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Electrostatic Clinging of Fabrics: Fabric-to-Metal Test

Developed in 1965 by AATCC Committee RA32; revised 1969, 1973, 2000; editorially revised 1974, 1976, 1977, 1978, 1991, 1999, 2008; reaffirmed 1977, 1980, 1989, 2005, 2011; editorially revised and reaffirmed 1986, 1995.

1. Purpose and Scope

1.1 This test method evaluates the relative clinging tendency of certain fabrics due to electrostatic charge generation. The test integrates the effect of fabric weight, stiffness, construction, surface character, finish application and other fabric parameters which affect the tendency of fabrics to cling.

2. Principle

2.1 Clinging of positively or negatively charged fabrics to the human body occurs due to instantaneous induction of an equal and opposite charge on the surface of the body when the charged fabric is brought close to it. A basic law of physics states that oppositely charged materials attract each other. A metal plate exhibits a similar phenomenon of instantaneous charge induction as would the human body when placed in the field of a charged material. Therefore, a metal plate can be used to simulate the problems of clinging observed between charged garments and the human body. Some individuals are more prone to electrostatic clinging than others, and a given individual may be more prone at one time than at another time. Therefore, fabric-to-metal cling times cannot be related directly to fabric-to-body clinging for different individuals.

2.2 In this test method, the time (t_d) is measured for the charge on a fabric specimen to decay to a level where the electrical attractive forces between the specimen and the metal plate are overbalanced by the gravitational forces of the specimen acting to pull the specimen away from the plate (see 12.1).

3. Terminology

3.1 **electrostatic clinging**, n.—adherence of one substance to another caused by an electrical charge on one or both surfaces.

4. 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. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 The radioactive bar emits alpha radiation which is externally harmless to the human body. The radioactive isotope polonium 210 is toxic and precaution should be exercised to prevent ingestion or inhalation of the solid material. Do not take the radioactive bar apart or touch the radioactive strip under the grid. If the strip is touched or handled, wash hands thoroughly at once. Return the device to the manufacturer when it loses its effectiveness as a static eliminator for reactivation when tested in accordance with 12.3.1 or for disposal if use is to be discontinued. **Do not discard as scrap.**

5. Uses and Limitations

5.1 This test method is not intended for use in determining the suitability of fabric for use in hazardous areas where the electrostatic generation of sparks might result in fires or explosions.

5.1.1 Certain fabrics, particularly those of heavy construction, which do not exhibit a clinging propensity by this method might cling under some conditions of use.

5.1.2 This test method is primarily useful for determining clinging properties of lightweight apparel fabrics, such as those intended for use in lingerie.

6. Apparatus and Materials (see 12.2)

6.1 Test plates.

6.1.1 Standard Test Plate—A test plate (see 12.3) is made by bending 100 × 450 mm strips of 18 gauge Type 304 stainless steel across the width 150 mm from one end so that an included angle of 1.22 ± 0.04 RAD is formed between the 100 × 150 mm base and the 100 × 300 upright plate. The grain of the finish should be such that the 450 direction of the test plate corresponds to the length or grain direction of the stainless steel sheets from which they are made. The face of the 100

× 300 plate must have a No. 4 finish (see 12.3.1) on the included angle side, and should be kept clean and smooth at all times. A fine line is indented across the test plate surface 230 mm from the top of the plate and this is used to position the lower edge of the specimen (see 12.3).

6.1.2 Variable Angle Experimental Test Plate—The sensitivity of this test depends on the included angle of the metal plate and can be diminished by decreasing the included angle or vice versa. A more versatile version of the test plate, suitable for research work, which allows facile change of the sensitivity, uses a 25 × 100 × 100 mm aluminum base with several slots machined into the base at different angles (e.g., 0.017, 0.087, 0.175, 0.35, 0.52, 0.70, 0.87, 1.05 RAD) from the vertical axis into which a 100 × 360 mm stainless steel plate fits.

6.2 Grounding Plate—This is a 200 × 360 mm, flat, 18 gauge Type 304 stainless steel plate, attached to a ground, such as a water pipe, with wire (e.g., No. 18 stranded, plastic-covered electronic wire). One such grounding plate is required for each test plate.

6.3 Radioactive bar (see 12.4).

6.4 Rubbing blocks, white pine, approx. 20 × 50 × 150 mm adjusted to weigh 65 g and with strips of 20 mm wide, double-faced tape on the ends of each block to attach ends of the rubbing fabric.

6.5 Polyurethane foam, 25 × 100 × 300 mm non-rigid, having a density of 21 kg/m³ and an ILD (Identification Load Deflection) firmness of 6.8 kg when tested (see 12.3) as directed in ASTM D3574.

6.6 Clamps, metal (e.g., No. 3 Bulldog Clamp or Di-acro Toggle Clamp, see 12.4), with 70 mm edges covered with 20 mm electrical tape to prevent scratching of the surface of the test plates.

6.7 Stopwatch, with 0.01 min or one of equivalent precision marked in other units.

6.8 Forceps or tweezers, non-conducting, ivory-tipped, forceps used with analytical balances.

6.9 Oven, forced-draft type, capable of maintaining a temperature of $105 \pm 2^\circ\text{C}$ ($221 \pm 5^\circ\text{F}$).

6.10 Conditioning chamber, capable of providing relative humidity control of $40 \pm 2\%$ and temperature at $24 \pm 1^\circ\text{C}$ ($75 \pm 2^\circ\text{F}$) with circulating air.

6.10.1 If tests are to be conducted at relative humidities or temperatures other than $40 \pm 2\%$ RH and $24 \pm 1^\circ\text{C}$ ($75 \pm 2^\circ\text{F}$), the conditioning test chamber should