Designation: F2749 – 15

Standard Test Method for Determining the Effects of Creasing a Membrane Switch or Printed Electronic Device[1]

This standard is issued under the fixed designation F2749; 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 test method establishes a method for the creasing of any part of a membrane switch or printed electronic device with conductive circuits.

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

1.2 *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. Terminology

2.1 *Definitions:*

2.1.1 *crease*—a ridge or groove made by folding and pressing.

2.1.1.1 *Discussion*—The fold mark in the substrate will be caused by a roller rolled over a fold that will likely remain in the substrate after testing.

2.1.2 *crease cycle*—a 180 degree crease followed by a straightening of the crease (see Fig. 1).

2.1.3 *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

2.1.4 *membrane switch tail*—a flexible portion of a membrane switch used for input/output connection.

3. Significance and Use

3.1 Creasing of membrane switches, printed electronic device, or their components can affect their visual appearance, mechanical integrity or electrical functionality. This practice simulates conditions that may be seen during manufacture, installation or use.

3.2 Crease testing may be destructive, therefore any samples tested should be considered unfit for future use.

3.3 Specific areas of testing include, but are not limited to:

3.3.1 Membrane switch flex tails or printed electronic device, and

3.3.2 Any component of a membrane switch or printed electronic device that may be subjected to creasing.

4. Interferences

4.1 The following parameters may affect the results of this test:

4.1.1 temperature,

4.1.2 humidity, and

4.1.3 orientation of the conductor (either extension or compression) could have significant impact on the results.

4.1.4 Inelasticity and parallelism of roller and test bed will affect the displacement of the force across the sample. In other words, the roller and test bed must not be compressible or subject to warping or distortion during the test cycle. Furthermore, the roller must remain parallel to the test bed through the entire test cycle.

NOTE 1—Experience has shown that some conductors recover their conductive properties if allowed to stabilize after the dynamic portion of the test. Therefore, continuous monitoring is necessary.

5. Apparatus

5.1 *Roller,* allowed to rotate smoothly around its longitudinal axis, rigid, low friction smooth surface.

5.1.1 *Roller,* measuring 50.8 mm (2 in.) in diameter, tolerance ±5 %.

5.2 Fixture to hold test sample securely in place in a horizontal manner (refer to Fig. 1).

5.3 Mechanisms capable of providing a constant force and rate of travel to roller.

5.4 Equipment for the continuous monitoring and recording of resistance.

NOTE 2—Experience has shown that some conductors recover their conductive properties if allowed to stabilize after the dynamic portion of the test. Therefore, continuous monitoring is necessary.

[1] This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Printed Electronics.

Current edition approved June 1, 2015. Published July 2015. Originally approved in 2008. Last previous edition approved in 2009 as F 2749-09. DOI: 10.1520/F2749-15.

