



# Standard Specification for Fitness Equipment<sup>1</sup>

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## INTRODUCTION

The goal of this specification is to promote proper design and manufacturing practices for stationary fitness equipment. Through these specifications this standard aims to assist designers and manufacturers in producing functional, safe products under proper operations. This standard specifies safety requirements that are generally applicable to all stationary fitness equipment. For specific types of fitness equipment, these requirements shall be supplemented or superseded by the requirements of specific standards that have been issued to cover these specific types or groups of fitness products. Where specific standards exist, this standard should be used in conjunction with the other standards. Special care is required in applying this standard alone to equipment for which no specific standard exists.

The equipment user must recognize, however, that a standard alone will not necessarily prevent injuries. Like other physical activities, exercise involving fitness equipment involves the risk of injury, particularly if the equipment is used improperly.

## 1. Scope

1.1 This specification establishes parameters for the design and manufacture of fitness equipment as defined in 3.1.9.

1.2 It is intended that these fitness products be used in an indoor setting or environment.

1.3 It is the intent of this specification to specify products for use by individuals age 13 and above.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *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.*

## 2. Referenced Documents

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

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.30 on Fitness Products.

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

F1749 Specification for Fitness Equipment and Fitness Facility Safety Signage and Labels

2.2 *ANSI Standards:*<sup>3</sup>

ANSI B29.1 Precision Power Transmission Roller Chains, Attachments and Sprockets

2.3 *European Standards:*<sup>4</sup>

EN 957-1 Stationary Training Equipment-Part 1: General Safety Requirements and Test Methods

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *accessible area, n*—area accessible to the user or third party when the equipment is in normal use, during setting up, grasping, or adjusting of equipment or position of the body.

3.1.1.1 *Discussion*—This area encompasses a region from the floor to a height of 1800 mm (71 in.) above the floor. This does not include areas that are accessible during the initial assembly.

3.1.2 *applied handgrips, n*—handgrip that is formed, molded, or attached to a support, component, or structure.

3.1.3 *consumer fitness equipment, n*—fitness equipment intended for use by one person or one family unit.

3.1.4 *corner, n*—intersection of three planes or surfaces on a single component.

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

<sup>4</sup> Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, <http://www.cenorm.be>.

3.1.5 *cycle, n*—movement of a point or load from a starting position and back to the same starting position. The cycle being executed through the full range of intended motion.

3.1.6 *edge, n*—intersection of two planes or surfaces on a single component.

3.1.7 *entrapment, n*—area that captures and requires force in excess of one pound to remove the test finger in EN 957-1.

3.1.8 *extrinsic loads, n*—all loads applied to the machine or user means in addition to the users body weight.

3.1.9 *fitness equipment, n*—mechanical device or hardware designed for use in exercising specific or multiple muscles of the body.

3.1.9.1 *Discussion*—Not to include toys used for recreation, jump ropes, outdoor or indoor playground equipment or facilities, bicycles or other fitness soft goods such as gloves, belts, apparel, balls, and so forth.

3.1.10 *general warning label, n*—label designed within the scope of this specification and Specification **F1749** which is affixed to a portion of the fitness equipment and draws attention to potential hazards associated with the use of that equipment.

3.1.11 *guard, n*—cover or enclosure that limits access to, without the use of tools, an otherwise accessible area.

3.1.12 *inaccessible area, n*—area inaccessible to the user of the machine but accessible to technicians or service personnel.

3.1.13 *institutional fitness equipment, n*—fitness equipment intended for use by numerous persons in a commercial or institutional facility, as opposed to home environment.

3.1.14 *integral handgrips, n*—handgrips that are created by, coating, texturing or other means, the material of a component or support structure.

3.1.15 *intended use, n*—use of the fitness equipment as described in the manual or as is readily apparent from the intended use as fitness equipment.

3.1.16 *intrinsic loads, n*—the loads applied to fitness equipment due only to the user’s body weight.

3.1.17 *maximum specified load, n*—maximum working load for the machine as set by the manufacturer.

3.1.18 *maximum tension developed, n*—maximum static tensile load experienced by a connector, fitting, rope, belt, chain, or other means, during use of the machine at the maximum specified load for the machine including all extrinsic loads.

3.1.19 *owner’s/user’s manual, n*—documentation supplied and intended by the manufacturer to convey information, including safety features and warnings, to the owner/user about the equipment.

