Test Method for Electrostatic Propensity of Carpets

Developed in 1969 by AATCC Committee RR32; jurisdiction transferred in 2007 to AATCC Committee RA57; revised 1975, 1979, 1991, 2001, 2011, 2016, 2019; reaffirmed 1986, 1996, reaffirmed and editorially revised 2006; editorially revised 2007, 2008, 2013. Related to ISO 6356.

1. Purpose and Scope

1.1 This test method assesses the propensity of carpets to generate static when a person walks across them. This method uses controlled laboratory simulation of the conditions, that may be encountered in use. The conditions used in this test include those known from experience to be contributors to excessive accumulation of static charges.

1.2 This test method does not include standards of performance. The specification requirements pertinent to any given application can vary considerably, depending on the specific demands of the application. It is recommended that specifiers evaluate results with caution as large variations were noted during inter- and intralab testing using this test method.

2. Principle

2.1 A carpet brought to moisture equilibrium at controlled atmospheric conditions is walked on by a test operator in a specified manner with specified shoe soles and heels. The static charge, which builds up on the operator, is monitored continuously by a voltage indicator with a recorder.

2.2 The maximum voltage, generated on the person by the charge accumulated, and measured during the test period is considered to be the static-generating propensity of the carpet under the conditions of this test.

3. Terminology

3.1 **electrostatic propensity,** n.—*of carpets*, the ability to produce and accumulate an electrostatic charge.

NOTE: For the purposes of this test, it is the *resultant voltage* on a person walking across the surface of a textile floor covering under specified conditions, which has been caused by the accumulation of an electrostatic charge on the body.

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 All chemicals should be handled with care.

4.3 Isopropyl alcohol is a flammable liquid and should be stored in the laboratory only in small containers away from heat, open flames and sparks.

4.4 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

4.5 Ground all electrical equipment.

4.6 High-voltage sources should have an internal impedance of not less than 1×10^8 ohm (or the maximum output current limited to 1 milliampere) to avoid shock hazard in calibration of the detection system.

5. Uses and Limitations

5.1 Build-up of a static charge on a person walking across a carpet under conditions of low atmospheric humidity has been recognized as a classic example of the triboelectric effect, whereby a separation of electrical charges is produced when two dissimilar surfaces in contact are separated. The magnitude of the charge separation and the resultant voltage on the person vary under the influence of many factors. The most important factors for the purpose of this test are:

(a) the chemical and physical characteristics of the two materials brought into contact, rubbed and separated; i.e., the shoe soles and carpet;

(b) the surface contamination on one or both;

(c) the nature of the rubbing and/or separation, i.e., the method of walk, including the height of the shoe above the carpet; and

(d) the ambient conditions (especially the relative humidity).

6. Apparatus and Materials

6.1 A room that can be maintained at a temperature of 21 ± 2°C (70 ± 4°F) and at 20 ± 5% RH, and suitable means for monitoring these conditions. Special requirements of end-use may dictate the use of other testing conditions (e.g., for aircraft or for controlled-humidity environments) and the test facility should be capable of achieving and maintaining those conditions.

6.1.1 The room should be of such dimensions and so arranged that the test operator comes no closer than approximately 600 mm to extraneous grounded or charged surfaces (such as walls or workbenches) during testing and should be equipped with open-wire shelves, racks or horizontal rods suitable for hanging carpet samples for conditioning. Air must pass freely around all surfaces of the samples to facilitate moisture equilibration.

6.2 Test sandals should be used only for testing carpet. New test sandals should be cleaned before use as prescribed in 9.7.1. Soles must be attached to the sandals by gluing and/or stitching. Tacks or rivets must not be used.

6.2.1 One pair of AATCC TM134 sandals (see 13.1) manufactured with XS 664 P-HK Neolite soles. A second pair of Neolite test shoes or sandals with optional self-adhesive (i.e., replaceable) suede leather attached to the shoe sole. The second pair of Neolite shoes or sandals must be dedicated to this use only.