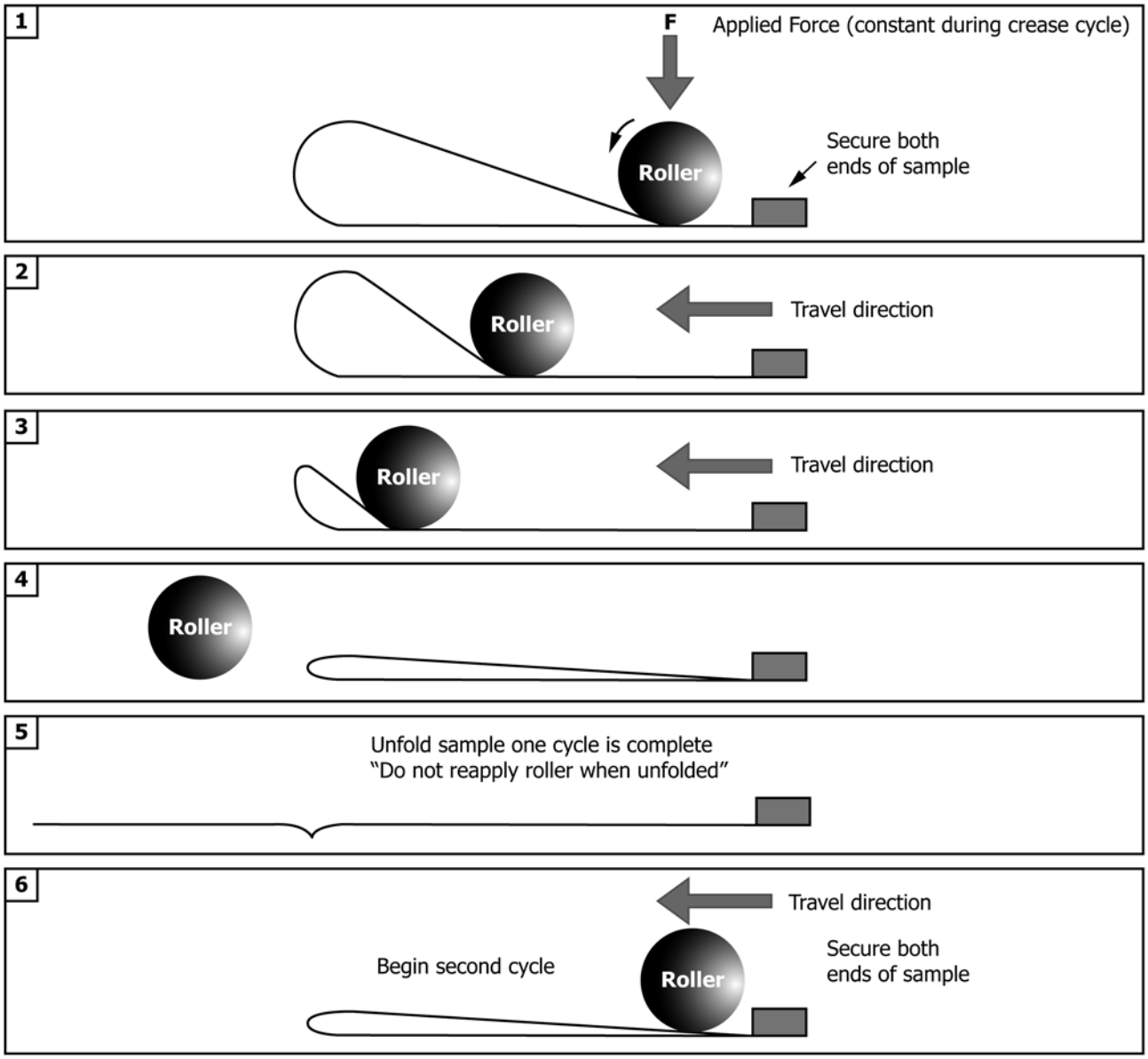

FIG. 1 Test Fixture Setup

6. Test Samples

6.1 The test samples may be components, tail assembles or finished switches. If the sample length is too short for the test fixture, a sample coupon of the same construction (layer to layer) must be provided (minimum; 250 mm length by 25 mm width).

6.2 The width of the test sample must not exceed the length of the roller.

7. Procedure

7.1 Refer to Fig. 1 – drawing of mechanical hook up.

7.1.1 Clamp one end of the test sample to the test fixture – this is the static end of the test sample.

7.1.1.1 *Compression Conductor Testing*—conductor side of the test sample faces away from the roller.

7.1.1.2 *Extension Conductor Testing*—conductor side of the test sample faces the roller.

NOTE 3—If direction not specified perform both compression and extension conductor testing.

7.1.2 Loop the unsecured end (dynamic end) of the test sample underneath the static portion.

7.1.3 Clamp the dynamic end of the test sample to the dynamic position of the test fixture.

7.1.3.1 Ensure that the both ends of the test sample remain aligned (one on top of another) during motion of test.

7.1.4 Connect to the test sample so that circuit resistance can be monitored continuously.

NOTE 4—Experience has shown that some conductors recover their conductive properties if allowed to stabilize after the dynamic portion of the test. Therefore, continuous monitoring is necessary.

7.1.4.1 Verify test sample is functional and being monitored.

7.1.4.2 Record the closed loop resistance (Ri) - measurement made before the first test cycle.

7.1.4.3 Apply constant force of predetermined value vertically to roller (see Fig. 1).

7.1.4.4 Start test.

7.1.5 Roll the roller from the clamped ends of the specimen toward the end of the loop (Fig. 1). Speed shall be approximately 25 mm/s. Roll the roller completely off of the loop creating a crease.

7.1.6 Immediately open the creased specimen such that the crease is now open.

7.1.7 Straighten the test sample. (DO NOT ROLL ROLLER OVER THE OPENED CREASE.)

7.1.7.1 A cycle is defined as; moving from a creased position to a straightened position and returning to a creased position.

7.1.8 Repeat for 500 cycles. Dwell time between cycles should be limited to the compression cycle time ±2 s. If an average (per cycle) increase in resistance (30 % or greater of Ri) is achieved in ten (10) consecutive cycles, before the 500 cycle limit, stop the test and record cycles.

7.1.9 Remove test sample from test fixture.

8. Report

8.1 *Report the following information:*

8.1.1 Temperature,

8.1.2 Humidity,

8.1.3 Number of cycles per test sample,

8.1.4 Resistance measurements, Ri, R maximum, R average,

8.1.5 Part number or description of test sample,

8.1.6 Date of test,

8.1.7 Orientation of test sample (compression, extension, or both),

8.1.8 Diameter of roller, and

8.1.9 Weight/Force of roller.

9. Precision and Bias

9.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method F 2749 for measuring crease because inter-laboratory studies have proven inconclusive due to insufficient participating laboratories with the appropriate equipment.

9.2 *Bias*—No information can be presented on the bias of the procedure in Test Method F 2749 for measuring crease because no standard sample is available for this industry.

10. Keywords

10.1 bend; crease; mandrel; membrane switch; printed electronic device; tail assembly