3.1.20 *pinch point, n*—location between two moving components or the location between a moving and fixed component that, when entered, causes a portion of the body to become entrapped.

3.1.21 *pulley, n*— component that guides ropes or belts and redirects the forces of the rope or belt.

3.1.22 *pull in point, n*—location between two moving components, or the location between a moving and a fixed

component, that when entered causes a portion of the body to be pulled into and entrapped between the components.

3.1.23 *range of movement, n*—space in which the user or part of the user is moving when using the machine in accordance to the instructions supplied by the manufacturer.

3.1.24 *resistance means, n*—for the purpose of this specification, the device or system that, when varied by the user, increases or decreases the force encountered by the user through the user means. For the purpose of the specification, such means include weights, pneumatic cylinders, or electronic systems and their controls.

3.1.25 *shear point, n*—location at which parts move past one another or past a fixed point in such a manner that, when entered, causes a portion of the body to become entrapped in a scissors action between the components.

3.1.26 *site specific label, n*—label designed within the scope of this specification and Specification **F1749** which is affixed to a portion of the strength equipment and draws attention to a potential hazard in the immediate area of the label.

3.1.27 *stationary training equipment, n*—equipment that is used to exercise or to train muscles or muscle groups that does not travel or move across the ground as a unit during use.

3.1.28 *third party, n*—someone other than the user who is in the immediate area of the fitness equipment when it is in use.

3.1.29 *training envelope, n*—maximum space in which the user and machine components traverse when the machine is operated in accordance with the instructions.

3.1.30 *user weight (maximum), n*—manufacturer defined weight of the exerciser that the equipment was designed to safely accommodate.

## 4. Design and Construction Requirements

### 4.1 Stability:

4.1.1 Fitness equipment shall be stable while in storage, unloaded, and in the intrinsically and extrinsically loaded use conditions.

### 4.2 Support:

4.2.1 Fitness equipment shall support the user and any additional loads applied by the user in normal operation without breakage. Examples include: seats, foot rests, backrests, etc.

### 4.3 Edges, Corners, and Tube Ends:

4.3.1 *Edges*—All edges in accessible areas shall be free of burrs and sharp edges.

4.3.2 *Corners*—All corners in accessible areas shall be radiused or chamfered.

4.3.3 *Tube Ends*—Tube ends in the exposed accessible areas shall be closed off either by other components or by plugs. Plugs shall remain in place during normal operation and storage.

### 4.4 Guarding and Entrapment in Accessible Areas:

4.4.1 *General*—Pinch, shear, and crush points in the accessible area as defined in **3.1.1**, **3.1.20**, and **3.1.25** shall be avoided or guarded. In the event that the hazard can not be removed or guarded, a site specific warning label shall be

present alerting the user or third party to the presence of the hazard. Guarding is not required if a minimum clearance between affected components of 60 mm (2.36 in.) can be maintained. Exceptions to this requirement are as follows:

4.4.1.1 *Fingers*—If during operation or adjustment of the equipment the only portion of the body that could become entrapped is the fingers then the spacing between the affected components shall be less than 9.5 mm (0.37 in.) or greater than 25 mm (0.98 in.).

4.4.1.2 *Third Party Access*—If during the intended use of the product, third party access to the affected area of the machine is prevented by the user's body placement or if the user can immediately stop the movement of the affected components then the spacing between the affected components shall be at least 25 mm (0.98 in.).

4.4.1.3 *Component(s) Moving Past Fixed Component(s)*—In general, the guidelines in the previous sections shall be followed. However, if during the intended operation or adjustment, a component moves past a fixed component in such a manner that no shear or pinch points are created, then the spacing between the fixed component and the moving component shall be less than 9.5 mm (0.37 in.) or greater than 25 mm (0.98 in.).

4.4.1.4 *Component Stops*—Open and obvious stops for moving components are excluded.

4.4.1.5 *Chain or Gear Drives*—Chain or gear drives on fitness equipment shall be guarded in accordance with ANSI B29.1.

4.5 *Overheating*—No external nonmetallic surface shall achieve a temperature exceeding 85°C (185°F). No external metallic surface shall achieve a temperature exceeding 60°C (140°F).

4.6 *Control Panel*—If it is intended for the user to vary the function of the equipment during its intended use, then the control panel shall be readily accessible by the user during the equipment's intended use.

