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An American National Standard

Standard Test Methods for Evaluating Design and Performance Characteristics of Motorized Treadmills[1]

This standard is issued under the fixed designation F2106; 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 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.

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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:

~~1.2.1Stability,~~
~~1.2.2Exterior design,~~
~~1.2.3Endurance,~~
~~1.2.4Static loading,~~
~~1.2.5Overheating,~~
~~1.2.6Adjustable incline system function,~~
~~1.2.7User interface parameters,~~
~~1.2.8Motorized drive system operation,~~
~~1.2.9Warning label compliance, and~~
~~1.2.10Documentation.~~

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[1] 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:*[2]

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

F2115 ~~Specification for Motorized Treadmills~~ 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:*[3] ~~*UL 1439Test for Sharpness of Edges on Equipment*~~

UL 1647 Motor Operated Massage and Exercise Machines

2.3 *European Standard:*[4]

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

~~2.4 *ISO Standards:*~~

~~ISO 4649Rubber—Determination of Abrasion Resistance Using a Rotating Cylindrical Drum Device~~

~~ISO 5904Gymnastic Equipment—Landing Mats and Surfaces for Floor Exercises—Determination of Resistance to Slipping~~

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.

5. Certification

5.1 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, ~~and/or~~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

[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 Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

[4] Available from CEN Management Centre, 36 rue de Strasse, B-1050, Brussels, Belgium.

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 ~~non-skid~~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°~~10 ± 0.5°. Calibrate the load measurement apparatus to confirm accuracy to within ±20 N (4.5 ~~lb.)~~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.

~~9.1.3.2Repeat~~

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 ~~*Sharp Edges*—The purpose of this test is to verify that there are no edges in the accessible area that would constitute a risk of injury. Where there is uncertainty, a sharp-edge tester as specified by UL 1439 is to be employed.~~ 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*~~—Elevate the treadmill incline to the least favorable position for applying a sharp-edge tester as specified in UL1439.~~ —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*~~—Calibrate sharp-edge tester per UL1439~~—Verify the probe conforms to the dimensions of Fig. 2, "Test Finger," of EN 957-1.

9.2.1.3 *Procedure*~~—Examine the accessible area by visual and tactile means to ensure all parts are burr-free, rounded, or otherwise insufficiently sharp to constitute a risk of injury. Wherever there may be uncertainty as to the sharpness of an edge, use the edge tester as follows. Cover the tester head with sensing tape as specified in UL1439. Application force should be 6.5 N (1.5 lb). Move the head along the test edge for a distance of 51 mm (2 in.) and back without tiffing the tester off the edge. If the available edge for testing is less than 51 mm (2 in.), repeat the stroke without lifting the tester. Total travel time should range from 2 to 5 s. Examine the tape upon completion of each edge analysis. If any of the sensing tapes break, record the violation and reapply the sensing tapes accordingly.~~ —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*~~—If both outer layer sensing tapes have been cut, the edge is unacceptable.~~ —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 sharp edges since the test result is non-quantitative.~~ for evaluating hazards of rotating parts since the test result is non-quantitative.

9.2.2 ~~*Corners*—This test is a visual inspection of the unit to insure that all corners in the accessible area are radiused or chamfered.~~ 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*~~—The test is to be conducted with the treadmill at all inclines and positions possible in normal use and storage.~~ —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*—No calibration required. Visual inspection only. —Verify articulate probes conform to the dimensions of UL 1647.

9.2.2.3 *Procedure*—Inspect all corners to verify that the corners have been radiused or chamfered. —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*—All corners in the accessible area shall be radiused or chamfered. —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 comers since the test result is non-quantitative. for evaluating accessibility of electrical components since the test result is non-quantitative.

9.2.3 *Tube Ends*—This test is a visual inspection of the unit to insure that all tube ends in the accessible area are closed off. 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*—Elevate the treadmill to the incline(s) that will expose all tube ends to the accessible area. —No set up required, dimensional inspection only.

9.2.3.2 *Calibration*—No calibration required. Visual inspection only. —Verify that the distance measuring equipment is calibrated and accurate to within ±1 mm (0.040 in.).

9.2.3.3 *Procedure*—Inspect all tube ends in the accessible area to verify that they are closed off by other components, caps, plugs, or covers. —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*—All tube ends in the accessible area shall be closed off.

9.2.3.5No information is presented about either the precision or bias of test —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 evaluating tube end closure since the test result is non-quantitative.

9.2.4Rotating 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. 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*—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. —No set up required, dimensional inspection only.

9.2.4.2 *Calibration*—Verify the articulate probe conforms to the dimensions of Fig. 2, "Test Finger," of EN 957–1. —Verify that the distance measuring equipment is calibrated and accurate to within ±1 mm (0.040 in.).

9.2.4.3 *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. —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 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). —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 evaluating hazards of rotating parts since the test result is non-quantitative. for measuring moving surface dimensions since the test result is non-quantitative.

