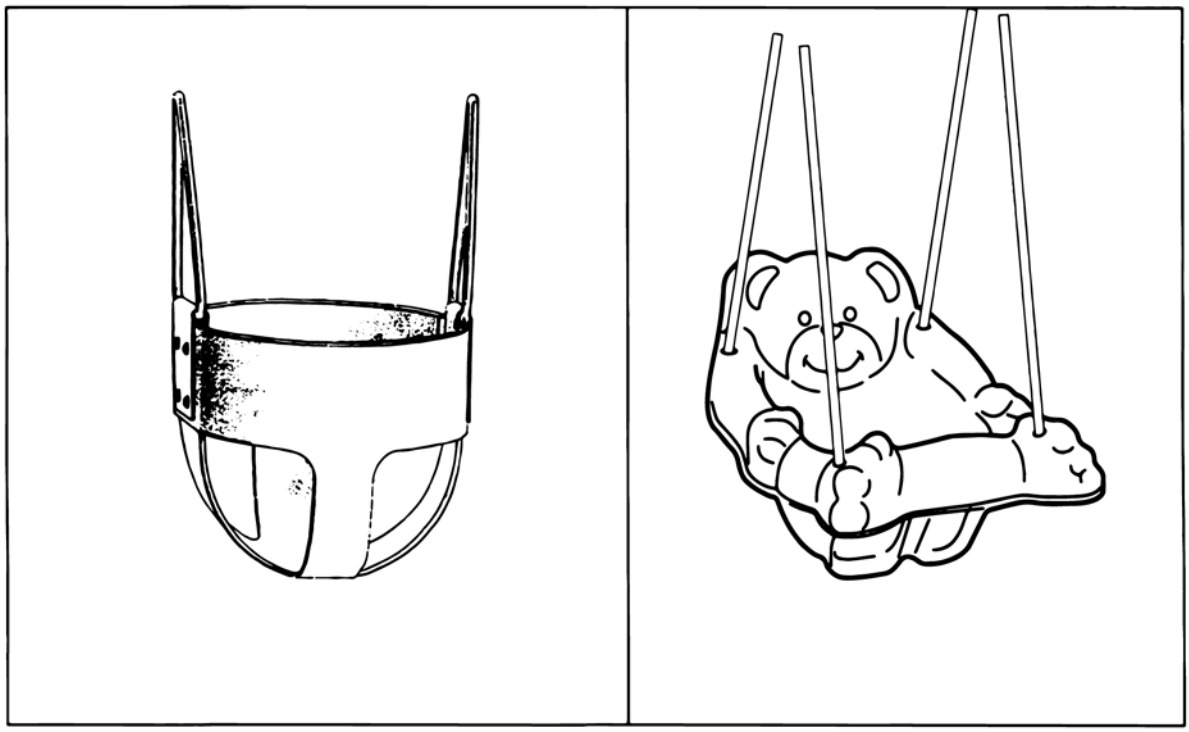


FIG. A1.5 Illustration of Fully Enclosed Toddler Swing Set

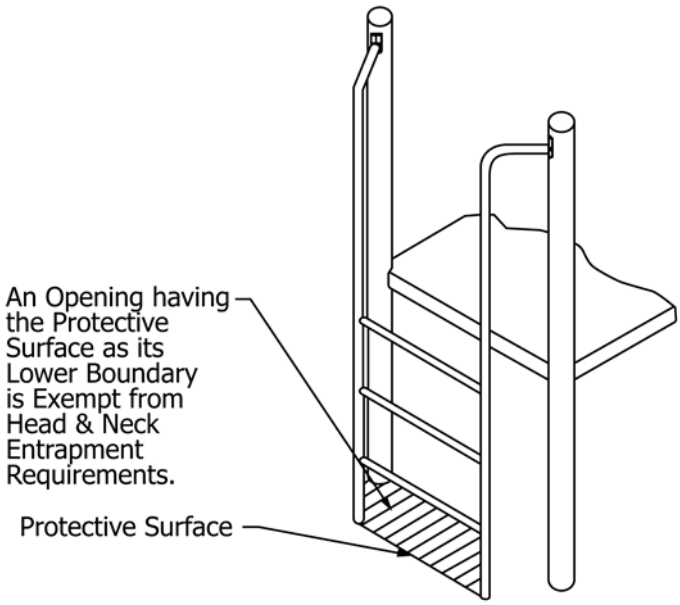


FIG. A1.6 Entrapment Exemption

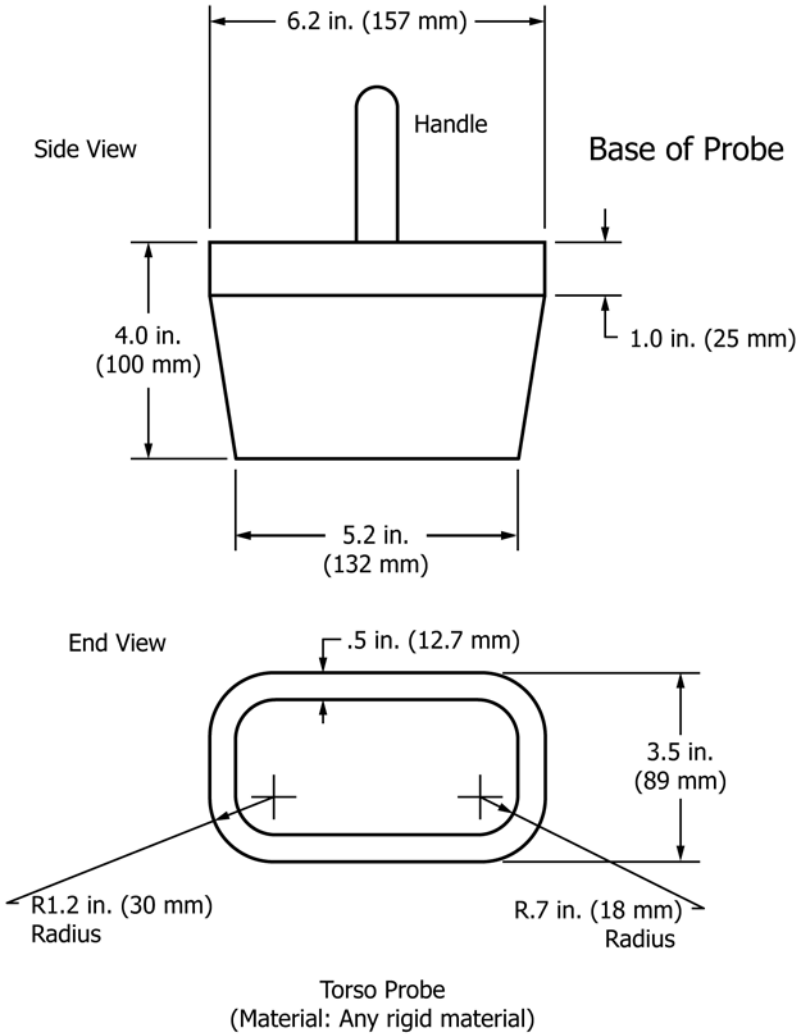


FIG. A1.7 Torso Probe

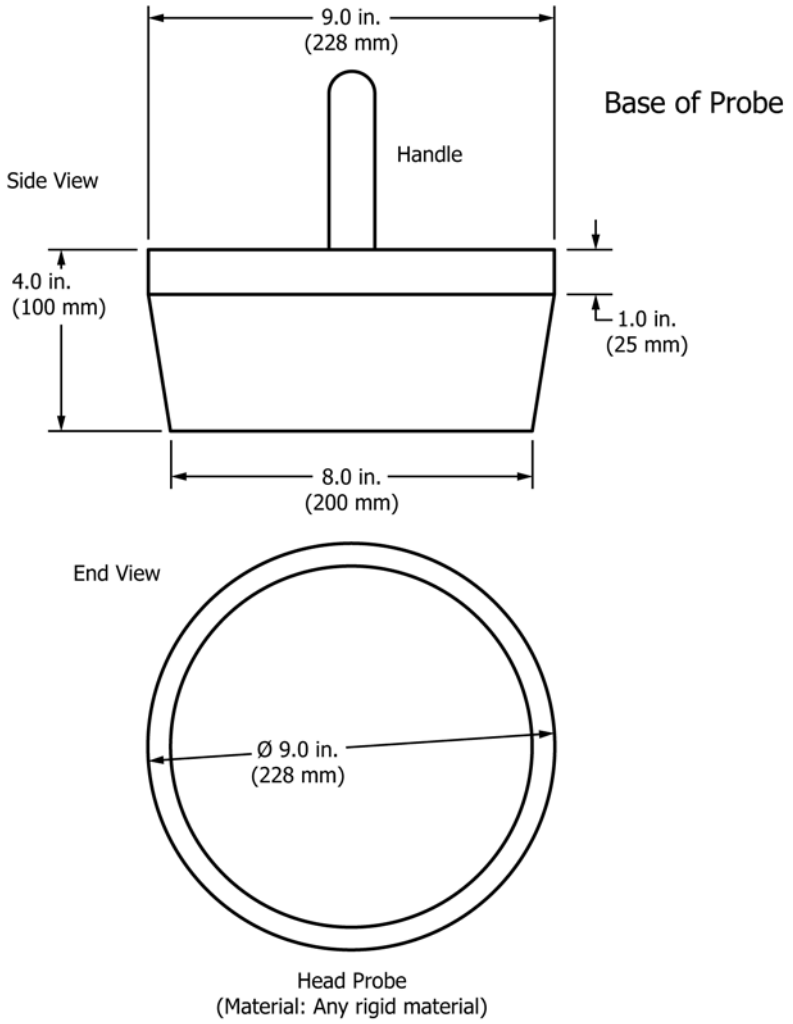
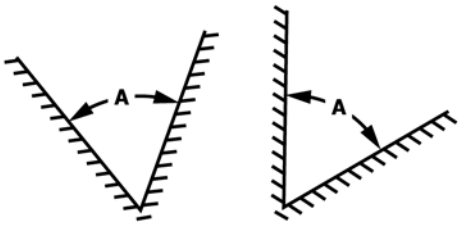
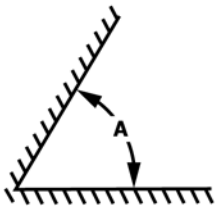


FIG. A1.8 Head Probe

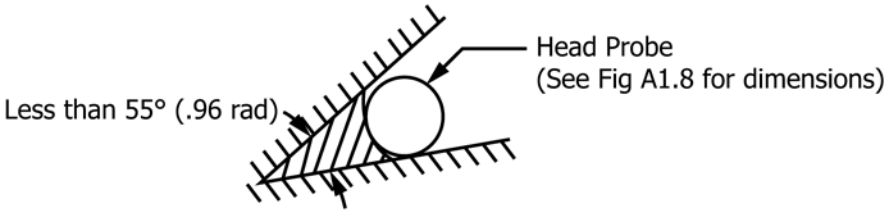


Angle "A" shall exceed 55° (.96 rad)



Angle "A" is exempt if one leg of the "V" is horizontal or slopes downward from the apex

Recommendations for Angles



Filled apex illustrating the location of the shield for angles less than 55° (.96 rad)

