



# Standard Test Methods for Evaluating Design and Performance Characteristics of Motorized Treadmills<sup>1</sup>

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## INTRODUCTION

The goal of these test methods is to provide reliable and repeatable methods for the evaluation of motorized treadmills. Users of the equipment must recognize that conformance to a standard will not necessarily prevent injuries. Like other physical activities, exercise involving a treadmill involves a risk of injury, particularly if the equipment is not maintained or used properly.

## 1. Scope

1.1 These test methods specify procedures and equipment used for testing and evaluating a motorized treadmill for compliance to Specification F2115. 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 F2115, Specification F2115 takes precedence.

1.2 This test method is to be used in conjunction with Specification F2276, Test Methods F2571, and Specification F2115.

1.3 This standard takes precedence over Specification F2276 and Test Methods F2571 in areas that are specific to motorized treadmills.

1.4 *Requirements*—A motorized treadmill is to be tested for all of the following parameters:

- 1.4.1 Stability,
- 1.4.2 Exterior design,
- 1.4.3 Endurance,
- 1.4.4 Static loading,
- 1.4.5 Overheating,
- 1.4.6 Adjustable incline system function,
- 1.4.7 User interface parameters,
- 1.4.8 Motorized drive system operation,
- 1.4.9 Warning label compliance, and
- 1.4.10 Documentation.

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

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## 2. Referenced Documents

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

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

F2115 Specification for Motorized Treadmills

F2276 Specification for Fitness Equipment

F2571 Test Methods for Evaluating Design and Performance Characteristics of Fitness Equipment

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

UL 1647 Motor Operated Massage and Exercise Machines

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

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

## 3. Terminology

3.1 *Definitions*—For definitions applicable to this standard see Specification F2115.

## 4. Significance and Use

4.1 The purpose of these test methods is to provide reliable and repeatable test methods for the evaluation of motorized treadmills assembled and maintained according to the manufacturer's specifications. Use of these test methods in conjunction with Specification F2115, Specification F2276, and Test Methods F2571 is intended to insure appropriate performance and reliability of a motorized treadmill and reduce the risk of serious injury from design deficiencies.

<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.

<sup>3</sup> Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

<sup>4</sup> Available from CEN Management Centre, 36 rue de Strasse, B-1050, Brussels, Belgium.

## 5. Certification

5.1 These test methods permit self-certification. It is recommended that each manufacturer employ an independent laboratory to evaluate and validate that their designs and test procedures conform and comply with these test methods and Specification F2115, Specification F2276, and Test Methods F2571.

## 6. Units of Measure

6.1 The values stated in SI units are to be regarded as the standard. The values in parenthesis are for information only.

## 7. Sample Preparation

7.1 Assemble and adjust the treadmill on a horizontal surface according to the manufacturer's instructions. On treadmills that are fully assembled, verify according to the manufacturer's instructions that the moving surface has been adjusted to the proper tension and alignment. Unless otherwise stated, the treadmill must pass the following tests without adjustment from this initial condition. Apply power to the treadmill and verify that the unit functions properly. If the unit is equipped with an adjustable incline system, operate it through its full range.

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

## 8. Report

8.1 *Record of Tests*—Maintain complete test records and test summary reports for all testing, whether performed by the manufacturer or an independent laboratory. The records can be stored on paper, electronically, or on photographs, or a combination thereof. A copy of the test summary must be kept by the laboratory that performed the test for a minimum of five years from the date of the test and by the manufacturer for a minimum of five years past the end of production of the model tested. The summary shall include the signature of the technician(s) performing the tests and a management representative of the laboratory performing the test. The test summary shall include the following information:

8.1.1 Manufacturer's name and location,

8.1.2 Information provided by the manufacturer to accurately identify the configuration of, and specific unit provided to, the testing agency,

8.1.3 Dates over which the tests were conducted, and

8.1.4 Name and location of the testing laboratory, if different from the manufacturer.

8.1.5 Summary and results of each test performed including method and apparatus used. This shall include what the desired requirement was and whether the test sample met that parameter or failed. If the test requires a specific number of cycles to be met, then the report must include the number of cycles actually conducted. If the treadmill fails to meet a parameter, then that failure must be noted in clear and accurate terms to enable a reader of the report to understand at a later date what transpired.