4.7 *Switches and Switch Actuation Mechanisms*—For motorized fitness equipment, switches and switch actuation mechanisms for controlling the stop, pause, or end functions of the motorized system, shall function properly as follows:

4.7.1 *Consumer Fitness Equipment*—3 times/h × 5 h/week × 52 weeks/year × 1 yr × a safety factor of 2 = 1560 actuations.

4.7.2 *Institutional Fitness Equipment*—3 times/h × 50 h/week × 52 weeks/year × 3 years × 1 yr × a safety factor of 2 = 46 800 actuations.

4.8 *Adjustment and Locking Means*—All adjustment and locking means shall function securely at all adjustment positions. The possibility of inadvertent disengagement shall be reduced by spring retention, clamps, or other means.

4.8.1 Adjustment knobs and levers shall not interfere with the user's range of movement.

4.9 *Handgrips/Foot Support:*

4.9.1 *Integral Handgrips*—Integral handgrips, if required for proper use as defined by the manufacturer, shall be conspicuous and shall reduce slippage during normal use.

4.9.2 *Applied Handgrips*—Applied handgrips shall be of a material that reduces slippage and shall withstand an applied force of 90 N (20.2 lb) without movement in the direction of the applied force.

4.9.3 *Rotating Handgrips*—Rotating handgrips shall be constrained against lateral movement along their rotational axis and be constructed of a material that reduces slippage.

4.9.4 *Foot Support*—Bars or plates designed to support the user's feet during exercise shall be fitted with or be of a material or surface type or configuration that reduces slippage.

4.10 *Load Development and Transmitting Components:*

4.10.1 *Ropes, Belts, Chains, and Other Means*—Including all attachment devices (links, shackles, end fittings, and termination means) shall not fail with a load equal to six times the maximum static tension developed by the machine during normal operation.

4.10.2 *Chain or Gear Drives*—Chain or gear drives on fitness equipment shall be guarded in accordance with ANSI B29.1.

4.11 *Electrical Components*—Electrical components shall be guarded to prevent inadvertent contact with hazardous electrical elements.

## 5. Loading

5.1 *Intrinsic Loading*—All user supporting surfaces for consumer and institutional fitness equipment shall be able to withstand a single static load equal to a loading factor times the greater of 135 kg (300 lb), or the maximum specified user weight, as set forth by the manufacturer, at the point of user contact without breakage. The loading factor stated above shall be 2.5 for consumer fitness equipment and 4 for institutional fitness equipment.

5.2 *Extrinsic Loading*—The fitness equipment and user supports shall not break when loaded by a maximum specified user weight person and the maximum extrinsic load as specified by the manufacturer.

5.2.1 The test load to be applied for 5.2 is specified by the following equation:

$$F_{test} = [W_p + 1.5F_a] S \quad (1)$$

where:

$F_{test}$  = the total reactionary load to be applied during the test, expressed in kilograms or pounds depending on factor  $S$  and the values  $W_p$  and  $F_a$ ,

$F_a$  = the maximum user applied load at the point of user contact with the machine for the maximum capacity of the machine as stated by the manufacturer, expressed in kilograms or pounds,

$W_p$  = the proportionate amount of the user's body weight being applied to the machine component being tested. This value is to be expressed as the proportionate amount of either 135 kg (300 lb) or the maximum user weight as specified by the manufacturer, whichever is greater,

1.5 = dynamic coefficient, and

$S$  = factor of safety. This shall be 4 for institutional fitness equipment and shall be 2.5 for consumer fitness equipment.

5.2.2 Extrinsic loads calculated in 5.2.1 are to be applied to all machine components receiving extrinsic loads from operation of the machine according to the manufacturer's operating instructions. Examples of areas to conduct this testing include seats and lifting arms.

5.3 *Handlebar Loading*—Handlebars that support fully the user's body weight, shall meet the loading parameters of 5.1 without breakage. In general, handlebars that do not support the user's body weight, shall endure a vertical static load of the greater of  $1.0 \times 135$  kg (300 lb) or the maximum user weight without breakage. Handlebars shall endure a load of  $0.5 \times 135$  kg (300 lb) in all other directions without breakage.

5.4 *Seats and Their Adjustment Systems*—Seats and their adjustment systems shall pass either the intrinsic and extrinsic load parameters of 5.1 and 5.2 without breakage or an endurance load of the maximum user weight or 135 kg (300 lb), whichever is greater, for the prescribed number of cycles set forth in 5.5. Upon completion of the endurance test the seat or its adjustment system shall be subjected to a static load test of 1.5 times the maximum user weight or 202.5 kg (450 lb), whichever is greater.