FIG. A1.9 Requirements for Angles

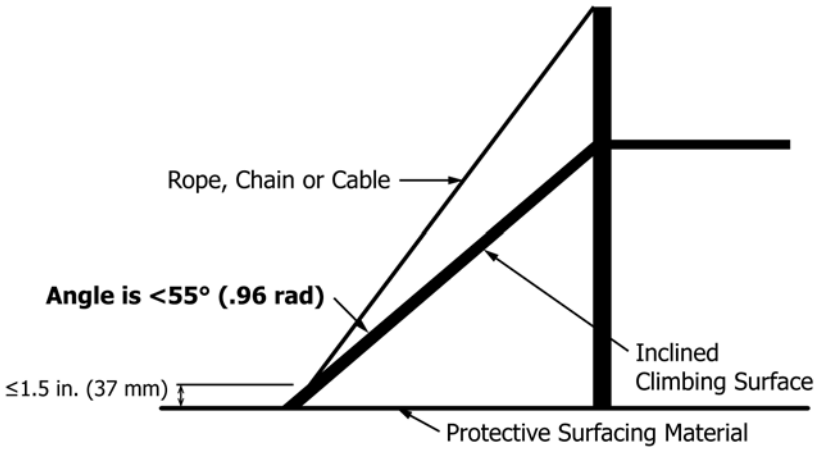


FIG. A1.10 Rope, Chain or Cable

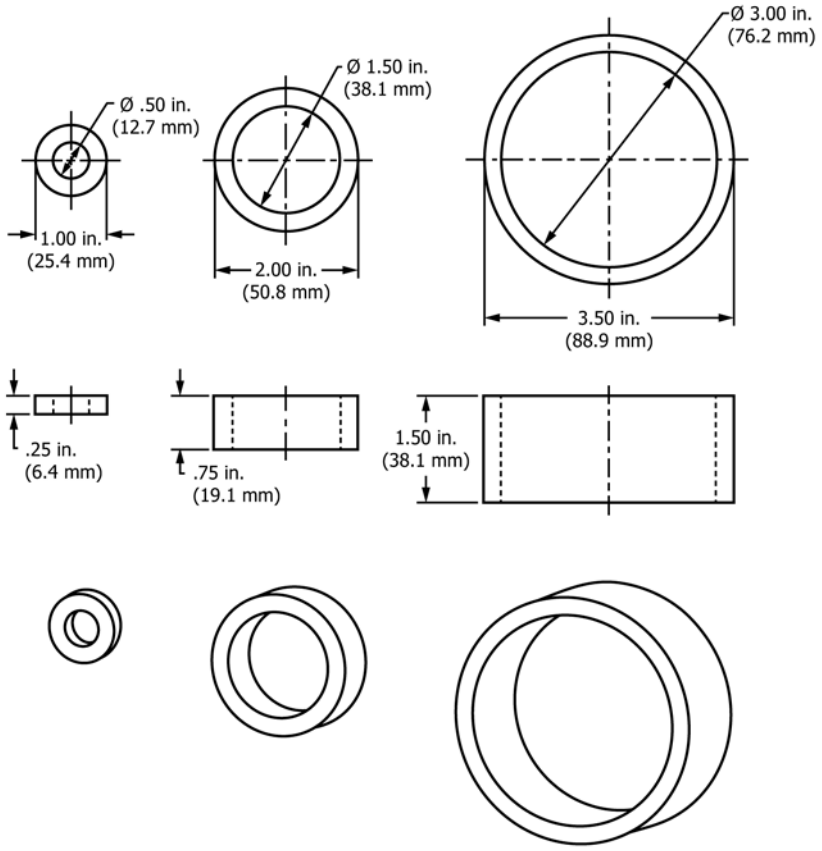
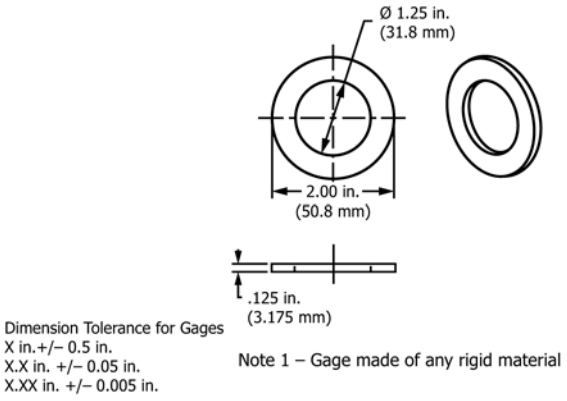
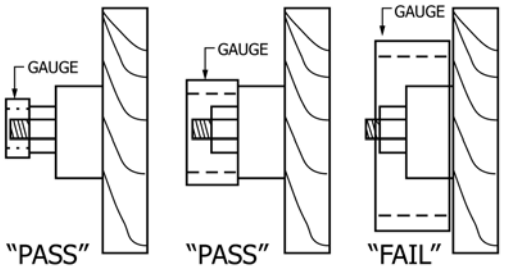


FIG. A1.11 Protrusion Test Gauges



NOTE 1—Gauge made of any rigid material.

FIG. A1.12 Motion Ride Test Gauge



NOTE 1—Starting with the smallest gauge, successively place each gauge over the projection.

FIG. A1.13 Compound Protrusion Test

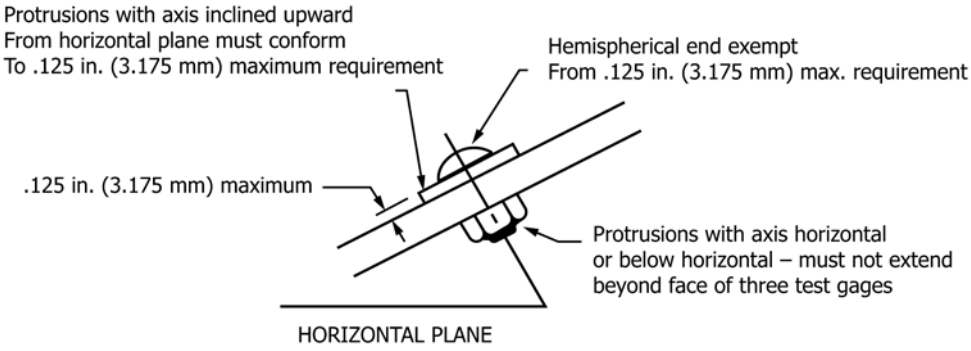
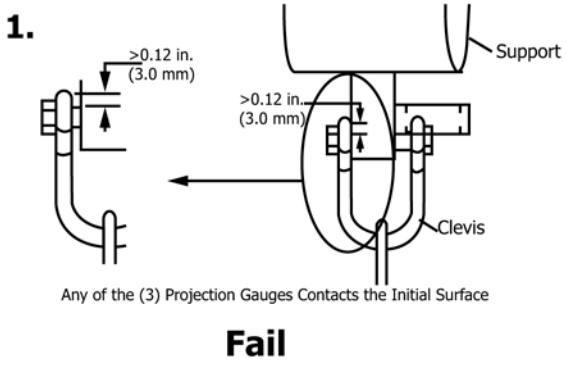


FIG. A1.14 Upright Protrusion Test



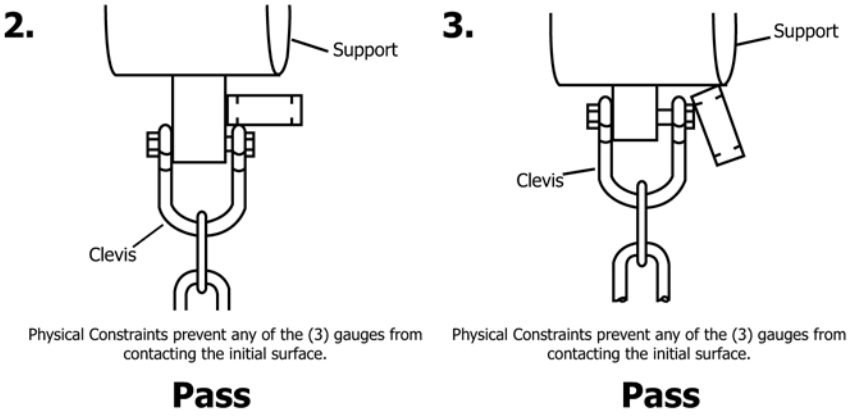
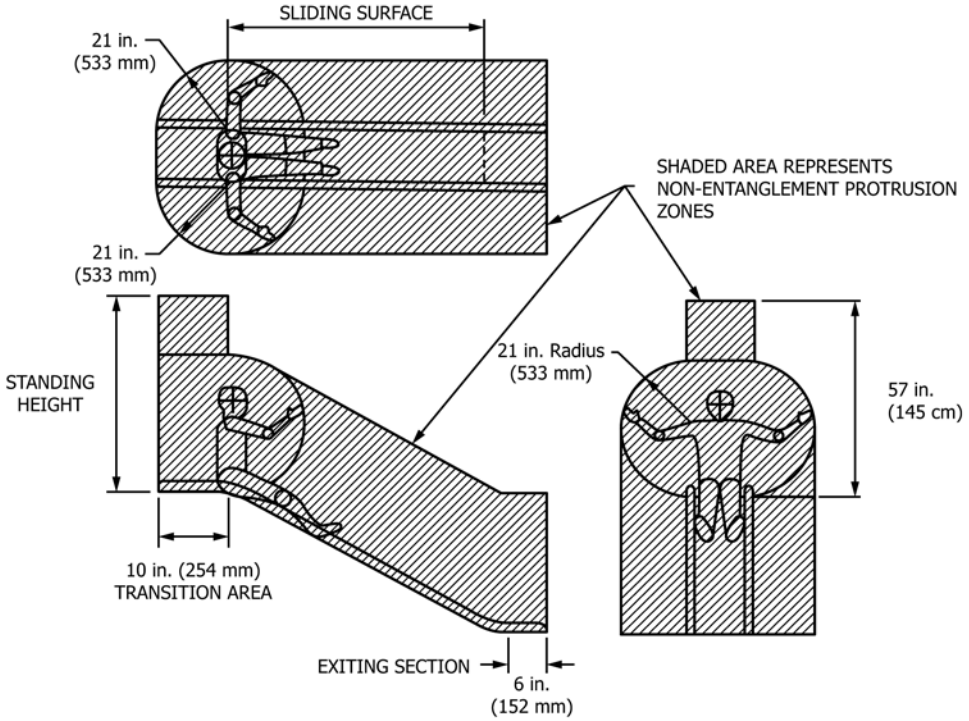


