

IPC-TM-650 TEST METHODS MANUAL

Number 2.3.43.1	
Subject Exposure to Sweat and Perspiration for E-Textiles	
Date 02/2025	Revision
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Originating Task Group: D-74b E-Textiles Exposure and Durability Test Methods Task Group	

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 sweat and perspiration.

1.1 Principles of Test The e-textile is exposed to alkaline or acidic sweat solutions for an extended amount of time while observing a change of one or more relevant functional parameters throughout testing or at regular intervals.

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 affect product functionality or the ability for the product to operate as intended.

1.2.2 Data Recorder A measuring device used to record electrical resistance or electrical continuity.

1.2.3 Liquor Ratio The ratio of the volume of liquid in L to the weight of a textile in kg.

2 APPLICABLE DOCUMENTS

2.1 International Organization for Standardization (ISO)¹

ISO 139 Textiles — Standard atmospheres for conditioning and testing

ISO 3696 Water for analytical laboratory use

3 SPECIMENS

3.1 Specimen Preconditioning

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

3.2 Specimen Description

If the testing equipment is large enough, the entire e-textile **shall** be tested. Otherwise, cut specimens containing at least one type of critical area from the e-textile to a size that fits the testing equipment.

If applicable, remove insulation from conductive structures for data recorder attachment.

3.3 Number of Specimens

The number of test specimens **shall** be defined to respect the statistical treatment (at least five / at least five per affected critical area).

¹ www.iso.org

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4 APPARATUS AND MATERIAL

4.1 Glass rod, with a rounded end

4.2 Protective equipment

4.3 Flat-bottom glass dish large enough to contain specimen

4.4 Grade 3 water

4.5 Alkaline and acid sweat solutions (see below)

4.5.1 Alkaline Solution

Freshly prepared, using grade 3 water complying with ISO 3696, containing, per liter:

- 0.5 g of l-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$)
- 5 g of sodium chloride (NaCl)

and either

- 5 g of disodium hydrogen orthophosphate dodecahydrate ($Na_2HPO_4 \cdot 12H_2O$)

or

- 2.5 g of disodium hydrogen orthophosphate dihydrate ($Na_2HPO_4 \cdot 2H_2O$).

The solution is brought to pH 8 (± 0.2) with 0.1 mol/L sodium hydroxide solution.

4.5.2 Acid Solution

Freshly prepared, using grade 3 water complying with ISO 3696, containing, per liter:

- 0.5 g of l-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$)
- 5 g of sodium chloride (NaCl)
- 2.2 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4 \cdot 2H_2O$).

The solution is brought to pH 5.5 (± 0.2) with 0.1 mol/L sodium hydroxide solution.

4.6 Data recorder for functionality testing

5 PROCEDURES

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 Alkaline Sweat Exposure

5.2.1 Lay out the fresh and dry specimen smoothly in a flat-bottomed dish and cover it with an alkaline sweat solution.

5.2.2 Thoroughly wet the specimen in this solution at an approximate liquor ratio of 50:1 (liquor:specimen) and allow it to remain in the solution at room temperature for the target exposure time. Using the glass rod, press and move it from time to time to ensure good and uniform penetration of the liquor into the critical area.

5.2.3 Pour off the solution and wipe the excess liquor off the specimen.

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5.2.4 If possible, use the data recorder to take the measurements during the exposure. Otherwise, take the specimen out during the test at specific intervals and take measurements while still wet.

5.3 Acid Sweat Exposure

5.3.1 Lay out the fresh and dry specimen smoothly in a flat-bottom dish and cover it with an acid sweat solution.

5.3.2 Thoroughly wet the specimen in this solution at an approximate liquor ratio of 50:1 and allow it to remain in the solution at room temperature for the target exposure time. Using the glass rod, press and move it from time to time to ensure good and uniform penetration of the liquor into the critical area.

5.3.3 Pour off the solution and wipe the excess liquor off the specimen.

5.3.4 If possible, use the data recorder to take the measurements during the exposure. Otherwise take the specimen out during the test at specific intervals and take measurements while still wet.

6 TEST REPORT

The test report **shall** include the following:

- 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 (if smaller specimen are cut from the e-textile, include size, cutting direction (warp/weft (wovens), course/wale (knits)), type of critical area, location of critical area within specimen, etc.)
- Description/Specifications of testing equipment
- Testing parameters/specifications (type of solution used, duration of testing, other relevant info)
- Time intervals for intermediate testing
- Test results (parameter values before, during (if applicable) and after testing), if applicable: plotting of parameter values over time), 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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