5.5 *Endurance Loading*—The components of fitness equipment that provide a resistance means and the components that transmit that load shall not fail when cycled as intended by the manufacturer at maximum user load for a minimum of 80 % of the range. The number of cycles shall be a minimum equivalent to 20 min of exercise, times three times per week, times 52 weeks, times a safety factor of two. For example, if the fitness equipment is used for 60 cycles during a normal 20 min exercise regime as specified by the manufacturer, the cycle test would require a minimum of 60 by 3 by 52 by 2 which equals 18 720 cycles. As a minimum, institutional fitness equipment shall withstand 250 000 cycles at the maximum specified load over a minimum of 80 % of the possible range of movement and consumer fitness equipment shall withstand 14 000 cycles at the maximum specified load over a minimum of 80 % of the possible range of movement.

5.5.1 *Multiple Exercise Stations*—When the equipment consists of two or more separate functional units or exercise stations, each station shall withstand the endurance load test. When more than one function is to be tested, any common components (ropes, belts, selector pins, pulleys, and so forth) may be replaced prior to commencing the next test.

5.5.2 *Exercise Stations with Common Frame*—Fitness equipment may have several exercise stations sharing a common frame. In this case, the frame shall withstand 500 000 cycles for institutional fitness equipment and 28 000 cycles for consumer fitness equipment. The frame may be replaced during the test period if the number of stations to be tested causes the frame to experience cycles in excess of the numbers stated above.

5.5.3 Tests for endurance shall apply loads to the machine in the same manner that the machine is loaded when it is operated in accordance to the manufacture's operation instructions.

5.5.4 After the test, the equipment shall be capable of functioning as specified by the manufacturer, without increasing the risk of injury to the user.

## 6. Documentation

6.1 If the fitness equipment requires assembly, instructions for multiple operations, or warnings for safe operation, an owners/users manual shall be provided. The first topic of the manual shall be a comprehensive listing of the warnings applicable to the product. It shall also include a review of the warnings placed on the fitness equipment and the placement locations.

6.2 *Assembly Instructions*—If the fitness equipment requires assembly, the owners/users manual or an assembly manual shall be supplied that gives clear detailed assembly instructions for the equipment.

6.2.1 Fitness equipment requiring assembly shall include a listing of the tools required for assembly even if the manufacturer supplies the tools.

6.3 *Equipment Parts List*—Equipment requiring assembly of multiple parts shall include an exploded view of the equipment and a parts list that provides part names, and part numbers or reference numbers.

6.4 *Operational Instructions*—If the fitness equipment has multiple intended uses or operations, each intended use of the machine shall be explained in the owners/users manual or the operating instructions.

6.5 *Maintenance Instructions*—If the fitness equipment requires an owners/users manual, care and necessary maintenance advice shall be provided.

NOTE 1—The safety and integrity designed into the machine can only be maintained when the equipment is regularly examined for damage and repaired. It is the sole responsibility of the user/owner or facility operator to ensure that regular maintenance is performed. Worn or damaged components shall be replaced immediately or the equipment removed from service until the repair is made. The maintenance instructions must call the reader's attention to this fact.

6.6 *Marking*—Fitness equipment shall have identification affixed to the product indicating the following:

6.6.1 The manufacturer's or distributor's, or both, name, address, and telephone number.

6.6.2 Serial and model numbers.

6.6.3 Date of manufacture or code number, which includes the date and manufacture.

6.6.4 If the equipment is intended for consumer (non-institutional) use then it shall be identified as "For Consumer Use Only".

6.6.5 *User Weight Restrictions*—User weight limits shall be provided in the manual for all fitness equipment. If the manufacturer does not provide a manual and does restrict the user's weight, then the maximum user's weight shall be provided on the fitness equipment in a prominent location easily seen by the user of the equipment.

6.6.6 *Institutional Fitness Equipment*—Fitness equipment that does not state in the manual or on the equipment that it is intended for home use only, shall have the user weight posted on the equipment in a prominent location easily seen by the user of the equipment if the user weight maximum is less than 136 kg (300 lb).

## 7. Warnings

7.1 *Warnings/Warning Labels*—Adequate warnings following the guidelines of Specification **F1749**.

## 8. Keywords

8.1 extrinsic loading; fitness equipment; range of movement; stationary training equipment

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