FIG. A1.15 Example of Upright Protrusion Accessibility



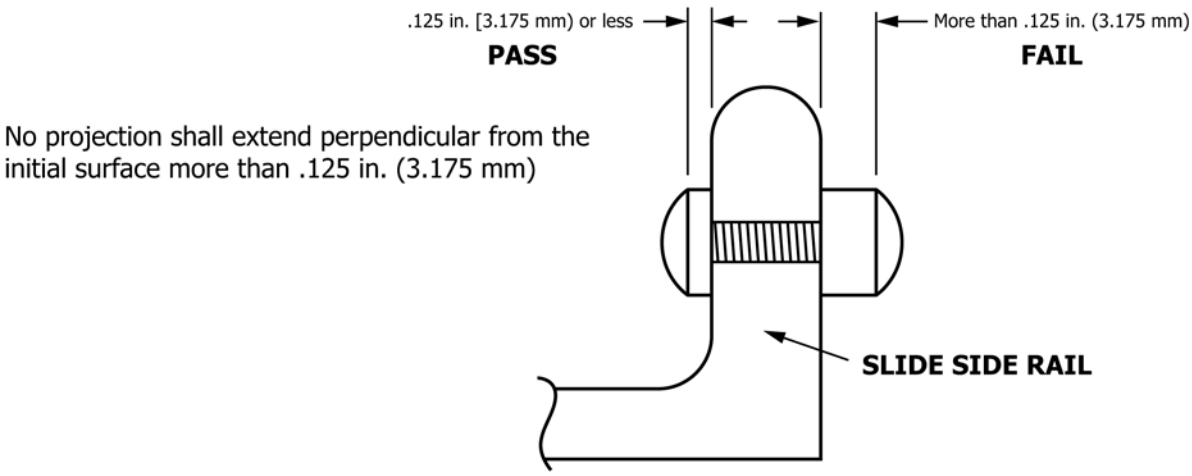


FIG. A1.16 Nonentanglement/Protrusion Zone

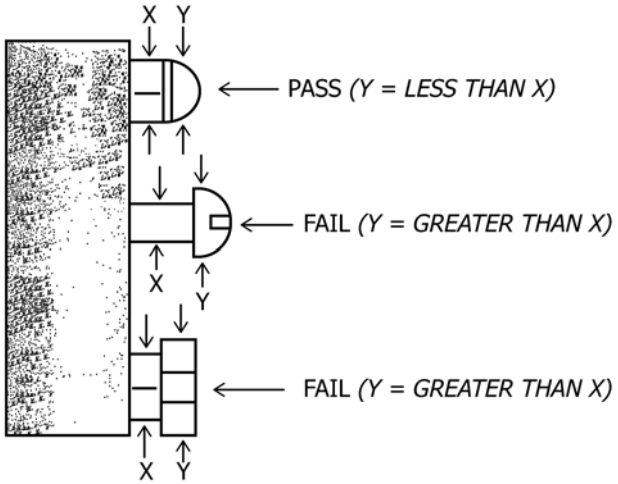


FIG. A1.17 Examples of Protrusion Configurations

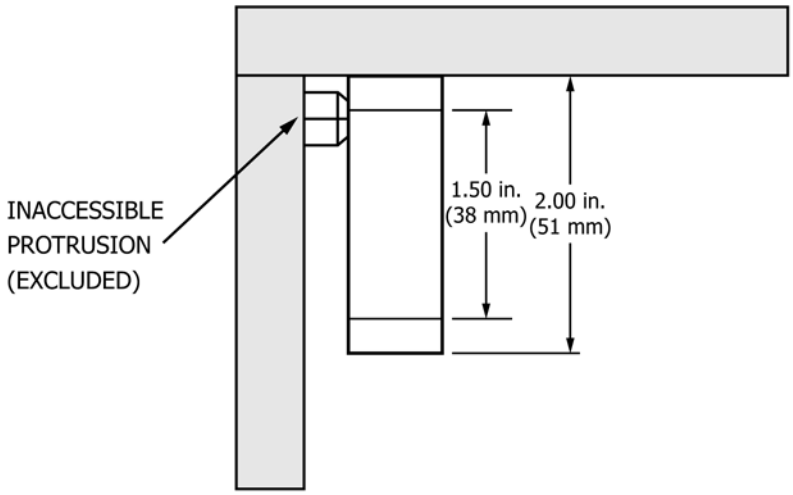


FIG. A1.18 Example of Excluded Protrusion

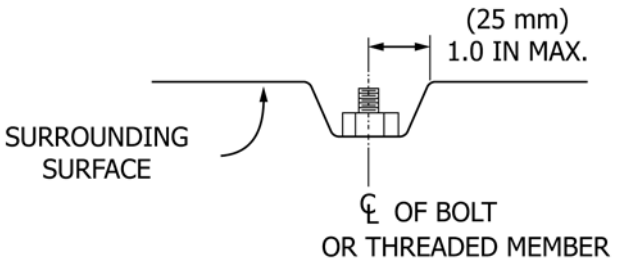


FIG. A1.19 Example of Bolt End Exempt from Requirements of 6.8.2

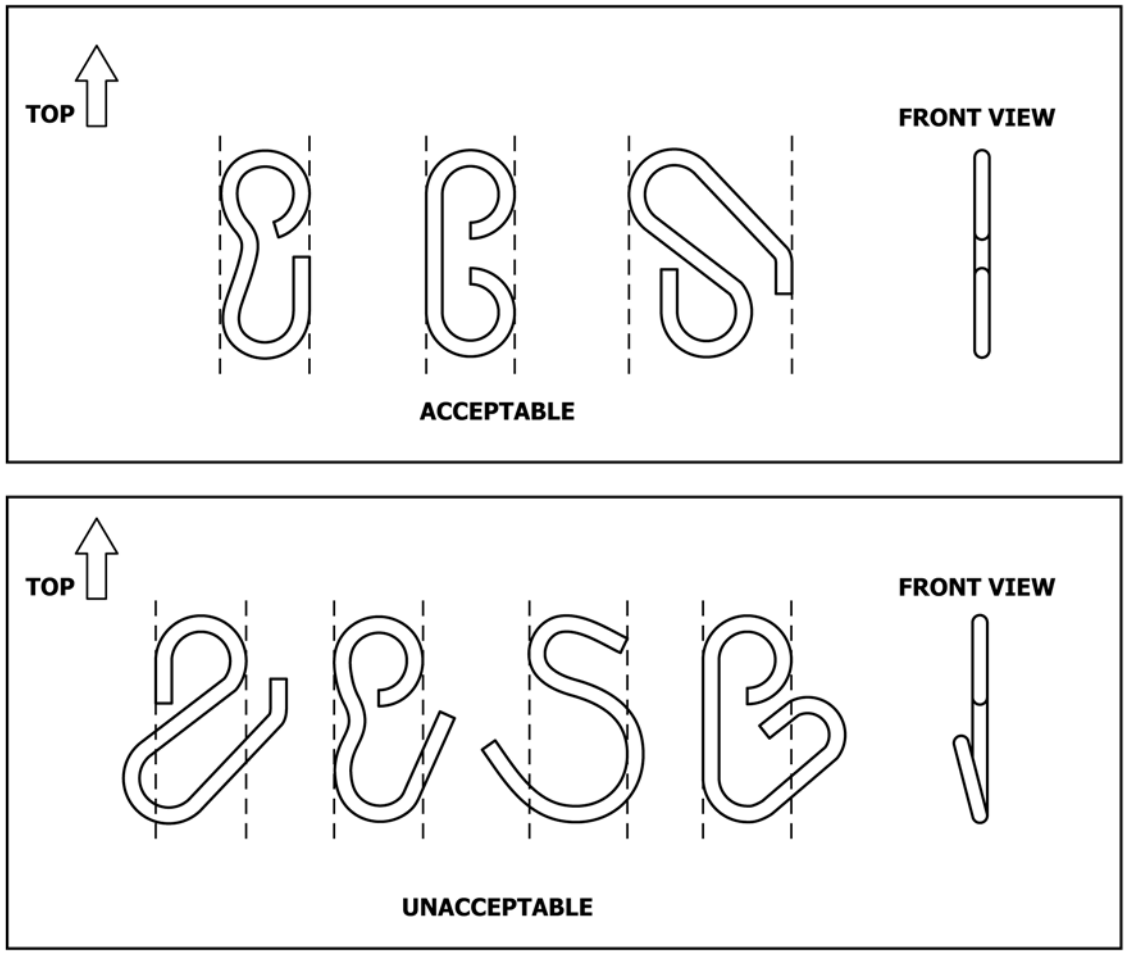


FIG. A1.20 Examples of Acceptable and Unacceptable Hooks

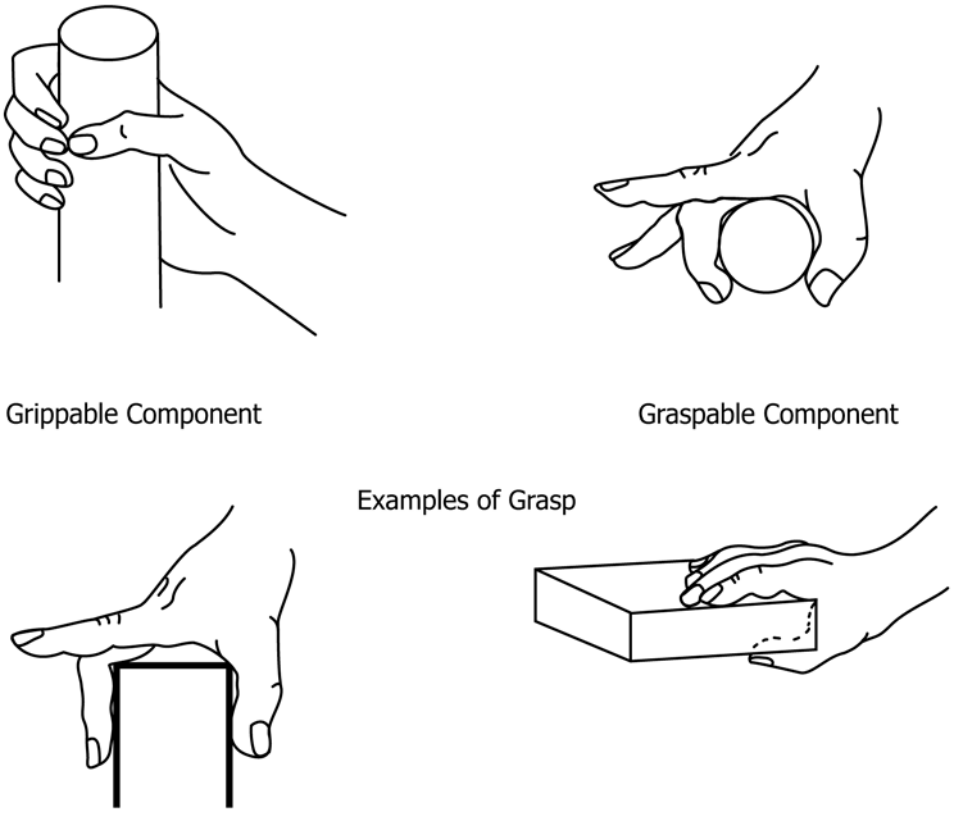


