

Number 2.4.55	
Subject Abrasion Resistance of E-Textiles	
Date 02/2025	Revision
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Originating Task Group: D-74b E-Textiles Exposure and Durability Test Methods Task Group	

IPC-TM-650 TEST METHODS MANUAL

1 SCOPE

This test method is used for determining the change of one or more functionally relevant parameters in e-textiles as a result of exposure to cyclic abrasion.

1.1 Principles of Test E-textile specimens are exposed to cyclic abrasion using the Martindale method while observing a change of one or more relevant functional parameters at regular intervals. A specimen of defined size is cut from flat functional areas of the e-textile, while a non-functional textile part is used as rubbing cloth.

1.2 Terms and Definitions

1.2.1 Critical Area The areas of e-textiles that have a higher tendency of failure compared to other areas (e.g., joints, connection points, textile electrodes) or that if affected will negatively impact product functionality or the product capability to operate as intended.

1.2.2 Cycle One complete circular motion of the Martindale tester.

1.2.3 Flat Functional Area Areas of an e-textile containing electrical functionality with a topography of not more than 2 mm above the textile surface.

2 APPLICABLE DOCUMENTS

2.1 International Organization for Standardization (ISO)¹

ISO 139 Textiles — Standard atmospheres for conditioning and testing

ISO 12947-1 Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus

ISO 12947-3 Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 3: Determination of mass loss

3 TEST SPECIMENS

3.1 All test specimens **shall** be conditioned for ≥ 24 hours according to ISO 139. If other conditions are used, they **shall** be reported with the test results.

3.2 Specimens **shall** be cut from the e-textile according to the following specifications:

- For flat critical areas, circular specimens with a diameter of 140 mm **shall** be prepared.
- Specimens **shall** be cut from the e-textile in a way that the critical area(s) are located in the middle of the specimens.
- Critical areas narrower than 140 mm (i.e., ribbons with integrated conductors) **shall** be sewn to a nonfunctional textile part of the e-textile and then cut into 140 mm diameter specimens.
- As the rubbing cloth, circular pieces with a diameter of 38 mm of textile material without any electrical functionality **shall** be cut from the e-textile.

¹ www.iso.org

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3.3 The number of test specimens **shall** be defined to respect the statistical treatment (at least five per type of critical area). All test specimens **shall** be conditioned for ≥ 24 hours according to ISO 139.

4 APPARATUS

4.1 Martindale Tester defined by ISO 12947-1

5 PROCEDURE

5.1 Using the data recorder, measure the initial value of the relevant functional parameter(s). Conduct a visual inspection of the specimen prior to testing.

5.2 Place the specimen and the rubbing cloth in the respective holders of the Martindale equipment as described in ISO 12947-3.

5.3 Depending on the capacity of the testing equipment, multiple specimens **shall** be tested simultaneously.

5.4 Test up to the target cycle count or until specimen destruction.

5.5 Remove the specimen to conduct visual inspections and to measure the functional parameters.

5.6 The test may be stopped at regular intervals to conduct visual inspections and parameter measurements at intermediate testing points.

6 TEST REPORT

The report **shall** contain the following information:

- Date and time of test
- Testing location and name of tester
- Environmental test conditions (if differing from ISO 139)
- Number of test specimens
- Description of test specimens (size, cutting direction (warp/weft (wovens), course/wale (knits)), type of critical area, location of critical area within specimen, etc.) and rubbing cloths
- Description/Specifications of testing equipment
- Testing parameters/specifications (number of test cycles, other info)
- Cycle count for intermediate testing
- Test results (parameter values before, during (if applicable) and after testing); if applicable: plotting of parameter values over cycle count), other types of measurements
- Results of visual inspection before, during (if applicable) and after testing
- Any deviations from the presented methods
- Comments

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