## 9. Test Methods and Procedures

9.1 *Stability*—The treadmill shall be tested by a series of load applications in the orientation that is most obviously unstable.

9.1.1 *Apparatus and Set Up*—Place treadmill on a nonskid 10° surface in the orientation that is least stable. A method of applying a steady state force equal to 1.0 × maximum user weight in the vertical direction must be provided. Possible methods of providing force include, but are not limited to, pneumatic cylinder(s) or dead weights.

9.1.2 *Calibration*—Using an angle measuring instrument accurate to within 0.1°, verify the nonskid surface is 10 ± 0.5°. Calibrate the load measurement apparatus to confirm accuracy to within ±20 N (4.5 lb) over entire user weight range.

9.1.3 *Procedure*—Test the treadmill as follows:

9.1.3.1 Using the aforementioned load apparatus, apply a vertical load equal to 1.0 × maximum specified user weight ± 5 % in a non-impact manner at the point on the foot rail which creates the most instability. Verify that the treadmill does not tip over.

9.1.3.2 Repeat 9.1.3.1 with the treadmill oriented in any other directions of potential instability.

9.1.3.3 For folding treadmills, the treadmill shall, after completing 9.1.3.1 and 9.1.3.2, be folded to its storage position per manufacturer's instructions and placed on the 10° inclined surface in all orientations that could cause instability. No additional load is to be applied.

9.1.4 *Pass/Fail Criteria*—In none of the above test conditions shall the treadmill tip over.

9.1.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.1 for measuring stability since the test result is non-quantitative.

9.2 *Exterior Design:*

9.2.1 *Rotating Parts in the Accessible Area and Rear Roller Area*—The purpose of this test is to evaluate the risk of injury due to a moving mechanical part. Methodology entails insertion of an articulate probe that simulates an accepted case finger into all questionable areas.

9.2.1.1 *Apparatus and Set Up*—This test requires a probe as specified in Fig. 2, "Test Finger," of EN 957-1. Verify that all guards are properly positioned and secured and the moving surface is centered per instructions in the owner's manual. Apply power to the treadmill so that its incline can be elevated and the moving surface can be run.

9.2.1.2 *Calibration*—Verify the probe conforms to the dimensions of Fig. 2, "Test Finger," of EN 957-1.

9.2.1.3 *Procedure*—With no power applied, insert probe at any pull-in nip points or areas accessible to any mechanical hazards on the treadmill. Points of insertion include, but shall not be limited to the rear roller guards, foot rail to moving surface interface, motor compartment/moving surface gap and any openings in the motor compartment or shroud. For all insertions, the probe is to be rotated and bent in all possible configurations and application force shall not exceed 4.4 N (1 lb). Elevate the treadmill to its maximum incline position. Under the assumption there shouldn't be any hazard, run the moving surface at minimum speed and verify the finger will

not get trapped anywhere. If any other incline positions reveal a potential pull-in or nip points, the test shall be repeated at that incline position.

9.2.1.4 *Pass/Fail Criteria*—The probe shall not become entrapped in any mechanical hazard. Entrapment is defined to have occurred if the force to pull out the probe is greater than 4.4 N (1 lb).

9.2.1.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.1 for evaluating hazards of rotating parts since the test result is non-quantitative.

9.2.2 *Guarding from Electrical Hazards*—The purpose of this test is to verify that all electrical elements are adequately guarded to prevent electric shock from un-insulated live parts and film-coated wire. Methodology entails insertion of an articulate probe that simulates a worst case finger into all questionable areas.

9.2.2.1 *Apparatus and Set Up*—This test requires an articulating probe as specified in UL 1647. Verify that all guards are properly positioned and secured and the moving surface is centered per instructions in the owner’s manual. Treadmill to be tested in all incline positions and all normal usage positions that may present a hazard.