FIG. A1.21 Hand Gripping and Grasping Components

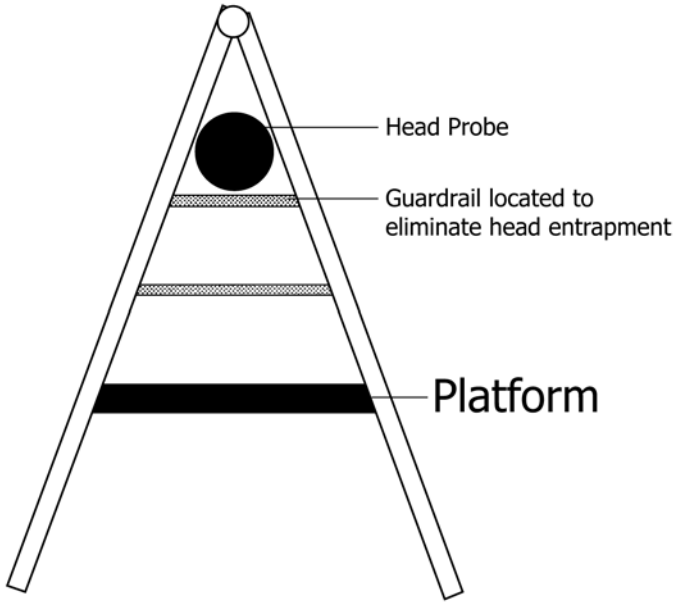


FIG. A1.22 Guardrail Location to Avoid Entrapment

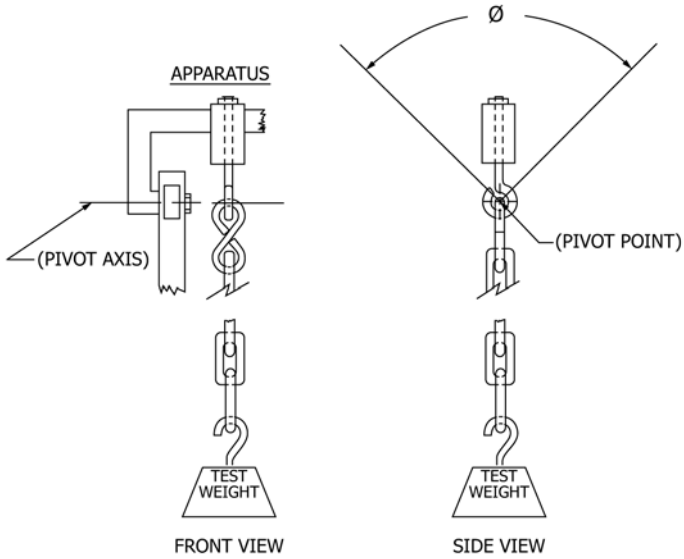


FIG. A1.23 Hanger Test Fixture

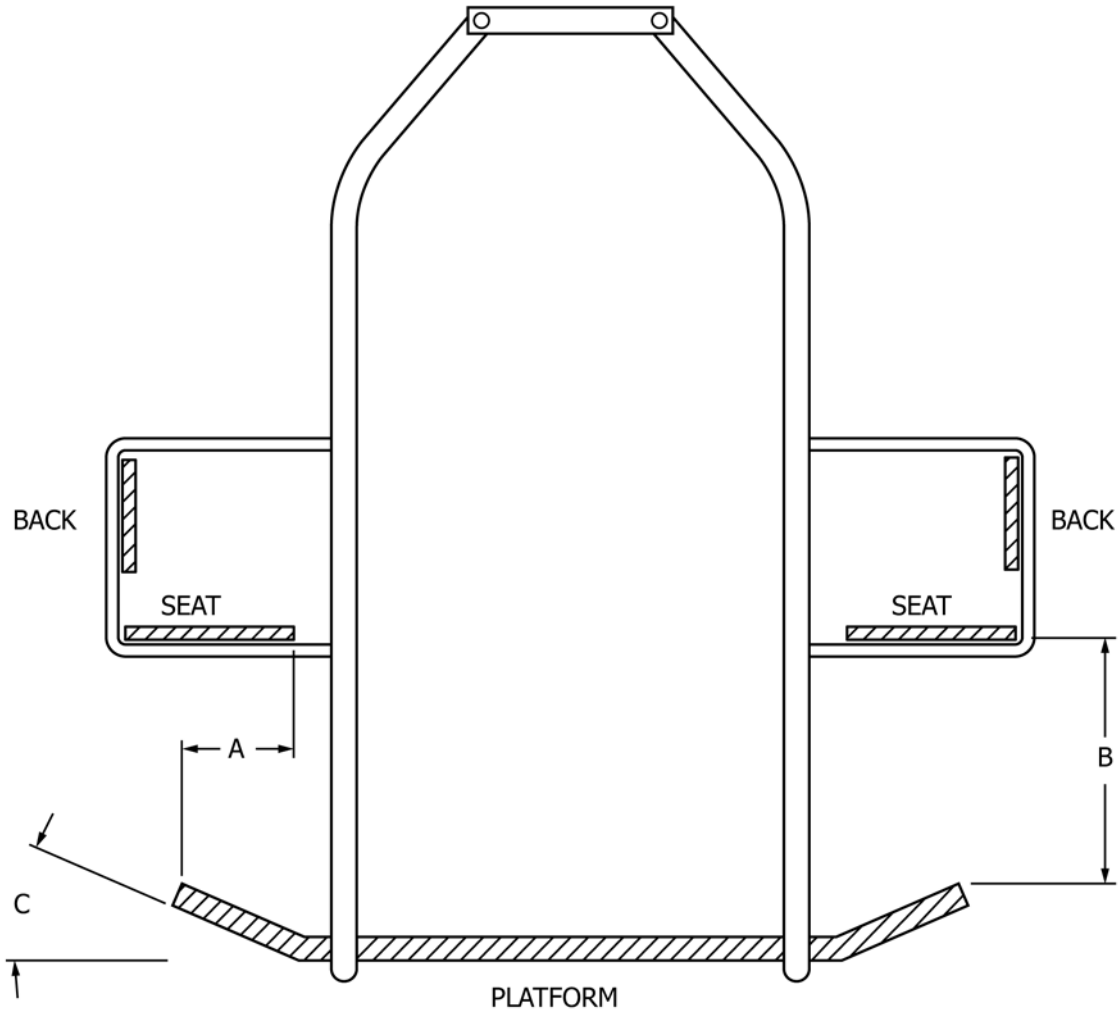


FIG. A1.24 Side View of Lawn Swing

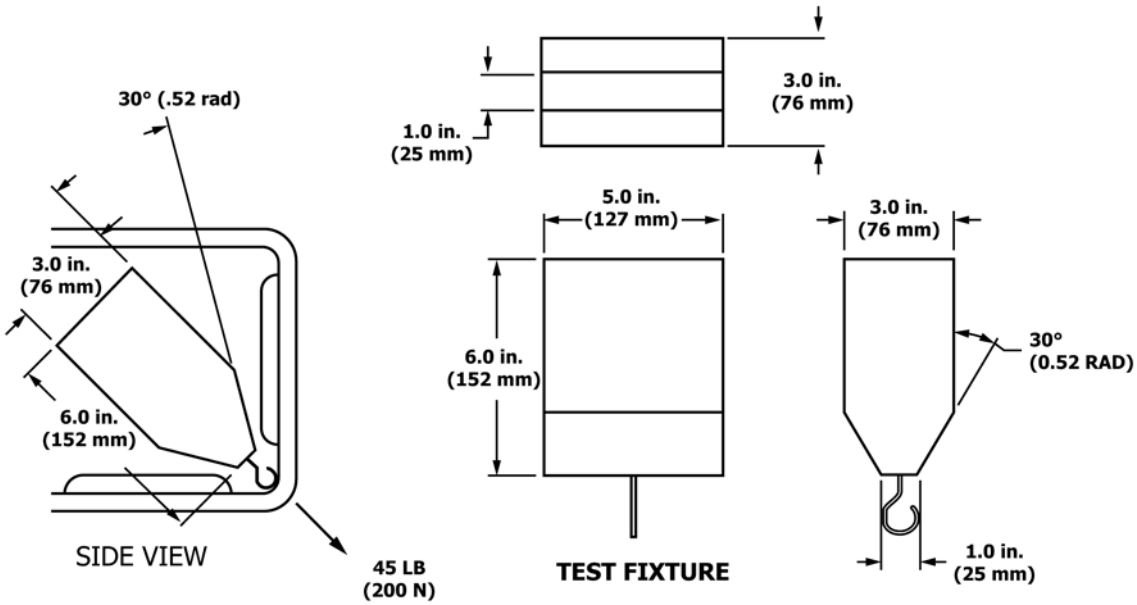


FIG. A1.25 Test Fixture for Multiple-Occupancy Swings

FIG. A1.26 Chain Criteria for Toddler Swings

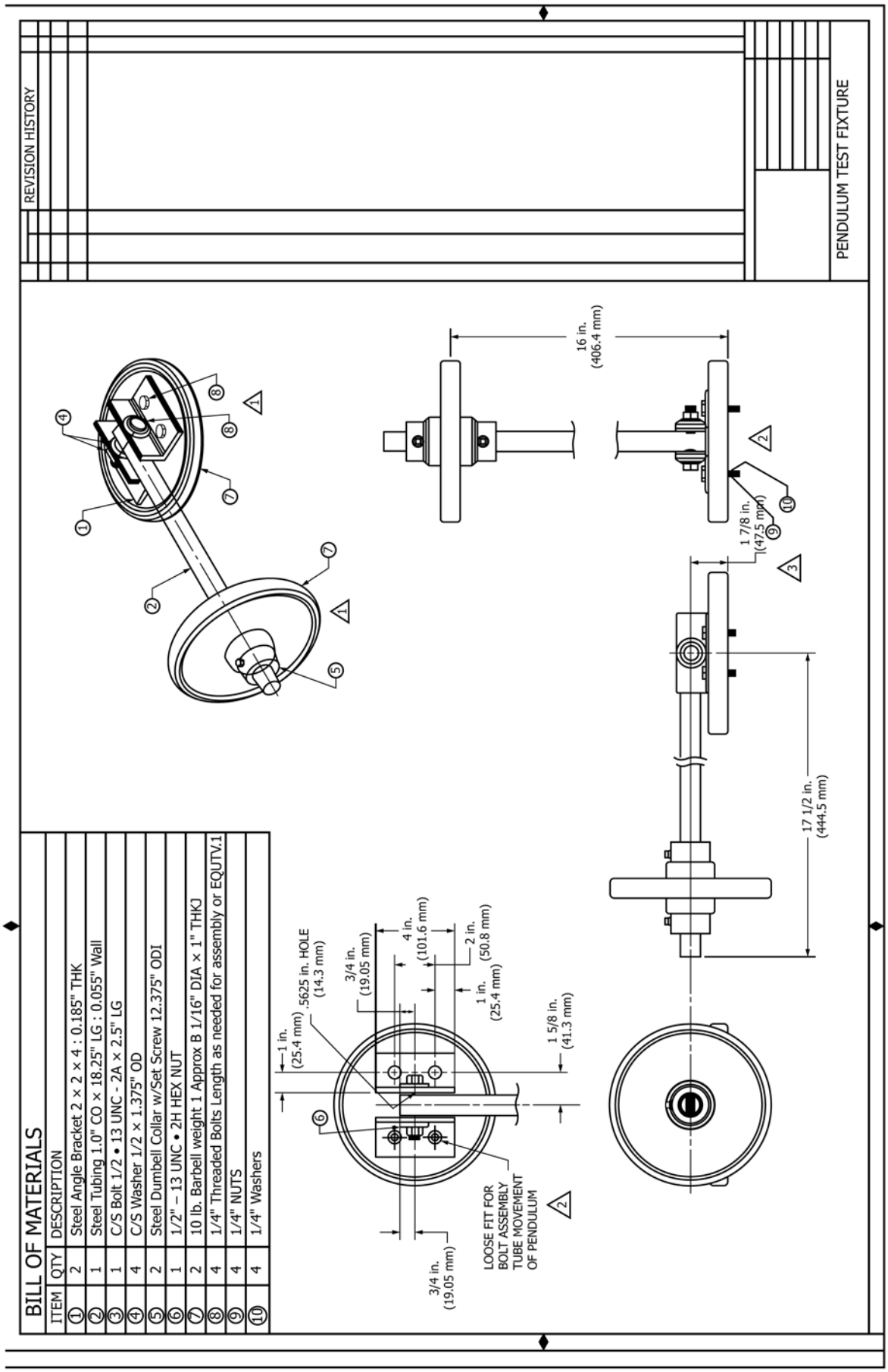


FIG. A1.27 Pendulum Test Fixture

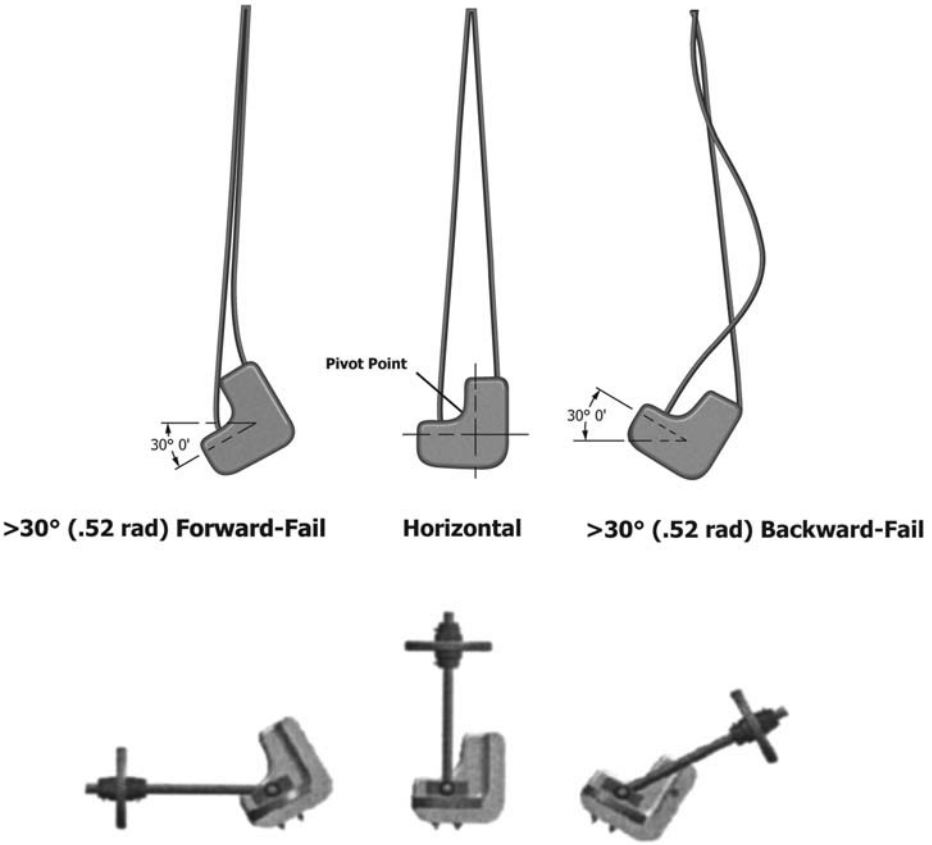


