



Standard Test Methods for Evaluating Design and Performance Characteristics of Elliptical Trainers¹

This standard is issued under the fixed designation F2811; 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.

INTRODUCTION

The goal of these test methods is to provide reliable and repeatable methods for the evaluation of elliptical trainers. 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 or not properly maintained. In addition, users with physical limitations should seek medical advice or instruction from the fitness facility, or both, prior to using this equipment. Certain physical conditions or limitations may preclude some persons from using this equipment properly and without increasing the risk of serious injury.

1. Scope

1.1 These test methods specify procedures and equipment used for testing and evaluating elliptical trainers for compliance to Specification **F2810**. Both design and operational parameters will be evaluated. Where possible and applicable, accepted test methods from other recognized bodies will be used and referenced. In case of a conflict between this document and Specification **F2810**, Specification **F2810** takes precedence.

1.2 *Requirements*—An elliptical trainer is to be tested for all of the following parameters:

- 1.2.1 Endurance,
- 1.2.2 Static loading,
 - 1.2.2.1 Handlebars
 - 1.2.2.2 Foot supports
- 1.2.3 Adjustable guide systems,
- 1.2.4 Control panel,
- 1.2.5 Warnings, and
- 1.2.6 Documentation.

1.3 This test method² contains additional requirements to address the accessibility of the equipment for persons with disabilities.

1.4 The values stated in SI units are to be regarded as the standard. The values in parenthesis 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*:³

- F1749** Specification for Fitness Equipment and Fitness Facility Safety Signage and Labels
- F2276** Specification for Fitness Equipment
- F2571** Test Methods for Evaluating Design and Performance Characteristics of Fitness Equipment
- F2810** Specification for Elliptical Trainers
- F3021** Specification for Universal Design of Fitness Equipment for Inclusive Use by Persons with Functional Limitations and Impairments
- F3022** Test Method for Evaluating the Universal Design of Fitness Equipment for Inclusive Use by Persons with Functional Limitations and Impairments

3. Terminology

3.1 *Definitions*—For definitions applicable to this standard, see Specifications **F2810** and **F3021**.

³ 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.

¹ These test methods are 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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4. Significance and Use

4.1 The purpose of these test methods is to provide reliable and repeatable test methods for the evaluation of elliptical trainers assembled and maintained according to the manufacturer's specifications. Use of these test methods, in conjunction with Specification **F2810**, is intended to ensure appropriate performance and reliability of an elliptical trainer and reduce the risk of serious injury from design deficiencies.

5. Sample Preparations

5.1 Assemble and adjust the elliptical trainer on a horizontal surface according to the manufacturer's instructions. On trainers that are fully assembled, verify according to the manufacturer's instructions that all components are functioning and that they have been adjusted and aligned properly. Unless otherwise stated, the trainer must pass the following tests without adjustment from this initial condition. Apply power to, if required, or use the trainer and verify that the unit functions properly. If the unit is equipped with a guide system, operate it through its full range.

5.2 The individual test methods will describe any variations or modifications that are required to the test sample.

5.3 Upon completion of the tests the equipment shall function as intended by the manufacturer.

6. Test Methods and Procedures

6.1 In addition to the tests specified in Test Methods **F2571**, elliptical trainers shall be evaluated as follows:

6.2 Exterior Design:

6.2.1 *Foot Supports*—The purpose of this test is to evaluate the dimensions of the foot supports used on the sample.

6.2.1.1 *Apparatus and Set Up*—The sample shall be set up as described in **5.1**.

6.2.1.2 *Calibration*—Verify that the measurement device is properly calibrated and has a resolution of 1 mm (0.04 in.).

6.2.1.3 *Procedure*—Measure the dimensions of the slip resistant area of the pedal. Measure the guard heights of the pedal at the front and inside edges. Check for pinch or shear points along the outer edge of the footplate per Specification **F2276** and Test Methods **F2571**. If pinch or shear points exist, measure the guard height of the pedal at the outside edge.

6.2.1.4 *Pass/Fail Criteria*—The dimensions of the slip resistant surface of each pedal shall conform to dimensional requirements of subsection 5.1 of Specification **F2810**.

6.2.1.5 Precision and Bias:

(1) *Precision*—The precision of this test method has not been determined.

(2) *Bias*—The bias of this test method includes quantitative estimates of the uncertainties of the measuring devices, the calibrations of testing equipment and the skill of the operators. At this time, the statements on bias should be limited to documented performance of particular laboratories.

6.2.2 *Handlebars*—The purpose of this test is to verify the existence of the handlebar.

6.2.2.1 *Apparatus and Set Up*—The sample shall be set up as described in **5.1**.

6.2.2.2 *Calibration*—No calibration required.

6.2.2.3 *Procedure*—Visually verify the presence of a handlebar.

6.2.2.4 *Pass/Fail Criteria*—The handlebar must be present and conform to the requirements of subsection 5.2 of Specification **F2810**.

6.2.2.5 *Precision and Bias*—No information is presented about either the precision or bias of this test since the test result is non-quantitative.

6.2.3 *Movable Handlebar Design*—The purpose of this test is to evaluate the dimensions of the movable handlebars used on the sample.

6.2.3.1 *Apparatus and Set Up*—The sample shall be set up as described in **5.1**.

6.2.3.2 *Calibration*—Verify that the measurement device is properly calibrated and has a resolution of 1 mm (0.04 in.).

6.2.3.3 *Procedure*—Measure the dimensions of the end portion of the movable handlebar. The evaluator shall also use the elliptical trainer per the manufacturer's instructions and observe the orientation of the end portion of the movable handlebars with respect to the head of the evaluator throughout the range of travel of the movable handlebars.

6.2.3.4 *Pass/Fail Criteria*—The dimension of the end portion of the movable handlebar shall conform to dimensional requirements of subsection 5.2 of Specification **F2810**. Alternately, if the end portion of the movable handlebars is always angled away from the user during operation of the elliptical trainer then it shall be concluded that the movable handlebars meet the requirements of the specifications.

6.2.3.5 Precision and Bias:

(1) *Precision*—The precision of this test method has not been determined.

(2) *Bias*—The bias of this test method includes quantitative estimates of the uncertainties of the measuring devices, the calibrations of testing equipment and the skill of the operators. At this time, the statements on bias should be limited to documented performance of particular laboratories.

6.3 *Endurance*—The purpose of this test is to confirm the endurance of the main components of the elliptical trainer. Load input to the elliptical trainer can be accomplished by securing weight to the foot pedals and lifting the weight using pneumatic cylinders, or by pushing down with pneumatic cylinders (with or without weight). Regardless of how the load is input to the elliptical trainer under test, careful consideration shall be given by the testing facility as to how the test apparatus is constructed. The testing facility shall communicate with the manufacturer prior to commencing the test and verify that the apparatus functions and loads the elliptical trainer in a manner similar to how a user would actually use and interface with the elliptical trainer. **Figs. 1 and 2** illustrate pneumatic apparatuses that have been used successfully to conduct endurance testing. The elliptical trainer shown in **Fig. 2** is driven by the two pneumatic cylinders which are attached to the footplates of the device under test. The cylinders can be pivoted or mounted to linear bearings on the test apparatus frame so that the cylinders are able to follow the horizontal motions of the elliptical pedals. The timing of the cylinder actuations can be such that the pistons are pushing downward generally synchronous to the downward motion of the footplate as it follows the elliptical