6.2.2 Reagent grade isopropyl alcohol and cheesecloth.

6.3 Electrostatic detection and recording means for voltages up to at least 20 kV (see 13.2 and 13.3).

6.3.1 The system should have a high input impedance and be suitably damped such that a steady recorder or meter indication of 3000 V will, when the input is grounded, decay to 1500 V in not less than 1 s or more than 3 s (this corresponds to a time constant of 1.4-4.3 s). To achieve reasonable accuracy in use, the input capacitance, including lead-in wire, should not exceed 30 pF. (See Appendix A for additional information on measurement of damping and Appendix B for information on damping techniques.)

6.4 A grounded metal plate approximately 1200 × 1200 mm.

6.5 A standard 1350 g/m^2 rubberized jute/hair cushion underlay (see 13.1) at least 1200 × 1200 mm. The vertical resistance through the cushion shall not be less than 10^{12} ohms (see 13.6).

6.6 A set of AATCC TM134 Static Control Carpets (see 13.1) consisting of static unprotected and static protected versions.

6.7 An optional metronome.

6.8 An optional handheld blowing-fan balanced ionizer (see 13.4).

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7. Specimens

7.1 Cut each carpet test specimen to a size of approximately 900 × 900 mm or 1000 × 1000 mm. If test specimens are less than this size, multiple specimens may be pieced together to reach the required test size.

8. Conditioning

8.1 Condition specimens under the required test conditions, 21 ± 2°C (70 ± 4°F) and 20 ± 5% RH, for a minimum of 48 h prior to testing. This will equilibrate the moisture content of the specimens to the test conditions. The temperature and relative humidity should be automatically recorded during the conditioning period with a chart recorder or other electronic recording device.

8.1.1 Hang or lay specimens in such manner that free circulation of air over both surfaces is possible.

9. Procedure

9.1 Test AATCC TM134 Static Unprotected Control Carpet *without* an underlay (to avoid charging the underlay) and the Static Protected Control Carpet *with* an underlay at the beginning of each testing session. If the results are outside of the test laboratory's Control Chart Control Limits, then seek the cause of the deviation and correct the problem. Check relative humidity and temperature (current values and recorded values during the specimen conditioning period) (see 6.1). Test backup Control Carpets if available (see 6.6), reclean soles (see 9.7) and check instrument calibration. Use a blowing-fan, handheld, balanced high-voltage ionizer to neutralize any charge on the underlay pad between tests and prior to testing any specimen, moving it slowly over the entire surface at a height of about 100-200 mm above it for at least 1 min.

9.2 Test the specimen once a day until two reproducible voltages are obtained. Voltages are considered reproducible when consecutive tests agree within 10% or 0.5 kV, whichever is greater. Leaving the specimen in the test chamber overnight should allow any static charges to be dissipated. This process may be accelerated by using a blowing-fan, balanced high-voltage ionizer to neutralize any charges. If an ionizer is used to thoroughly neutralize the specimen (held about 100-200 mm above the specimen and moved slowly over its entire surface, requiring approximately 1-2 min), the same specimen may be retested the same day.

9.3 Test the specimen over the standard underlay (see 6.5), which is placed on the grounded metal plate.

9.3.1 Residual static charges on the specimen and underlay have been found to be a major source of error. Residual charges should decay naturally over a period of several hours. Specimens should be hung undisturbed for a minimum of 4 h, or thoroughly neutralized with a blowing-fan, balanced high-voltage ionizer, prior to each testing, as above.

9.3.2 Lay the underlay on the grounded metal plate, rubberized side up. Avoid dragging the underlay across the surface or rubbing different parts of it together.

9.3.3 If a blowing-fan, balanced high-voltage ionizer is available, thoroughly and slowly cover the entire surface of the underlay with the ionizer output, holding the ionizer about 100-200 mm above the underlay. This will neutralize any residual charges from handling.