FIG. A1.28 Pass/Fail Criteria for Toddler Swings

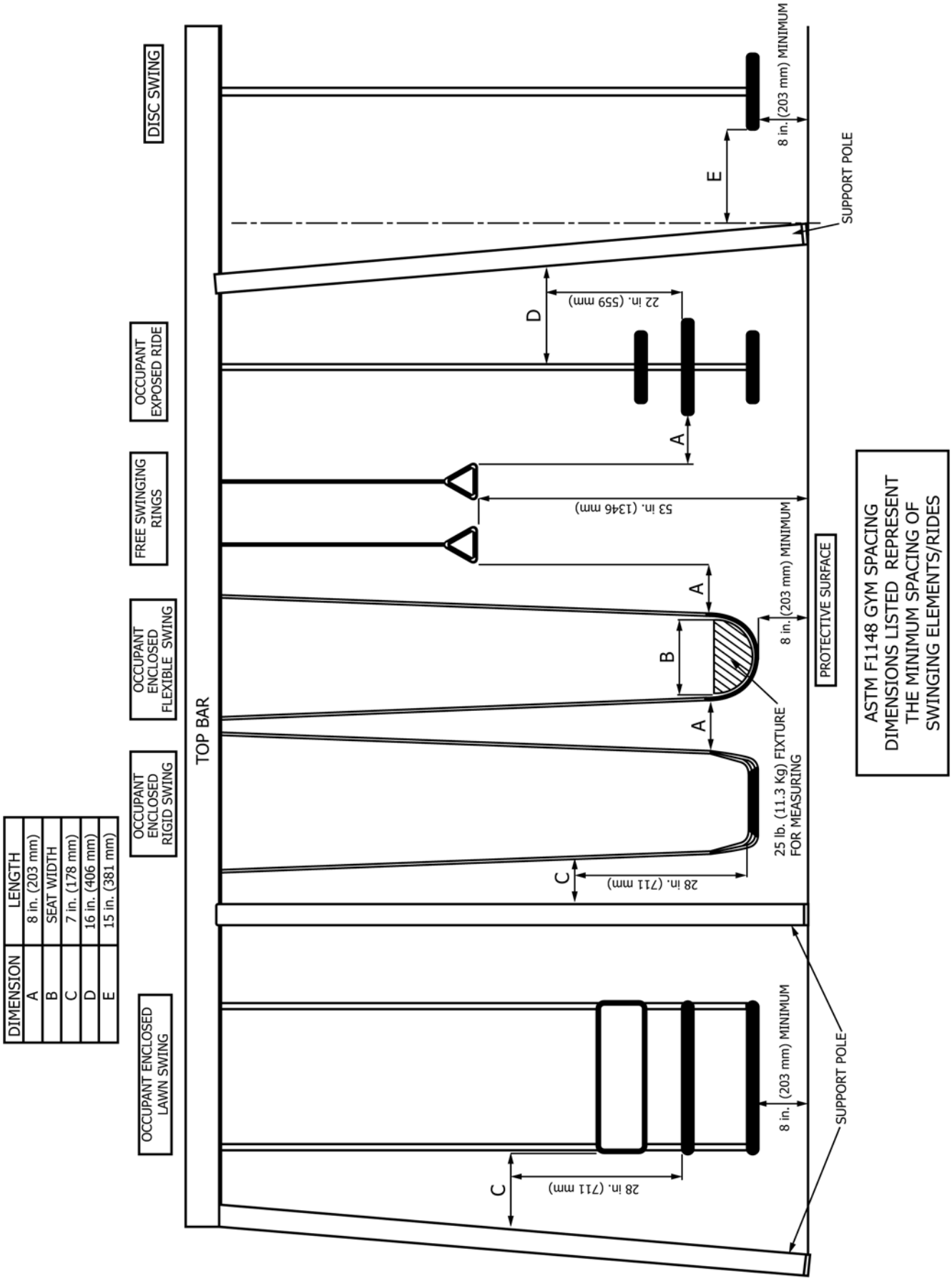


FIG. A1.29 Swing Spacing

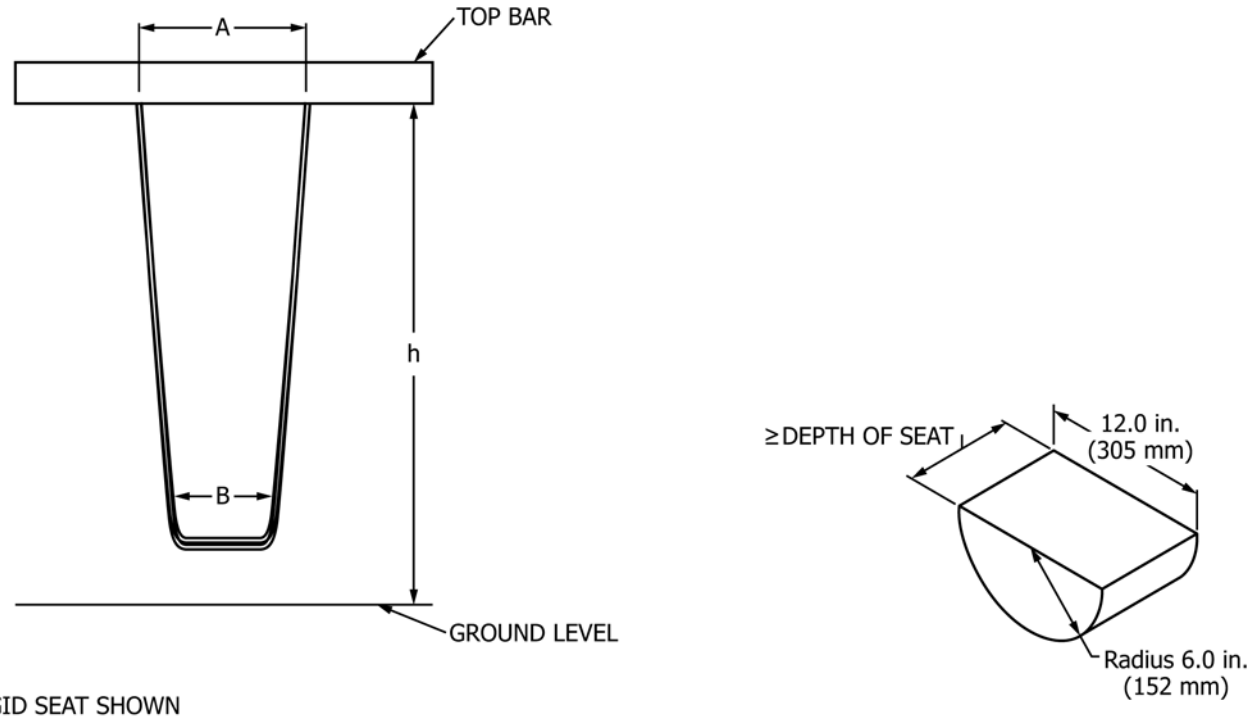
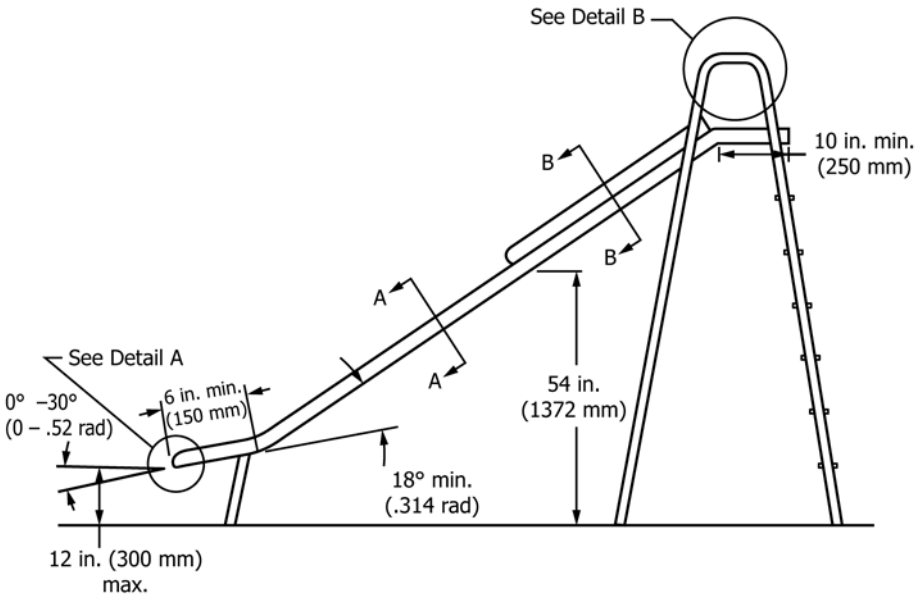
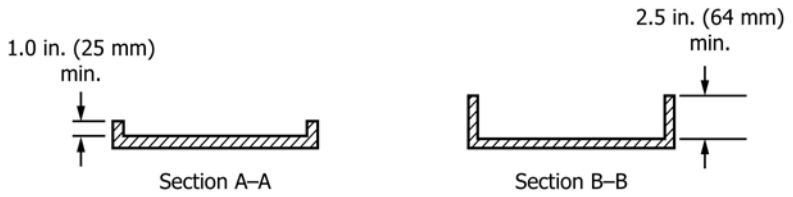


FIG. A1.30 Lateral Stability of Swing Elements





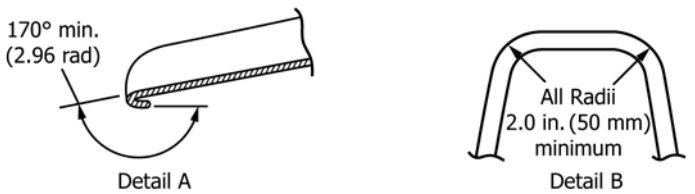
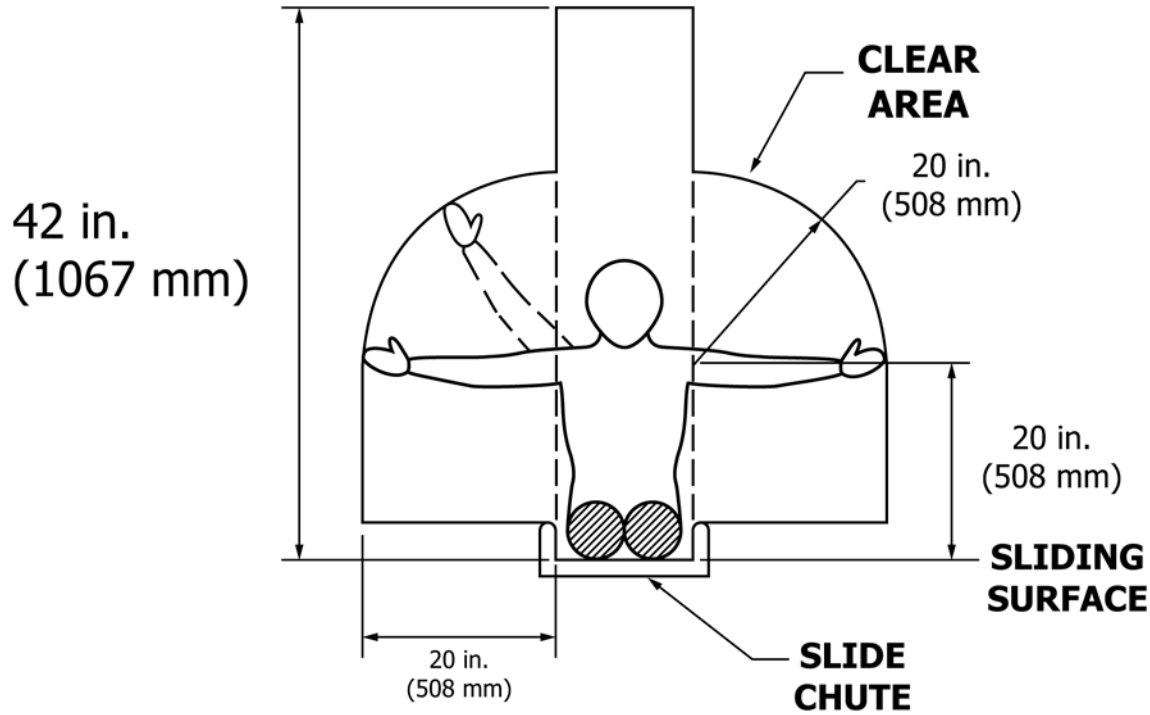


FIG. A1.31 Requirements for Slides (see 8.2)



NOTE 1—The 42 in. seated vertical clearance area is measured perpendicular to the sliding surface and begins where the bedway slopes more than 5° below horizontal.