9.2.5 *Guarding from Electrical Hazards*—The purpose of this test is to verify that all electrical elements are adequately guarded to prevent electric shock from uninsulated live parts and film-coated wire. Methodology entails insertion of an articulate probe that simulates a worst case finger into all questionable areas. 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*—This test requires an articulate 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. —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*—Verify articulate probes conform to the dimensions of UL 1647. —Per Test Methods F2571, no calibration is required.

9.2.5.3 *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. —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*—The probe shall not contact any electrical hazard. —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 accessibility of electrical components since the test result is nonquantitative. for evaluating moving surface slip resistance since the test result is nonquantitative.

9.2.6 *Foot Rails*—The purpose of this test is to evaluate the slip resistance of the foot rails of the treadmill and to verify that they meet specified dimensional requirements. Handrails—The purpose of this test is to verify the dimensional compliance of the handrails.

9.2.6.1 *Apparatus and Set Up*—The treadmill shall be placed adjacent to a test device consisting of a roughened (using 60 to 63 grain size abrasive paper) rubber surfaced block made with standard rubber as defined in clause B.2 of Annex B of ISO 4649, which will apply a vertical force of 30 N (6.6 lb), pulled by a rope affixed to a tensile testing apparatus (equivalent to test set up shown in ISO 5904) or other appropriate means. Temperature of the test apparatus and test specimen shall be 20° ± 3°C (68° ± 6°F). Provide a means of spraying a light mist of water onto the foot rails. —No set up required, dimensional inspection only.

9.2.6.2 *Calibration*—Verify that the test equipment is properly calibrated and accurate to within ±0.5 N (±0.1 lb.) and that the measuring equipment is calibrated and accurate to within ±1 mm (.040 in). —Verify that the distance measuring equipment is calibrated and accurate to within ±1 mm (0.040 in.).

9.2.6.3 *Procedure*—Place the friction block attached to the test apparatus on the foot rail. Slowly apply force to the friction block until it begins to move. Record maximum forced applied to the friction block. Repeat this procedure two (2) more times. Apply a light mist of water to the foot rail and repeat test. Measure the length, width and placement of the foot rails with respect to the moving surface and the distance between the foot rails. —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*—Divide the average maximum force applied to the friction block by the weight of the friction block for both the dry and wet conditions. This result is the static coefficient of friction. The coefficient of friction for the foot rails shall exceed 0.5 for both wet and dry conditions. The foot rail dimensions shall conform to dimensional requirements of Sections 4.3.7.2 and 4.3.7.3 of Specification F2115—The dimensions of the handrails shall conform to dimensional requirements of subsection 4.3.5 of Specification F2115.

9.2.6.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.2.6 for measuring static coefficient of friction and foot rail dimensions since the test result is non-quantitative.

9.2.7*Moving Surface*—The purpose of this test is to evaluate the slip resistance of the moving surface of the treadmill and to verify that the moving surface meets dimensional requirements. Note that the procedure for measurement is essentially the same as outlined in section 9.2.6.

9.2.7.1*Apparatus and Set Up*—The treadmill shall be placed adjacent to a test device consisting of a roughened (using 60 to 63 grain size abrasive paper) rubber surfaced block made with standard rubber as defined in clause B.2 of annex B of ISO 4649, which will apply a vertical force of 30 N (6.6 lb.), pulled by a rope affixed to a tensile testing apparatus (equivalent to test set up shown in ISO 5904) or other appropriate means. Temperature of the test apparatus and test specimen shall be 20° ± 3°C (68° ± 6°F). Provide a means of spraying a light mist of water onto the foot rails.

9.2.7.2*Calibration*—Verify that the test equipment is properly calibrated and accurate to within ±0.5 N (±0.1 lb). Verify that the distance measuring equipment is calibrated and accurate to within ±1 mm (.040 in.).

9.2.7.3*Procedure*—Secure the moving surface so that it cannot move. Place the friction block attached to the test apparatus on the moving surface. Slowly apply force to the friction block until it begins to move. Record maximum forced applied to the friction block. Repeat this procedure two (2) more times. Apply a light mist of water to the moving surface and repeat test. Measure the length and width of the usable moving surface.

9.2.7.4*Pass/Fail Criteria*—Divide the average maximum force applied to the friction block by the weight of the friction block for both the dry and wet conditions. This result is the static coefficient of friction. The coefficient of friction for the moving surface shall exceed 0.5 for both wet and dry conditions. The dimensions of an obstructed rectangle of the moving surface shall conform to dimensional requirements of Section 4.3.8.2 of Specification F2115.

9.2.7.5*Precision and Bias*—No information is presented about either the precision or bias of test 9.2.7 for measuring static coefficient of friction and moving surface dimensions since the test result is non-quantitative.

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

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

9.2.8.2*Calibration*—Verify that the distance measuring equipment is calibrated and accurate to within ±1 mm (.040 in).

9.2.8.3*Procedure*—Measure the length of all segments of the hand rail. 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.