9.3.4 Lay the specimen on the underlay carefully to avoid excessive friction against the mat or rubbing different parts of it together.

9.3.5 If a blowing-fan, balanced high-voltage ionizer is available, thoroughly and slowly cover the entire surface of the sample with the ionizer output, holding the ionizer about 100-200 mm above the sample. This will neutralize any residual charges from handling.

9.3.6 Zero the test apparatus. Place clean test sandals (see 9.7) on the specimen, grasp the test probe and ground the test operator while standing off the specimen in stocking feet. Ensure that the recorder reads "0." Step into the clean test sandals specified for the test while standing on the specimen and holding the test probe, being careful not to move the sandals around on the specimen.

9.4 After following the procedure in 9.3, there should be very little voltage indication. Presence of significant voltage (more than 200 V) indicates excessive initial charge somewhere in the system and the procedures in 9.2 and 9.3 must be repeated to avoid possible significant errors. Since the location of the spurious charge is important in affecting the final test results, it is not sufficient to simply reground the test subject, although this will obviously create a new zero value.

9.5 If the carpet is not intended for installation over an underlay, then the specimen shall be tested without an underlay. In such cases, test the specimen on the grounded metal plate and record the fact that the test was performed on the specimen mounted directly on a grounded surface. Otherwise, follow the procedure outlined in 9.3.

9.6 Proceed with the tests described below in 9.6.1 with the neolite soles, and if required, the suede leather soles. NOTE: Be sure to keep SEPARATE shoes or sandals for the Neolite and suede leather tests; do not remove the leather and test with the underlying Neolite, since it will be contaminated by the adhesive. Note that the samples and underlay must be discharged between repeat tests or between types of tests or between tests with different soles, in order to avoid errors. Discharge may be achieved by allowing natural discharge over 4 h or overnight, or neutralization with a blowing-fan, handheld balanced high-voltage ionizer, as above.

9.6.1 Tests.

Test I—Step Test/Neolite Soles

Test II—Scuff Test/Neolite Soles (Optional)

Test III—Step Test/Self-adhesive suede leather soles (Optional)

Test IV—Scuff Test/Self-adhesive suede leather soles (Optional)

9.6.2 **Step Test Procedure.** While holding the hand probe, walk on the specimen using a simple box step, lifting the sandals as close as possible to 80 mm above the specimen at the rate of 120 ± 10 steps per min (a metronome can be used). Always keep the plane of the sandal soles parallel to the plane of the specimen. Do not scuff or rub the sandals over the specimen. Cover the entire surface of the specimen during stepping, for a total test time of 1 min or until a consistent peak voltage is observed for each step. Touch the ground with the hand probe to bring the body voltage to "0." Neutralize the carpet and underlay prior to any further testing.

9.6.3 **Scuff Test Procedure.** While holding the probe, scuff (or wipe) as though wiping chewing gum from the bottom of both sandals. The wiping action is always in a backward motion. As above, the bottom of the sandal should reach a height of as close as possible to 80 mm above the specimen, parallel to the sample. Repeat scuffing at a rate of 60 ± 5 steps per min and continue the motion for about 1 min while covering the entire specimen. Touch the ground with the hand probe to bring the body voltage to "0." Neutralize the carpet and underlay prior to any further testing.

9.7 Remove and clean the sandal. Hang or lay the specimen on the conditioning rack. The procedures in 9.7.1 and 9.7.2 will usually suffice to clean the sandals. Sandals must be cleaned with extreme care after testing specimens, which have had surface-type (spray-on, topical) antistatic treatments (see 13.7). Failure to do so may transfer material from one specimen to another.

9.7.1 Clean Neolite sandal soles by swabbing with cheesecloth or paper towel moistened with isopropyl alcohol, using a fresh cheesecloth or paper towel. In case of extensive contamination, repeat this procedure, sand the sole with fine sandpaper to expose fresh material and clean again.

9.7.2 The suede leather soles are difficult to clean, once contaminated. Sanding

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