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Test Method for Electrical Resistance Before and After Various Exposure Conditions

Foreword

This test method provides guidance for testing durability of e-textile resistance. The method includes a procedure for testing electrical resistance as well as modifications of established industry methods for laundering, drycleaning, water, perspiration, acids and alkalis, ultraviolet (UV) radiation, and microbe exposure. Test exposures relevant to the expected end use of sample. Similar modifications to other established methods may also be possible. Additional modifications may be required to accommodate large or unusually-shaped samples that cannot be cut into standard swatches. If the referenced industry methods are also used for their original purpose (e.g., colorfastness), use a separate set of specimens.

1. Purpose and Scope

1.1 This test method is used to determine the electrical resistance of e-textiles before and after exposure to laundering, drycleaning, water, perspiration, acids and alkalis, ultraviolet (UV) radiation, and/or microbes.

1.2 this test method is applicable to e-textile fabrics or end products with incorporated (woven, knitted, printed, embroidered, etc.) conductive paths/traces. It is not for evaluation of yarns or fibers.

2. Principle

2.1 Electrical resistance is measured along a conductive path or segment of a conductive path before and after various exposure conditions. Any or all of the provided exposure methods may be used: laundering, drycleaning, water, perspiration, acids and alkalis, ultraviolet (UV) radiation, and microbes. Resistance is reported in ohms (Ω), where a higher value indicates more resistance (less conductance). Change in resistance after exposure is also calculated and reported as percent change, where a higher value indicates more change (typically a greater increase in resistance).

3. Referenced Documents

NOTE: Use current versions of all publications unless otherwise specified.

3.1 AATCC EP13, Evaluation Procedure for Electrical Resistance of Electronically-Integrated Textiles (see 16.1).

3.2 AATCC LP1, Laboratory Procedure

for Home Laundering: Machine Washing (see 16.1).

3.3 AATCC LP2, Laboratory Procedure for Home Laundering: Hand Washing (see 16.1).

3.4 AATCC TM6, Test Method for Colorfastness to Acids and Alkalis (see 16.1).

3.5 AATCC TM15, Test Method for Colorfastness to Perspiration (see 16.1).

3.6 AATCC TM22, Test Method for Water Repellency-Spray Test (see 16.1).

3.7 AATCC TM100, Test Method for Antibacterial Finishes on Textile Materials: Assessment of (see 16.1).

3.8 AATCC TM106, Test Method for Colorfastness to Water: Sea (see 16.1).

3.9 AATCC TM127, Test Method for Water Resistance: Hydrostatic Pressure Test (see 16.1).

3.10 AATCC TM158, Test Method for Dimensional Changes on Drycleaning in Perchloroethylene: Machine Method (see 16.1).

3.11 AATCC TM186, Test Method for Weather Resistance: UV Light and Moisture Exposure (see 16.1).

3.12 ASTM D1776, Standard Practice for Conditioning and Testing Textiles.

4. Terminology

4.1 **electronically-integrated textile (e-textile)**, n. —a fabric or textile product with permanently-integrated electrical circuits or parts of electrical circuits.

4.2 **electrical resistance**, n. — A specific textile's ability to reduce electric current flowing through it at a given voltage. Resistance, R, is expressed in units of ohms (Ω).

5. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Users MUST consult manufacturers for specific details such as safety data sheets and other manufacturer's recommendations. Consult and follow all applicable OSHA standards and rules.

5.1 Follow good laboratory practices. Wear safety glasses in all laboratory areas.

5.2 Follow manufacturer's safety recommendations when operating laboratory testing equipment.

6. Uses and Limitations

6.1 Each conductive path to be measured must be accessible, at least at the two measurement points. Connectors may be used to provide accessibility. The measured specimen should mimic the intended design of the end product, if known.

6.2 The exposure procedures referenced in this document were not developed to measure changes in electrical resistance. Electrical resistance changes after various exposure conditions may not accurately reflect end use results but provide a relative measure of electrical resistance durability.

7. Apparatus and Materials (see 16.2)

7.1 Electrical Resistance Measurement

7.1.1 Conditioning facilities and racks with pull-out, perforated shelves for laying specimens flat (see 16.1).

7.1.2 Flat workbench with grounded electronic static dissipation (ESD) mat. The surface should be at least as large as the specimen.

7.1.3 Indelible ink marking pen (see 16.1) or needle and sewing thread, for making benchmarks.

7.1.4 Digital multimeter or ohmmeter, resolution to at least 0.1 Ω and 0.9% accuracy. For samples with resistance less than 1 Ω , use a four-wire (four-point) system with resolution to at least 0.01 Ω . Select probes appropriate to the test material. Weighted probes of an appropriate size may improve repeatability.

7.1.5 Tape or rule marked in millimeters.

7.2 Exposure 1: Home Laundering

7.2.1 For home laundering using a washing machine, refer to AATCC LP1 for apparatus and materials.

7.2.2 For home laundering by hand washing, refer to AATCC LP2 for apparatus and materials.

7.3 Exposure 2: Drycleaning

7.3.1 Refer to AATCC TM158 for apparatus and materials related to drycleaning exposure.

7.3.2 The measuring scale referenced in AATCC TM158 is NOT necessary for evaluation of electrical resistance.

7.4 Exposure 3: Water: Spray

7.4.1 Refer to AATCC TM22 for apparatus and materials related to water spray exposure.

7.5 **Exposure 4: Water: Hydrostatic Pressure**