FIG. A1.32 Slide Clearance Zones

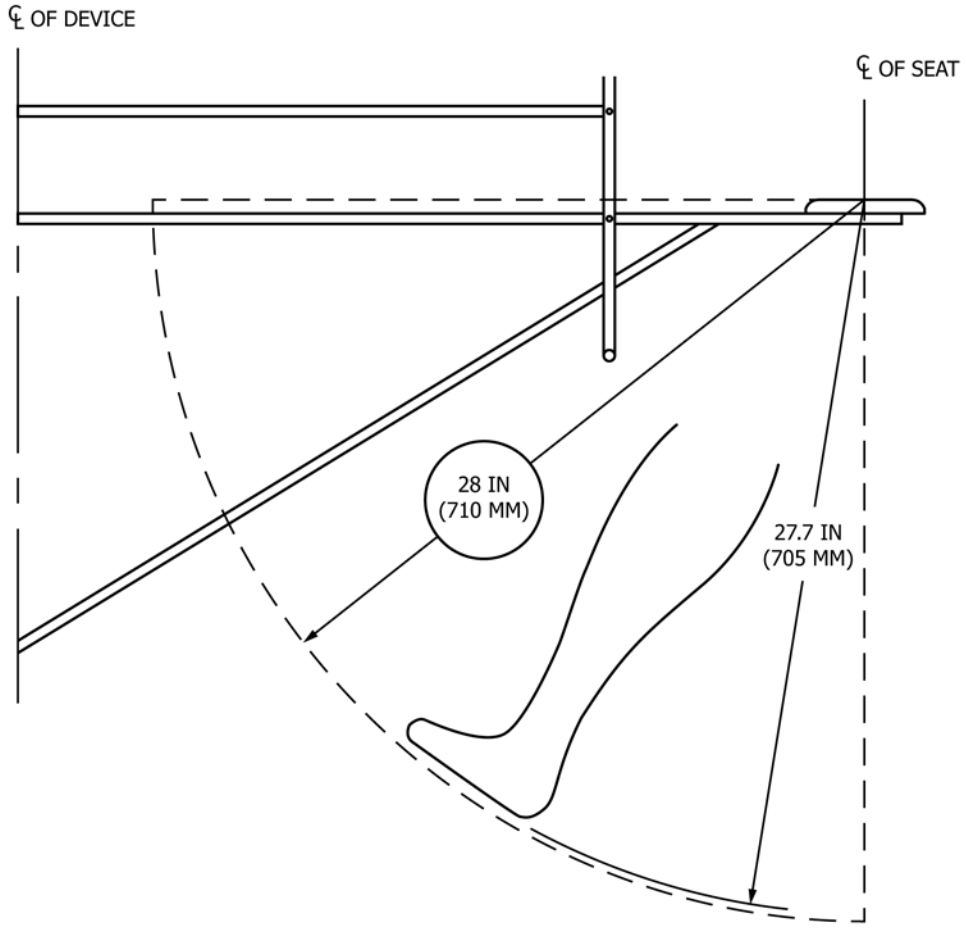


FIG. A1.33 Clearance Zone for Merry-Go-Round Stationary Members

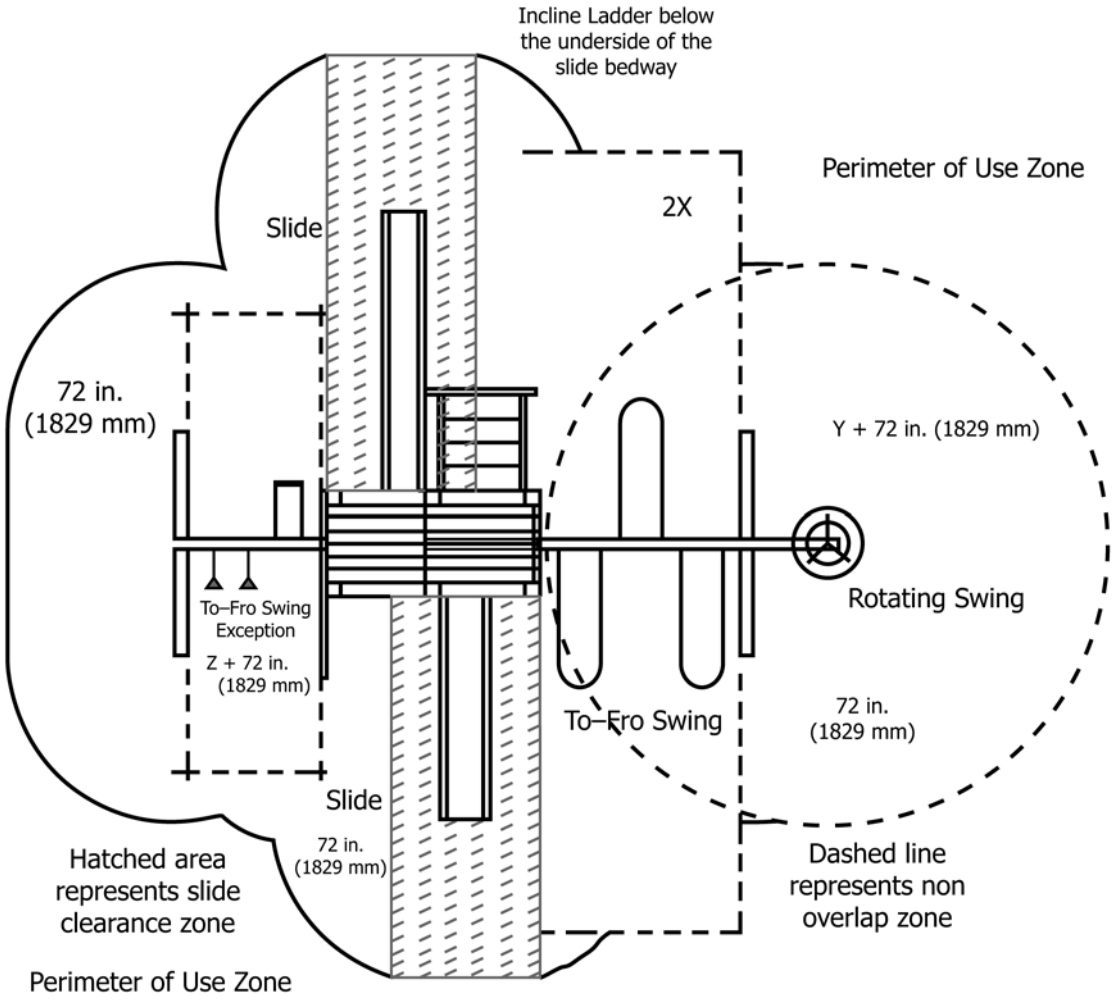


FIG. A1.34 Use Zones

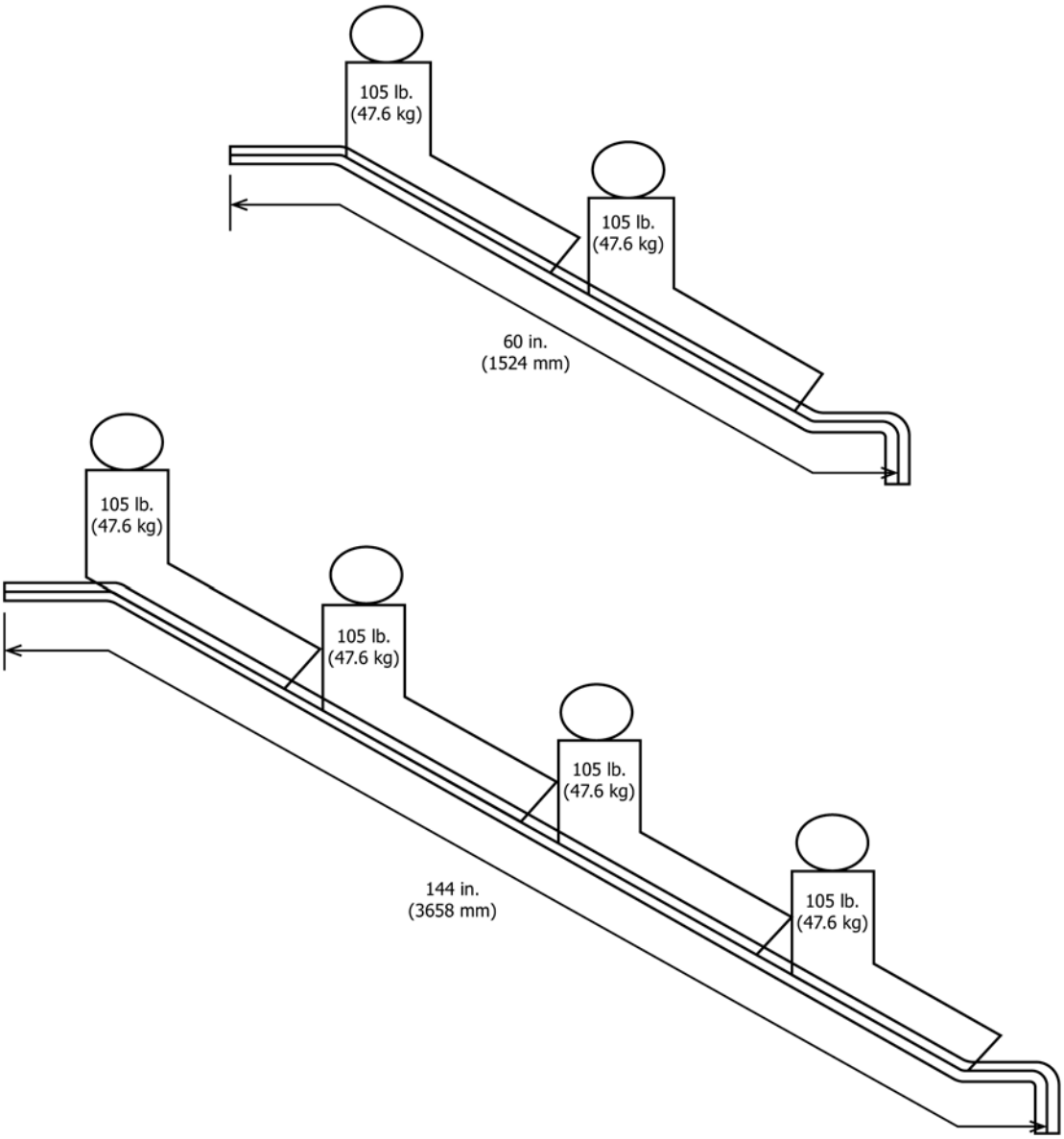


FIG. A1.35 Example of Slide Loading Diagram

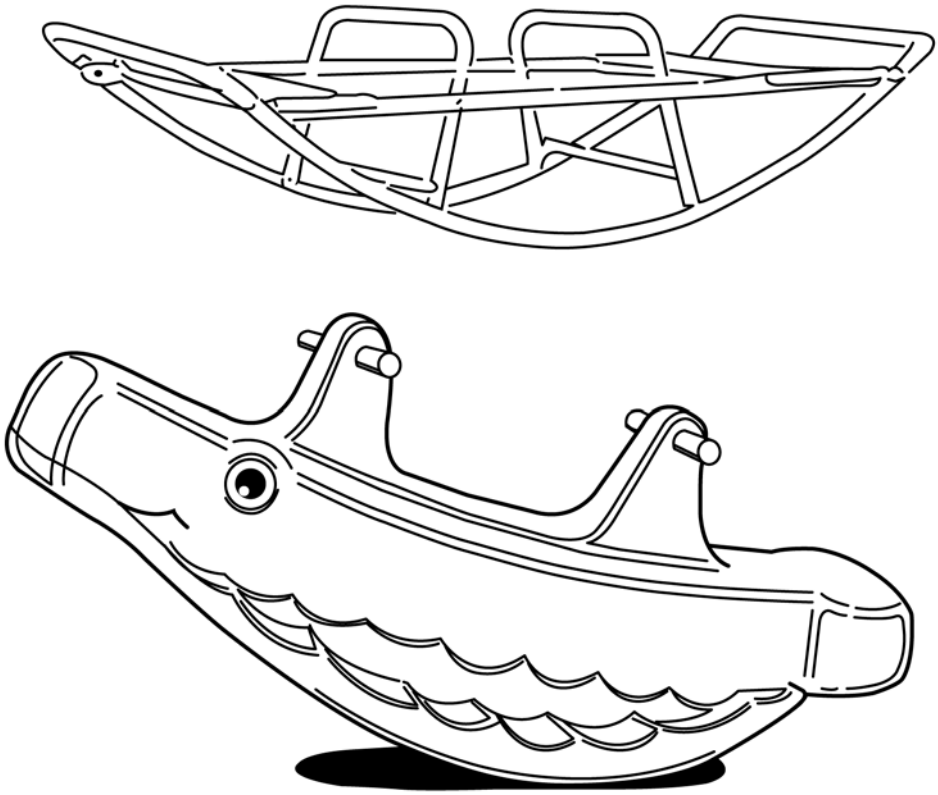


FIG. A1.36 Kiddie Rocker

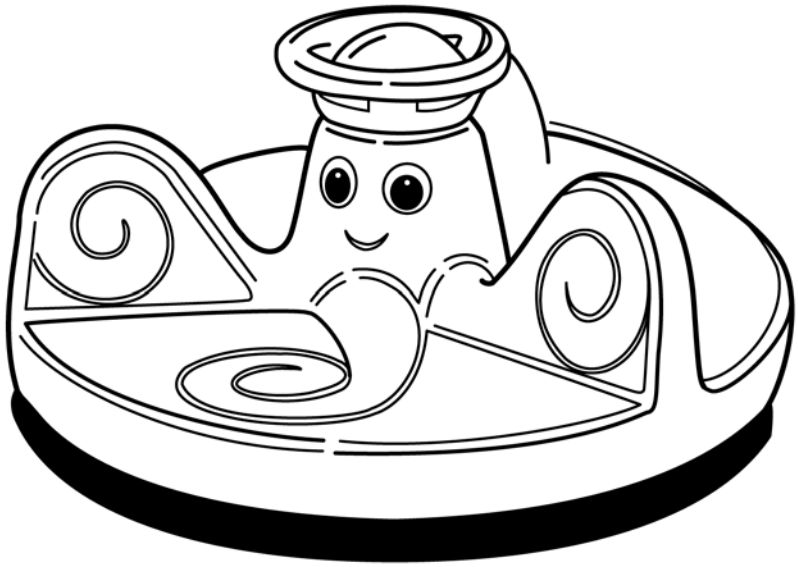
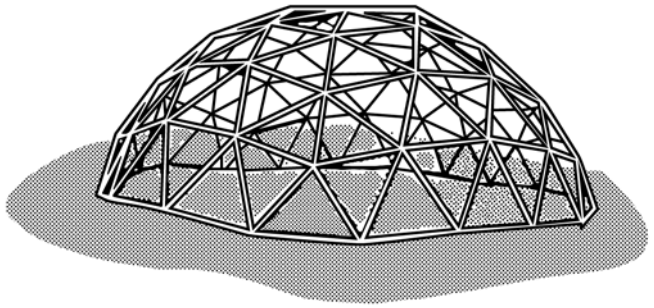