9.2.2.2 *Calibration*—Verify articulate probes conform to the dimensions of UL 1647.

9.2.2.3 *Procedure*—With no power applied, insert probe at any points where contact with electrical elements is possible. Points of insertion include, but shall not be limited to, the motor compartment/moving surface gap and any openings in the motor compartment or shroud. For all insertions, the probe is to be rotated and bent in all possible configurations and application force shall not exceed 4.4 N (1 lb). Elevate the treadmill to all other incline positions that may present a hazard and repeat the insertion test. The components not involved in the insertion area may now be removed to clearly see whether the probe can contact any electrical hazard.

9.2.2.4 *Pass/Fail Criteria*—The probe shall not contact any electrical hazard.

9.2.2.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.2 for evaluating accessibility of electrical components since the test result is non-quantitative.

9.2.3 *Foot Rails*—The purpose of this test is to verify the dimensional compliance of the foot rails.

9.2.3.1 *Apparatus and Set Up*—No set up required, dimensional inspection only.

9.2.3.2 *Calibration*—Verify that the distance measuring equipment is calibrated and accurate to within  $\pm 1$  mm (0.040 in.).

9.2.3.3 *Procedure*—Measure the length of the foot rails. Measure the distance from the forward edge usable moving surface to the beginning of the foot rail. Locate the center of the usable moving surface. Measure the distance from this point to the end of the foot rail. Measure the width of the foot rail surface.

9.2.3.4 *Pass/Fail Criteria*—The dimensions of the foot rails shall conform to dimensional requirements of subsection 4.3.3 of Specification F2115.

9.2.3.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.3 for measuring foot rail dimensions since the test result is non-quantitative.

9.2.4 *Moving Surface*—The purpose of this test is to verify the dimensional and marking compliance of the moving surface.

9.2.4.1 *Apparatus and Set Up*—No set up required, dimensional inspection only.

9.2.4.2 *Calibration*—Verify that the distance measuring equipment is calibrated and accurate to within  $\pm 1$  mm (0.040 in.).

9.2.4.3 *Procedure*—Consult the moving surface table Specification F2115. Refer to Fig. 3 in Specification F2115 and measure the length and width of the moving surface. Verify the presence of movement indicators on the moving surface. Verify that they meet the minimum dimensions specified in Specification F2115. Operate the treadmill and verify that a portion of the movement indicator is visible at all times as the moving surface rotates.

9.2.4.4 *Pass/Fail Criteria*—The dimensions of the moving surface shall conform to dimensional requirements of subsection 4.3.4.3 of Specification F2115.

9.2.4.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.4 for measuring moving surface dimensions since the test result is non-quantitative.

9.2.5 *Moving Surface Slip Resistance*—The purpose of this test is to evaluate the slip resistance of the moving surface of the treadmill.

9.2.5.1 *Apparatus and Set Up*—The treadmill shall be set up in accordance with Test Methods F2571. The moving surface shall be restrained from moving.

9.2.5.2 *Calibration*—Per Test Methods F2571, no calibration is required.

9.2.5.3 *Procedure*—Secure the moving surface so that it cannot move. Conduct the test in accordance with Test Methods F2571.

9.2.5.4 *Pass/Fail Criteria*—Moving surfaces that do not resist foot slippage shall fail the test.

9.2.5.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.5 for evaluating moving surface slip resistance since the test result is nonquantitative.

9.2.6 *Handrails*—The purpose of this test is to verify the dimensional compliance of the handrails.

9.2.6.1 *Apparatus and Set Up*—No set up required, dimensional inspection only.

9.2.6.2 *Calibration*—Verify that the distance measuring equipment is calibrated and accurate to within  $\pm 1$  mm (0.040 in.).

9.2.6.3 *Procedure*—Measure the length of all segments of the handrail. Measure the distance from the moving surface to the top of the grip surface. If so equipped, measure the horizontal distance between the side handrails.

9.2.6.4 *Pass/Fail Criteria*—The dimensions of the handrails shall conform to dimensional requirements of subsection 4.3.5 of Specification F2115.