Designation: F150 – 06 (Reapproved 2013)

Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring[1]

This standard is issued under the fixed designation F150; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of electrical conductance or resistance of resilient flooring either in tile or sheet form, for applications such as hospitals, computer rooms, clean rooms, access flooring, munition plants, or any other environment concerning personnel-generated static electricity.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2240 Test Method for Rubber Property—Durometer Hardness

3. Terminology

3.1 *Definitions:*

3.1.1 *conductive flooring*—a floor material that has a resistance to between 2.5×10^4 and 1.0×10^6 Ω.

3.1.2 *dissipative floor material*—floor material that has a resistance between 1.0×10^6 to 1.0×10^9 Ω.

4. Significance and Use

4.1 Conductive and static dissipative floors (static control flooring) serve as a convenient means of electrically connecting persons and objects together to prevent the accumulation of electrostatic charges. A static control floor is specified on the basis of controlled resistance values. The surface of the floor provides a path of moderate electrical conductivity between all persons and equipment making contact with the floor to prevent the accumulation of dangerous electrostatic charges. Static control footwear will need to be used in conjunction with the floor for the floor to perform effectively with personnel.

4.2 The resistance of some flooring materials change with age. Floors of such materials should have an initial resistance low enough or high enough to permit increase or decrease in resistance with age without exceeding the limits prescribed in the product specifications.

5. Apparatus

5.1 *Self-Contained Resistance Meter* (such as a megohm meter) or power supplies and current meters in the appropriate configuration for resistance measurement with ±10 % accuracy. For safety, all power supplies used herein should be current limited, usually below 5.0 mA. This apparatus shall be capable of open circuit voltages of 100 VDC ± 10 %, and 10 VDC ± 10 %. Test leads should be isolated from ground.

5.2 *Electrodes*—Two cylindrical 5 lb ± 1 oz (2.27 kg ± 28 g) metal electrodes shall have a diameter of 2.5 ± 0.062 in. (63.5 ± 1.58 mm) each having contacts of electrically conductive material with a Shore-A (IRHD) durometer hardness of 50–70 (Test Method D2240). The electrically conductive material may be permanently attached to the electrode. The resistance between the electrodes shall be less than 1 Kohms when measured at 10 V or less on a metallic surface.

6. Test Specimen

6.1 *Qualification Testing*—When mounting specimen, use insulative support material (¼ in. (6.35 mm) tempered hardboard is recommended). Use manufacturer's recommended procedures, adhesives, and grounding method to install the sample floor. The specimen shall consist of a portion of floor covering 48 by 48 in. (1.22 by 1.22 m) in area. If a qualification test is required, one specimen shall be tested unless otherwise specified. Unless otherwise specified, make five measurements on the specimen with electrodes at different locations for each measurement and record the value to two significant figures.

6.2 When the following is to be tested after jobsite installation, the specimen shall be a portion of the floor not exceeding 20 by 20 ft (6 by 6 m) in dimensions.

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[1] This test method is under the jurisdiction of ASTM Committee F06 on Resilient Floor Coverings and is the direct responsibility of Subcommittee F06.20 on Test Methods - Products Construction/Materials.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

7. Conditioning

7.1 Whenever possible, condition the test specimen at least 24 h at 73.4 ± 1.8°F (23 ± 1°C) and 50 ± 5 % relative humidity, and test in the same environment.

8. Procedure

8.1 *Qualification Testing*—Place the installed specimen as described in 6.1 on a nonconductive surface, and lightly wipe with a lint-free cloth to remove any foreign material prior to placing of the electrodes. The surfaces of the electrodes, prior to placing, should be cleaned with a minimum 70 % isopropanol-water solution using a clean low linting cloth. Allow to dry. Follow the manufacturer's recommendation as to the time after installation prior to testing.