FIG. A1.37 Merry-Go-Round



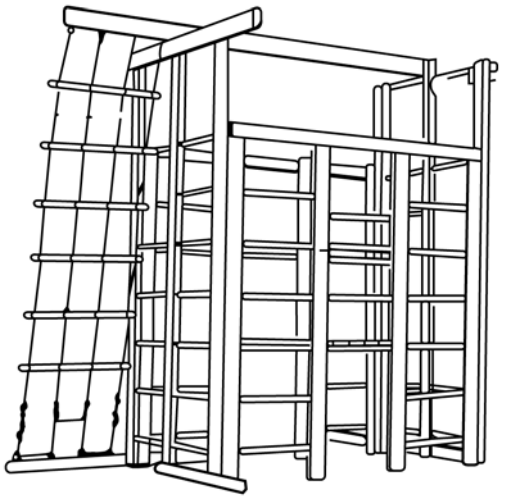


FIG. A1.38 Dome Climber and Ladder Climber

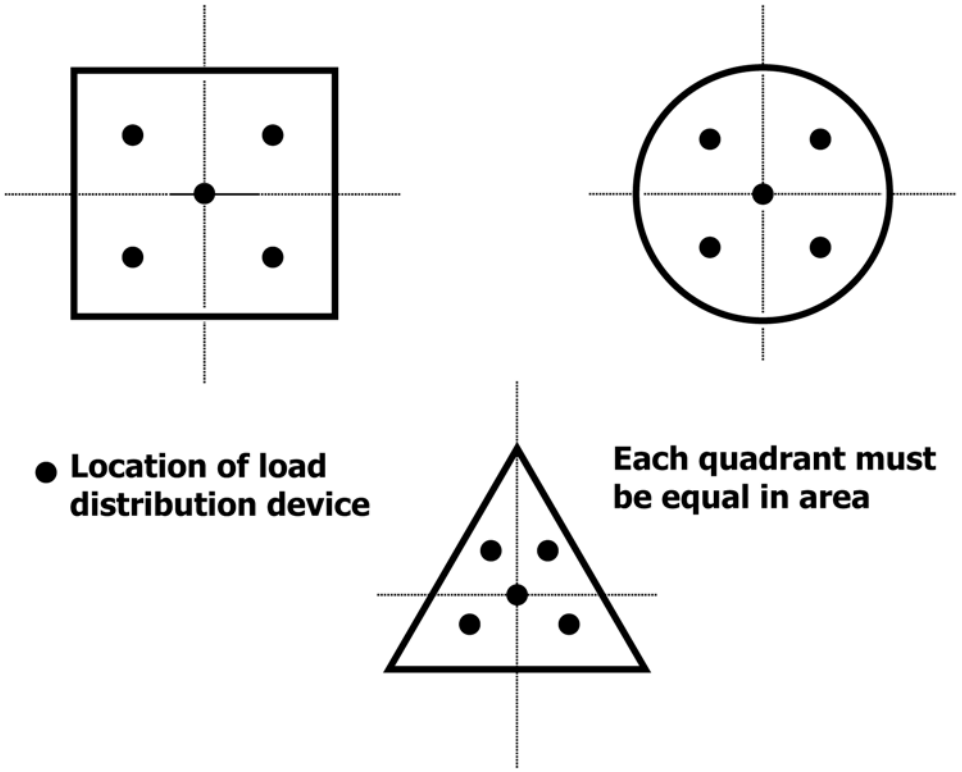


FIG. A1.39 Load Distribution on Platforms

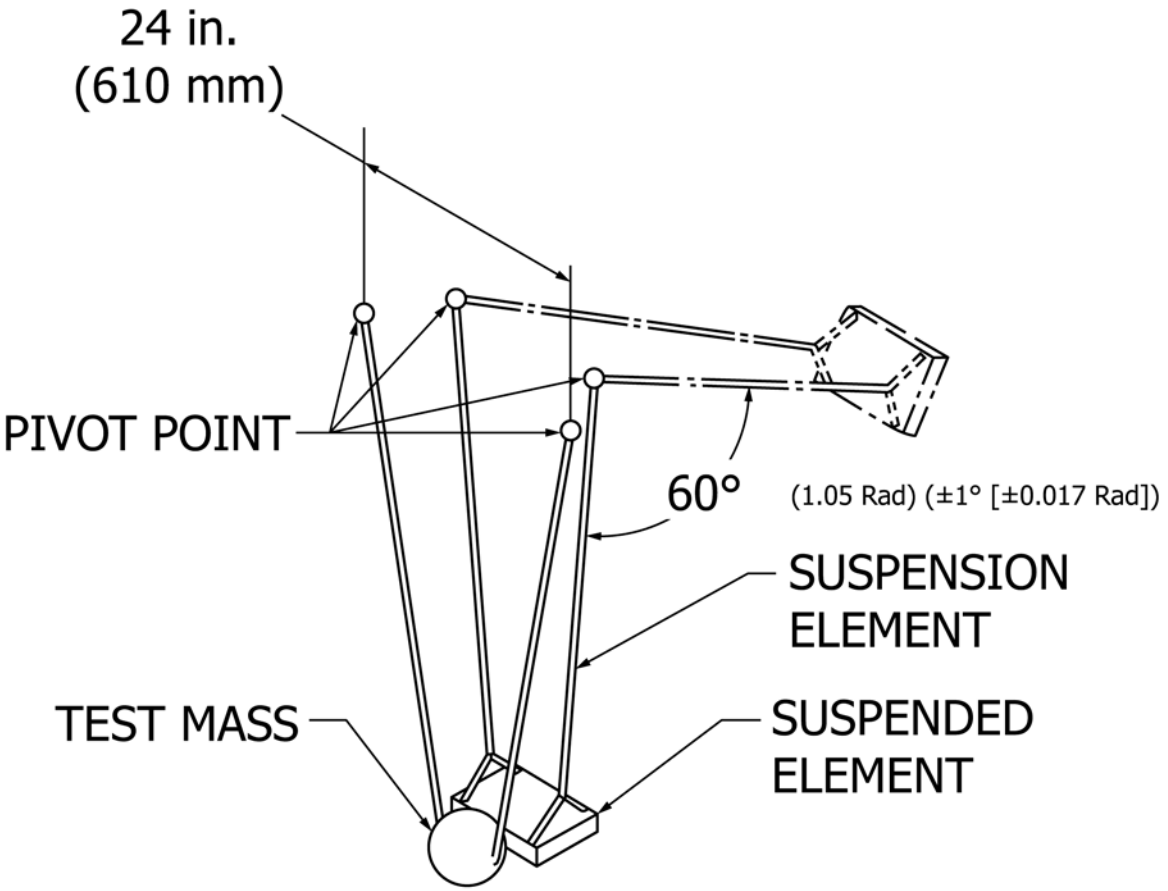


FIG. A1.40 Swing Impact Test Device Arrangement Reference Paragraphs 8.1.11.2(*1*) and 8.1.11.3(*3*)(*a*)

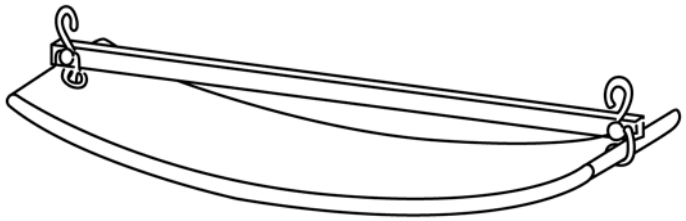


FIG. A1.41 Brace for Flexible Seats 8.1.11.3(*c*)

APPENDIXES

X1. RATIONALE FOR SAFETY REQUIREMENTS FOR HOME PLAYGROUND EQUIPMENT

X1.1 Introduction

X1.1.1 This consumer safety specification, originally published in 1988, replaced the Voluntary Product Standard PS 66-75, Safety Requirements for Home Playground Equipment.

X1.2 References to "Sharp Edge" and "Sharp Point"

X1.2.1 Reference to CPSC Sharp Edge Regulation 16 CFR Part 1500.49 and Sharp Point Regulation 16 CFR Part 1500.48 have been added to this consumer safety specification for home playground equipment (see section 3.1.9 and section 3.1.22). Such additions recognize the development and implementation of CPSC sharp edge and sharp point regulations and tests, applicable to products intended for children under eight years of age. Failure to comply with the sharp point and sharp edge test requirements does not in and of itself determine the existence of sharp points and edges. It must still be determined that noncomplying points or edges present an unreasonable risk of injury.

X1.3 Definition and Reference to "Small Parts"

X1.3.1 The definition and reference to small parts (see section 3.1.27) has been added to this consumer safety specification in order to alert manufacturers that products within the scope of this consumer safety specification must comply with Consumer Product Safety Commission mandatory regulation 16 CFR 1501 which addresses choking, aspiration, and ingestion hazards because of small parts if products are intended for children under three years of age.

X1.4 Definitions of Crush and Shear Points

X1.4.1 The practical test for the definition of a crush and shear point (see 6.6) was originally proposed by a CPSC staff member in an early discussion related to the bicycle requirements. The .187 in. (5 mm) dimension provides for finger accessibility. An opening at the juncture of a moving and a stationary member, if present, is required to have a greater clearance because of the greater hazard potential. The change to .50 in. (13 mm) is an attempt to be more severe and to keep the measurements consistent throughout the document.

X1.5 Acute Angles

X1.5.1 The 55° (.96 rad) minimum angle was established by observation and a limited amount of testing. The intent is to prevent entrapment which could result in strangulation. The exclusion of angles with the apex less than 18 in. (460 mm) above ground level is no longer allowed as new studies indicate that it is possible for young children to strangle even when their feet are on the ground. The 20 ft·lbf (27 J) impact is an arbitrarily established requirement to prevent the use of flimsy shields that would introduce a secondary hazard. The use of the head probe to determine where to place the shield has been added to enable the manufacturer to determine at which point a hazard is no longer present.

X1.6 Spacing Between Swing Elements and Stationary Frame Members

X1.6.1 Based upon an I.D.I. Report provided by the Consumer Product Safety Commission,[3] evidence is presented that spacing between supporting legs of the swing set frames and the pendulum seesaw rides may be insufficient to prevent rider contact and potential for injury. Reference is made to that report with attention to Item Numbers 2, 3, 4, 5, and 6, where in each instance children came into contact with frame-supporting elements while riding a pendulum seesaw.

X1.6.2 A review of the Voluntary Standard, Section Number 4.1.9 (simplified) allows for a 7 in. (178 mm) clearance between the outermost lateral extremity of the ride (seat) and the supporting legs, as measured at a distance of 28 in. (711 mm) above the seating surface when the seat is at least 15 in. (381 mm) from the ground.

X1.6.2.1 It is important to note that no incidents are recorded which indicate collision of the pendulum seesaw with adjacent swing rides. It is theorized that this is due in part to the additional dimension required between adjacent rides by the current standard 8 in. (205 mm) between outermost extremities of the seating service and also because the natural tendency of a pendulum is to maintain a vertical position at the center of its arc, which is where adjacent swing rides are located. This is as opposed to the location of the supporting legs, which are set at the outer region of the arc path where greater lateral motion may occur. Furthermore, there is no data to indicate that pendulum rides such as two- or four-passenger lawn swings have resulted in occupant collision with supporting members. Logically, it can be assumed that this is because the occupant is seated between the pendulum supports. Furthermore, the use

of multiple pendulums, which are separated laterally, reduces the possibility of lateral motion dramatically.

X1.6.2.2 The following data are compiled specifically to address clearance between the occupant of pendulum seesaws and supporting structures. It is not intended to apply to adjacent swing rides or to govern clearances between supporting members and laterally controlled swing elements.

X1.6.2.3 By observing children at play on pendulum seesaws, it can be determined that they often lean from side to side while riding, and must lean to some degree for comfortable positioning and clearance from the pendulums, which are directly in front of the rider.

X1.6.2.4 Further observance demonstrates that the maximum lean angle which occurs is from 20 to 25° (0.35 to 0.44 rad) as measured from the center line of the pendulum to the center line of the rider's head. Table X1.1 illustrates the appropriate anthropometric data for a 10-year-old 50th percentile child, in conjunction with a pendulum seesaw and a lean factor of 30° (0.52 rad). An evaluation can be made using Table X1.1 with regard to determining an adequate dimension for clearance from supporting members.

X1.7 Hardware

X1.7.1 The requirements of this section are intended to accomplish the following:

X1.7.1.1 Limit the amount a threaded bolt end can protrude beyond the nut unless the bolt end is recessed to reduce the possibility of producing a catch point.

X1.7.1.2 Necessitate the use of end caps on threaded bolt ends which protrude from adjacent surfaces in areas of normally expected play to protect the user from unintentional contact with bolt ends.

X1.7.1.3 Avoid the unnecessary use of end caps where threaded bolt ends existing in areas outside of normal play are free of hazardous sharp edges and burrs. The CPSC is aware of choking incidents resulting from end caps that have come off playground equipment, so an effort has been made to require end caps only where they are necessary for safety reasons.

X1.7.1.4 Require any end cap used to meet the Federal requirements for small parts (16 CFR 1501) in products intended for children under 3 years of age.

X1.8 Enclosed Openings

X1.8.1 The purpose of this requirement (see 6.1) was to eliminate a strangulation potential, where a child could insert its head into an opening from which it could not be removed without difficulty and where a child could enter an opening feet first. The numerical values limiting the openings are based upon the dimensions of a child's head and torso. The change in this consumer safety specification was prompted by a recommendation of the CPSC. A study was conducted by the Human Factors Division of the CPSC relating to head entrapment. This study showed that children were entering openings feet first, their torso sliding completely through, entrapping their heads. This study, along with accident data obtained from the National Electronic Injury Surveillance System suggested that a change was needed. The torso probe dimensions are based on the measurements of the 5th percentile two-year-old. The head probe dimensions are based on the tip of chin to top of head measurement of the oldest user at risk (95th percentile five-year-old).

TABLE X1.1 Anthropometric Data for a 10-year-old 50th Percentile Child

28 in. (710 mm) = head height at seated position
12.5 in. (320 mm) = shoulder width
18 in. (460 mm) = shoulder height
5.6 in. (140 mm) = head width
30° (0.52 rad) = lean angle provided[A]
14 in. (355 mm) = distance from center line of pendulum to the center of the head at a 30° (0.52 rad) lean angle
15.4 in. (390 mm) = head extremity at a 30° (0.52 rad) lean angle
X = proposed clearance standard
16 in. (405 mm) = dimension to *X* from center line of pendulum
22 in. (560 mm) = dimension to *X* from the seating surface
C = clearance as required by present standard

[A] In excess of 25° (0.44 rad) observed.

X1.9 Holes and Slots

X1.9.1 The limitations on holes and slots are to prevent finger entrapment, as discussed previously in X1.4.

X1.10 Hanger and Bearing Assemblies

X1.10.1 The dynamic test of hanger and bearing assemblies employs the 105 lb (47.7 kg) weight of a 95th percentile 10-year-old. Application of the principles of a simple pendulum to a swing or pendulum seesaw indicates that they will operate at approximately 20 cycles/min, or 1200 cycles/h. The required 180 000 cycles is then equivalent to 150 h of testing. The full correlation of this 150 h to normal usage is not repeated in this discussion, as the basis for this figure was developed in Committee F15 Report 53685-2, dated Sept. 30, 1971, and distributed by John Tascher to the Standard Review Committee under the date of Jan. 20, 1975.

X1.11 Minimum Ground Clearance

X1.11.1 The minimum ground clearance of 8 in. (203 mm) (see 8.1.3) provides clearance for a prone 95th percentile 10-year-old, whose chest depth is only 6.9 in. (175 mm).

X1.12 Single-Occupancy Swings

X1.12.1 In order to minimize injury due to impact by single-occupancy swings (see 8.1.4), Voluntary Standard PS 66-75 was amended to include a dynamic impact test originally developed for single-occupancy units in public playground equipment. While this consumer safety specification originally addressed criteria to minimize injury due to impact, it did not contain any specific test methods by which to make such a determination. The impact test which replaces the previous design requirements was developed by the National Institute of Standards and Technology for single-occupancy units in public playground equipment and was incorporated into this consumer safety specification as Appendix X1. Trapezes and exercise rings are exempt from this requirement based on the lack of current injury data. Straddle-type seats, such as a horse, and multiple occupancy swings are exempt from the requirement, subject to future revision.

X1.13 Multiple-Occupancy Swings

X1.13.1 Based upon I.D.I. reports provided by the Consumer Product Safety Commission, evidence is presented that the spacing between lawn swing footrests or platforms and the leading edge of the seating surface may allow excessive dimension, thereby permitting riders to place their legs through this area and contact the ground, causing leg injuries. The dimensional requirements for the multiple occupancy swing are intended to reduce the possibility of a child's foot being trapped in the gap between the seat and the footrest.

X1.13.2 The thickness of the test fixture (Fig. A1.25) reduces to 3 in. (76 mm) based on buttock depth of the smallest user (such as, 5th percentile child in 19- to 24-month age range = 3.3 in. [84 mm]). In addition, incidents have been reported that involved lawn swings which had a space between seat and backrest of between 3 and 3.75 in. (76 and 95 mm) (IDI's 850530CCC3161 & 861107CCC1057). Also, a German standard for playground equipment (DIN 7926) states that the space between seat and backrest of multiple-occupancy swings shall be between 2.4 and 3.0 in. (61 and 75 mm).

X1.13.3 Force to be applied to the wedge block test fixture increased to 45 lbf based on the weight of the largest user at risk (a 95th percentile child in the 49 to 54-month age range). Entrapment incidents generally involve children under 5 years of age.

X1.13.4 The direction of the force (perpendicular to plane of opening) was changed to simulate the most adverse condition.

X1.13.5 Since some openings between the seat and the backrest of lawn swings do not have uniform width along the length of the seat, we believe the test fixture should not enter the opening when applied at any location in the opening.

X1.13.6 We believe the minimum height (Fig. A1.24, Dimension B) of the seat skirt above the end of the platform should be 7.5 in. (190 mm) to minimize the likelihood of entrapment.