9.2.8.4*Pass/Fail Criteria*—The dimensions of the handrails shall conform to dimensional requirements of Section 4.3.8 of Specification F2115.

9.2.8.5*Precision and Bias*—No information is presented about either the precision or bias of test 9.2.8 for measuring handrail dimensions since the test result is non-quantitative.

9.3 *Endurance*—These tests are intended to confirm the endurance of the main components of the treadmill.

9.3.1 *Mechanical Frame Endurance*—The stationary moving surface, frame, and structural components of the treadmill are subjected to a repeated load equal to 1.5 times the maximum user weight as specified by the manufacturer.

9.3.1.1 *Apparatus and Set Up*—A pneumatic cylinder or other appropriate load application device shall be fixtured to apply load to the moving surface at the centerline of the treadmill 33 % of the length of the usable moving surface rearward from the front of the usable moving surface. ~~A30 × A~~ A 30 by 30 cm (12 ~~in. ×~~by 12 in.) load application area shall be used for the test. Timing controls must be supplied to regulate the load application frequency. Provide appropriate instrumentation to assure that the load is consistent throughout the test duration.

9.3.1.2 *Calibration*—Verify that the load and frequency measuring equipment is properly calibrated and that the load accuracy is within ±5 % of the applied load and that the frequency measurement is accurate to within ±0.2 Hz.

9.3.1.3 *Procedure*—Elevate the treadmill to the incline that will provide the most stress to the frame and incline system components and position the treadmill under the load application device. No power shall be connected to the treadmill. Block the treadmill into position so that the vibrations created by the test do not cause it to move on the floor. Apply power to the load application system. Adjust the applied load to 1.5 times maximum user weight ±5 % at a frequency of 0.5 to 2 Hz. Assure that the moving surface rebounds completely prior to the next cycle. Verify that the counter is recording the number of cycles. Inspect the treadmill and test apparatus approximately every ~~250,000~~250 000 cycles or as needed to insure that the test is functioning properly. If the design of the treadmill is such that keeping the moving surface stationary for the duration of the test would abnormally stress the moving surface (~~i.e.~~that is, a treadmill that employs moving slats rather than a conventional belt and deck), the moving surface may be repositioned periodically during the test.

9.3.1.4 *Pass/Fail Criteria*—Upon completion of the test, remove the test unit from the fixture and confirm normal operation of all functions. The treadmill must meet life requirements per classification of use per ~~Section~~subsection 4.4 of Specification F2115. The unit must not show structural cracks or other indications of impending failure.

9.3.1.5 *Precision and Bias*—No information is presented about either the precision or bias of test 9.3.1 for evaluating frame endurance since the test result is non-quantitative.

9.3.2 *Treadmill Switch and Switch Actuation Mechanism Endurance*—Stop, Pause or End functions (see Note 1).

NOTE 1—If several means of stopping exist—for example, Stop switch and Pause switch—each means must be separately tested only if the actuator types are different.

9.3.2.1 *Apparatus and Set Up*—Provide a mechanism to repeatedly activate the switch of interest at a rate not to exceed 2 Hz. and to accumulate a count of actuations. Activation force for testing shall be 1.5 times ± 10 % the minimum actuating force for the particular switch. For push switches, the activating mechanism can be a simulated finger mounted to an appropriate pneumatic cylinder operating parallel to the line of action of the switch, a test system designed specifically for switch testing ~~(for example, Data Switch Corporation 2100 life tester, or equivalent, having~~ (having an air cylinder plunger with a rounded simulated finger 0.675 diameter, 45 durometer ~~rubber—SF-45 from Data Switch Corporation),~~ rubber, SF-45), or other appropriate actuating means. For non-returning switches, a mechanism must be provided to pull out the switch between actuations, with a force equal to 1.5 times ± 10 % the minimum activating force. For lanyard-type, pull-off mechanisms, the switch can be tested as outlined above without the lanyard attached. If this method is employed, a separate lanyard strength test must be conducted by applying a load equal to 5 times the maximum activation force of the switch on the lanyard. A means of automatically sensing activation (~~e.g.~~for example, sensing a "beep" from the control panel internal electronics) will allow monitoring each activation response.

9.3.2.2 *Calibration*—Verify that the load application system applies 1.5 times ± 10 % of the minimum activation force for the switch to be tested. Using appropriate instrumentation, set the timing of the activator to 0.1 to 0.2 s "on" time and the repeat rate as desired but not over 2 Hz. Verify activation counter operation for at least 100 cycles. If a lanyard pull is required, the pull force must guarantee activation.

9.3.2.3 *Procedure*—Actuate the switch being tested with the load application system and confirm that the force applied causes the switch to function. The function of the switch shall be confirmed on every actuation of the switch via a circuit that actuates a counter. A manual check must be made of switch function before and after the full test sequence, and during the automated sequence, some activation-confirming feedback must be observable for each activation. As an alternate to this procedure, if the switch is installed according to the switch manufacturer's recommendations, the switch manufacturer's testing may be used.