8.1.1 *Surface to Surface Test:*

8.1.1.1 *For conductive floors*—Place the electrodes at least 1 in. (25.4 mm) in from an edge of the specimen and 36 in. (914.4 mm) apart. Set meter to 10 VDC, and apply the voltage and take the reading 15 s after the application of voltage or once the reading has reached equilibrium. If the reading is below 1.0×10^6 Ω, record the reading. If the reading is higher than 1.0×10^6 Ω, change the voltage to 100 VDC and take the reading 15 s after the application of voltage or once the reading has reached equilibrium and record the reading.

8.1.1.2 *For static dissipative floors*—Place the electrodes at least 1 in. (25.4 mm) in from an edge of the specimen and 36 in. (914.4 mm) apart. Apply the prescribed voltage (either 100 VDC or 10 VDC) and take a reading 15 s after the application of voltage or once the reading has reached equilibrium. If the floor is known to be greater than 1.0×10^6 Ω use 100 VDC.

8.1.2 *Surface to Ground Test*—Attach the positive electrode or the positive wire from the megohm meter to the ground connection and place the negative electrode on the surface of the flooring material. The negative electrode should be over 6 in. (152.4 mm) from the ground connection and over 6 in. (152.4 mm) from any metal ground strip embedded in the adhesive.

8.1.2.1 *For conductive floors*—Set meter to 10 VDC, apply the voltage and take the reading 15 s after the application of voltage or once the reading has reached equilibrium. If the reading is below 1.0×10^6 Ω, record the reading. If the reading is higher than 1.0×10^6 Ω, change the voltage to 100 VDC and take the reading 15 s after the application of voltage or once the reading has reached equilibrium and record the reading.

8.1.2.2 *For static dissipative floors*—Apply the prescribed voltage (either 100 VDC or 10 VDC) and take a reading 15 s after the application of voltage or once the reading has reached equilibrium. For static dissipative floors, place the electrodes 1 in. (25.4 mm) in from an edge of the specimen and 36 in. (914.4 mm) apart. Apply the prescribed voltage (either 100 VDC or 10 VDC) and take a reading 15 s after the application of voltage or once the reading has reached equilibrium. If the floor is known to be greater than 1.0×10^6 Ω, use 100 VDC.

8.2 *Installed Testing*—Lightly wipe the area to be tested with a lint-free cloth to remove any foreign material prior to placing of the electrodes. The surfaces of the electrodes, prior to placing, should be cleaned with a minimum 70 % isopropanol-water solution using a clean low linting cloth. Allow to dry. Follow the manufacturer's recommendation as to the time after installation prior to testing. Prior to the initial installed test the floor should be cleaned per the manufacturer's recommendation and be given sufficient time to dry completely.

8.2.1 *Surface to Surface Test:*

8.2.1.1 *For conductive floors*—Place the electrodes at least 1 in. (25.4 mm) in from an edge of the area to be tested and 36 in. (914.4 mm) apart. Set meter to 10 VDC, apply the voltage and take the reading 15 s after the application of voltage or once the reading has reached equilibrium. If the reading is below 1.0×10^6 Ω, record the reading. If the reading is higher than 1.0×10^6 Ω, change the voltage to 100 VDC and take the reading 15 s after the application of voltage or once the reading has reached equilibrium and record the reading.

8.2.1.2 *For static dissipative floors*—Place the electrodes at least 1 in. (25.4 mm) in from an edge of the area to be tested and 36 in. (914.4 mm) apart. Apply the prescribed voltage (either 100 VDC or 10 VDC) and take a reading 15 s after the application of voltage or once the reading has reached equilibrium. If the floor is known to be greater than 1.0×10^6 Ω, use 100 VDC.

8.2.2 *Surface to Ground*—Place the electrodes 36 in. (914.4 mm) apart and at least 36 in. (914.4 mm) from any ground connection or grounded object resting on the floor. Attach the positive electrode or the positive wire from the megohm meter to the ground connection and place the negative electrode on the surface of the flooring material.

8.2.2.1 *For conductive floors*—Set meter to 10 VDC, apply the voltage and take the reading 15 s after the application of voltage or once the reading has reached equilibrium. If the reading is below 1.0×10^6 Ω, record the reading. If the reading is higher than 1.0×10^6 Ω, change the voltage to 100 VDC and take the reading 15 s after the application of voltage or once the reading has reached equilibrium and record the reading.