X1.14 Slides

X1.14.1 The dimensional limits of 8.2 were established in early discussions with the Bureau of Product Safety, with the angular requirements more or less arbitrarily selected to describe existing practice. The limitations of the 10 to 30° (0.17 to 0.52-rad) angle, with the horizontal together with the maximum 12 in. (300 mm) off the ground at the exit end, places the child in suitable position for dismounting from the slide.

X1.14.2 In order to minimize or eliminate the potential for clothing entanglement and falls from the top of slides, the following changes were made: A minimum radius was prescribed for all bends in handrails at the top of slides and a minimum length was added for the transition area. The side height was increased for that portion of the slide that is over 52 in. (1372 mm) from the ground. Fig. A1.31 was added to illustrate all dimensional requirements for slides.

X1.15 Slide Ladders

X1.15.1 These dimensional requirements (see 8.2.1) were developed in early discussions with the Bureau of Product Safety. The basis for excluding climbers from the slide ladder requirements comes from a draft standard for public playground equipment which was prepared for the CPSC in 1976 by a committee sponsored by the National Recreation and Park Association (NRPA). The rationale for a provision addressing Ladder and Stairway Design in the NRPA draft standard stated: "It is not the intent of this requirement to preclude the use of climbing devices to reach elevations, and therefore the requirements addressed only ladders and stairways that are not intended as climbing devices other than for ascending and descending."[3]

X1.16 Stability of Free-Standing Slides

X1.16.1 This requirement (see 8.2.2) provides for stability with the weight of the 95th percentile age user hanging over the hand rail.

X1.17 Swing Set Stability

X1.17.1 The angular limitations were derived from the geometry and construction of the various swinging elements included in 8.1.8. In 1997 the standard was changed to reflect the need to design product for a specific age group within the 18 month to 10 year age range. To accomplish this the weight of the 95th percentile age user is applied.

X1.18 Merry-Go-Rounds

X1.18.1 Instead of any submitted data by the Consumer Product Safety Commission, but with regard to specific requests by ASTM Task Group members, consideration is given to the adequacy of clearance between merry-go-round moving and stationary members.

X1.18.2 Reference is made to Fig. A1.33, which illustrates a typical merry-go-round ride and displays the leg length of a 95th percentile 10-year-old (see Table X1.1).

X1.18.3 By comparing these figures, it may be assumed that children's legs would not come into contact with stationary elements of the product if said stationary elements were excluded from the area bounded by a 28 in. (711 mm) radius (center point located at center of seating surface and extending from a horizontal plane to a vertical plane projected from the extreme rear of the seating surface).

X1.19 Structural Integrity-Load Test

X1.19.1 In order to provide a more specific and uniform system of structural load testing (see 11.1 – 11.1.8), provisions have been added whereby loads on structural members shall be applied through a standardized wood block according to specific weight and time applications. In 1997 in order to accommodate the need to manufacture product within a specific age range the provisions to apply the 95th percentile weight of the user for whom the product was designed were added. The basis for the loading did not change.

X1.20 Rungs, Steps, and Horizontal Supporting Members

X1.20.1 The 3.5 in. (90 mm) resilient block represents the load distribution on the member under test by the shoe of a 10-year-old. The proof loads of 11.1.1 provide a factor of safety of at least 3 times the 95th percentile weight of the maximum age user.

X1.21 Top Support Bar

X1.21.1 The composite loads applied to the top support bar are rounded values of the maximum anticipated loading, assumed to be in excess of the 95th percentile weight of the intended user increased by appropriate factors which consider the centripetal force from the swinging elements. For a full derivation of the multiplication factors, refer to the study by Bal M. Mahajan, National Bureau of Standards Report NBSIR 74-563.

X1.22 Individual Suspended Units

X1.22.1 The loads specified in Table 4 represent rounded values which call for proof loads providing a factor of safety ranging from 1.5 to 6, dependent upon the nature of the suspended unit.

X1.22.2 The reasoning applies to the loads specified in 11.1.4, 11.1.5, and 11.1.6.

X1.23 Climbing Towers/Jungle Gyms

X1.23.1 Section 11.1.7 requires testing with five individual loads, each more than twice the weight of the 95th percentile age user, with the additional requirement that the loads be applied in a manner to cause the greatest tendency for instability. In this test, both the structural integrity and the stability of the unit are evaluated.

X1.24 Instructions

X1.24.1 Installation instructions and information (see 10.1) have been expanded through requirements that all installation instructions contain additional warnings advising consumers that falls onto hard surfaces can result in serious injury to the playground equipment user.

X1.24.2 Instructions on removal or nonuse of plastic swing seats when temperature drops below specific levels have been clarified to allow the manufacturer to select the applicable threshold temperature level, if any. Such amendment recognizes wide variations in the characteristics of existing plastics and the plastic rigidity/temperature ratio.

X1.25 Protrusions

X1.25.1 These requirements are intended to prevent protrusions that may puncture, impale, produce an eye or ear injury, or which are catch points for clothing that could result in falls. Protrusions of this type are identified if they protrude beyond the back surface of any of the specified gauges.

X1.25.2 Portions of these requirements have been taken from proposals that were prepared for and referenced by the Consumer Product Safety Commission in a document entitled "A Hand Book for Public Playground Safety," Volume II, that refers to proposals and studies conducted by The Recreation and Park Association and by The National Bureau of Standards. The requirements of this consumer safety specification are believed to be more stringent, and adapted to the present-day concerns of injuries related to entanglement and puncture. As related in a proposal to the ASTM committee (dated Feb. 14, 1992) after review of the prior documents referenced above, a 1 in. (25 mm) inner diameter test gauge has been added that limits protrusions less than 1 in. (25 mm) in dimension to not more than .50 in. (13 mm), as compared to the CPSC guidelines that allow .75 in. (19 mm).

X1.25.3 While this consumer safety specification includes sections that set forth requirements for bolts and threaded fasteners, those components must also conform to the protrusion requirements.

X1.25.4 While there is an endless variety of configurations for protrusions that could conceivably be contacted by the user, the specified test gauges provide a means of determining permissible protrusions. The gauge with a .50 in. (13 mm) opening limits projections of that maximum size to not more than .25 in. (6 mm); the 1 in. (25 mm) gauge to not more than .50 in. (13 mm); the 1.50 in. (38 mm) gauge to not more than .75 in. (19 mm); and the 3 in. (76 mm) to not more than 1.50 in. (38 mm) projections.

X1.25.5 A protrusion that fits inside any of the protrusion test gauges and projects upwards from a horizontal plane may be considered an entanglement hazard if the projection extends more than .125 in. (3 mm) perpendicular to the plane of its initial surface. The .125 in. (3 mm) dimension was arrived at by reviewing existing standards that had provisions for entanglement, evaluation of injury data, and by using sound engineering practices.

X1.25.6 Motion rides and the motion of the user are considered by the use of the .125 in. (3 mm) thick test gauge that is required for testing of protrusion in areas with potential for possible impact.

X1.26 Summary

X1.26.1 In summary, the requirements of this consumer safety specification have been based, to the greatest extent possible, on sound anthropometric data. It should also be noted that the essential content of 4.1.2, 6.5, 6.6, 6.2, 8.1.9, 8.1, 8.2, 8.2.1, 8.1.8, and 8.3 were included in a working draft of a proposed regulation by the Bureau of Product Safety in early 1973, just prior to the formation of the Consumer Product Safety Commission.

X2. SECTION 4 OF THE CONSUMER PRODUCT SAFETY COMMISSION'S OUTDOOR HOME PLAYGROUND SAFETY HANDBOOK[7]

X2.1 *Select Protective Surfacing*—One of the most important things you can do to reduce the likelihood of serious head injuries is to install shock-absorbing protective surfacing under and around your play equipment. The protective surfacing should be applied to a depth that is suitable for the equipment height in accordance with ASTM Specification F1292. There are different types of surfacing to choose from; whichever product you select, follow these guidelines:

X2.1.1 *Loose-Fill Materials:*

X2.1.1.1 Maintain a minimum depth of 9 in. (229 mm) of loose-fill materials such as wood mulch/chips, engineered wood fiber (EWF), or shredded/recycled rubber mulch for equipment up to 96 in. (2438 mm) high; and 9 in. (229 mm) of sand or pea gravel for equipment up to 60 in. (1524 mm) high. NOTE: An initial fill level of 12 in. (305 mm) will compress to about a 9 in. (229 mm) depth of surfacing over time. The surfacing will also compact, displace, and settle, and should be periodically refilled to maintain at least a 9 in. (229 mm) depth.

X2.1.2 Use a minimum of 6 in. (152 mm) of protective surfacing for play equipment less than 48 in. (1219 mm) in height. If maintained properly, this should be adequate. (At depths less than 6 in. (152 mm), the protective material is too easily displaced or compacted.)

NOTE: Do not install home playground equipment over concrete, asphalt, or any other hard surface. A fall onto a hard surface can result in serious injury to the equipment user. Grass and dirt are not considered protective surfacing because wear and environmental factors can reduce their shock absorbing effectiveness. Carpeting and thin mats are generally not adequate protective surfacing. Ground level equipment – such as a sandbox, activity wall, playhouse or other equipment that has no elevated play surface – does not need any protective surfacing.

X2.1.3 Use containment, such as digging out around the perimeter and/or lining the perimeter with landscape edging. Don't forget to account for water drainage.

X2.1.3.1 Check and maintain the depth of the loose-fill surfacing material. To maintain the right amount of loose-fill materials, mark the correct level on play equipment support posts. That way you can easily see when to replenish and/or redistribute the surfacing.

X2.1.3.2 **Do not** install loose fill surfacing over hard surfaces such as concrete or asphalt.

X2.1.4 *Poured-In-Place Surfaces or Pre-Manufactured Rubber Tiles*—You may be interested in using surfacing other than loose-fill materials – like rubber tiles or poured-in-place surfaces.

X2.1.4.1 Installations of these surfaces generally require a professional and are not "do-it-yourself" projects.

X2.1.4.2 Review surface specifications before purchasing this type of surfacing. Ask the installer/manufacturer for a report showing that the product has been tested to the following safety standard: ASTM F1292 Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment. This report should show the specific height for which the surface is intended to protect against serious head injury. This height should be equal to or greater than the fall height – vertical distance between a designated play surface (elevated surface for standing, sitting, or climbing) and the protective surfacing below – of your play equipment.

X2.1.4.3 Check the protective surfacing frequently for wear.

X2.1.5 *Placement*—Proper placement and maintenance of protective surfacing is essential. Be sure to:

X2.1.5.1 Extend surfacing at least 72 in. (1829 mm) from the equipment in all directions.

X2.1.5.2 For to-fro swings, extend protective surfacing in front of and behind the swing to a distance equal to twice the height of the top bar from which the swing is suspended.

X2.1.5.3 For tire swings, extend surfacing in a circle whose radius is equal to the height of the suspending chain or rope, plus 6 ft in all directions.

[7] This information has been extracted from the CPSC publications "Playground Surfacing—Technical Information Guide" and "Handbook for Public Playground Safety." Copies of these reports can be obtained by sending a postcard to the: Office of Public Affairs, U.S. Consumer Product Safety Commission, Washington, D.C., 20207 or call the toll-free hotline: 1-800-638-2772.

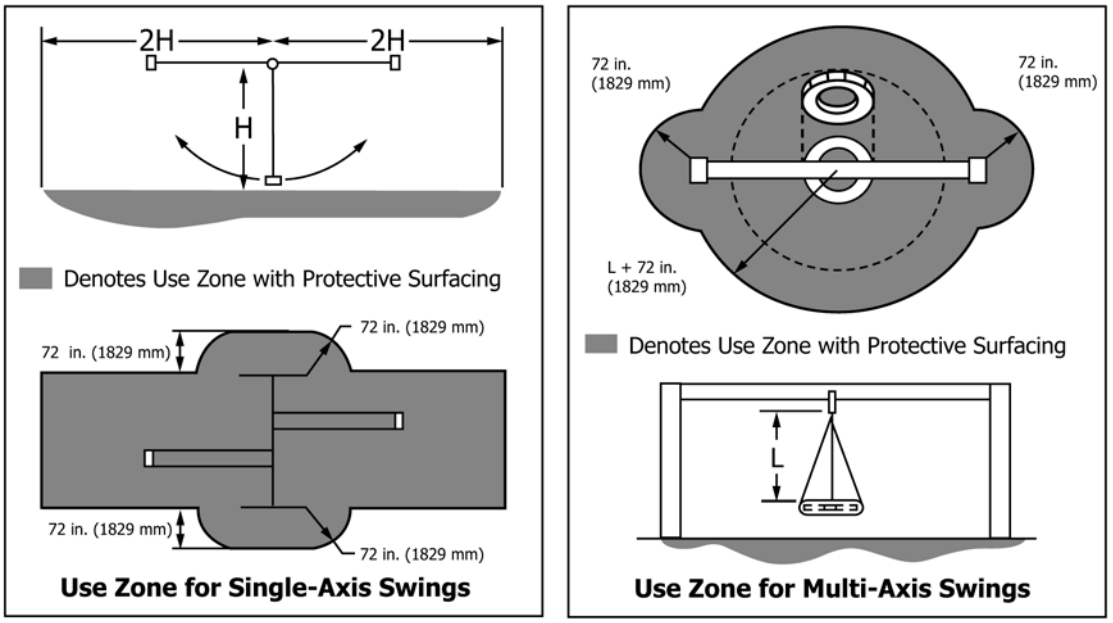


FIG. X2.1 Use Zone for Single- and Multi-Axis Swings