8.2.2.2 *For static dissipative floors*—Apply the prescribed voltage (either 100 VDC or 10 VDC) and take a reading 15 s after the application of voltage or once the reading has reached equilibrium. If the floor is known to be greater than 1.0×10^6 Ω, use 100 VDC.

8.3 On an installed floor, perform a minimum of 5 tests per floor surface material or a minimum of 5 tests per 5000 ft^2 (46.5 m^2) of floor material, whichever is greater. With an existing floor or when testing a floor that has had the initial test, a minimum of three of the five tests should be conducted in those areas that are subject to wear or have chemical or water spillage or that are visibly dirty. This will aid in determining if a floor finish has been applied or if the floor requires additional maintenance.

8.3.1 Areas that have lower ambient relative humidity could have resistance readings that vary from reading at higher ambient relative humidity.

9. Report

9.1 *Qualification Testing*—The report shall include the following:

9.1.1 Number of square feet comprising test area, date, and number of tests performed, all point to point and point to ground values shall be reported in ohms. The minimum, and maximum point to point and point to ground values of measurements in ohms and voltage shall also be reported.

9.2 *Installed Testing*—The report shall include the following:

9.2.1 Number of square feet comprising test area, date and number of tests performed, all point to point and point to ground values shall be reported in ohms. The minimum, and maximum point to point and point to ground values of measurements in ohms and voltage shall also be reported.

10. Precision and Bias

10.1 The precision and bias statements are currently under development.

11. Keywords

11.1 conductive; electrodes; electrostatic charge; flooring; ground; megohm meter; resistance; static dissipative

APPENDIX

(Nonmandatory Information)

X1. INTRA- AND INTERLABORATORY STUDIES

X1.1 Historically, Test Method F150 used a 500 VDC test voltage until 1998 when it was changed to allow the option of 100 VDC along with 500 VDC. The reason for having the two test voltages was a compromise between those who wanted 500 VDC only and those who desired 100 VDC only. Part of the compromise included an agreement that additional research and testing would take place to determine the best voltage or voltages to use when testing resilient flooring in the conductive and static dissipative ranges. It was determined that 500 VDC was too high to accurately test in the conductive range without increasing the amperage. Meters using 100 VDC and limited to 5.0 mA are mathematically not capable of measurement below 250,000 ohms. This was the basis for testing at 10 VDC and 100 VDC. The test is first done at 10 VDC to eliminate the possibility of polarizing the tile and producing a false reading. Extensive testing has verified these facts.

ADDITIONAL MATERIAL

(1) Navships 0901-690-0002, Naval Ships Technical Manual, Chapter 9690, Electrical Measuring and Test Instruments, Part 7, Accuracy 3 percent of scale @ 25°C, Naval Sea Systems Command, Crystal City, VA.

(2) Army Material Command, 20315 – 385-224 Section 7, Static Electricity, Washington, DC, June 4, 1964.

(3) Bureau of Mines Bulletin #520, Static Electricity in Hospital Operating Suites, Direct and Related Hazards and Pertinent Remedies, Superintendent of Documents, Government Printing Office, Washington, DC.

(4) UL-779, Standard for Electrically Conductive Flooring, Fifth Edition, Underwriters Laboratories, July 1985.

(5) Department of Defense Military Handbook, MIL-HDBK 253, Guidance for the Design and Test of Systems Protected Against the Effects of Electromagnetic Energy, Section 09675, Conductive Flooring, December 1988.

(6) Department of Defense Contractor's Safety Manual for Ammunition and Explosives 4145.26-M, March 1986.

(7) Department of Defense Military Handbook, DOD-HDBK-263 and Military Standard DOD-STD-1686, Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

(8) EOS/ESD-SD7.1 Flooring Materials—Resistive Characterization of Materials, Electrical Overstress/Electrostatic Discharge Association, Inc., Rome, NY.

(9) NFPA 99-1990 Health Care Facilities, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.