Designation: F 150 – 98

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

This standard is issued under the fixed designation F 150; 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.

This standard has been approved for use by agencies of the Department of Defense.

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:*

D 2240 Test Method for Rubber Property–Durometer Hardness[2]

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[3]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[3]

2.2 *Other Standards:*

EOS/ESD-SD7.1 Flooring Materials—Resistive Characterization of Materials[4]

NFPA 99-1990 Health Care Facilities[5]

Federal Test Method Std. No. 501a, Method 8311—Electrical Conductance[6]

Mono #11 Conductive Flooring for Hospital Operating Rooms[7]

3. Terminology

3.1 *Definitions:*

3.1.1 *conductive flooring*—resilient tile or sheet which, when tested in accordance with 8.1.1 or 8.2.1 shall have an average resistance greater that 25 000 Ω ($2.5 \times 10^4 \Omega$) and less than 1 000 000 Ω (1.0×10^6 Ω). When tested in accordance with 8.2.2 the average value shall be no less than 25 000 Ω ($2.5 \times 10^4 \Omega$) with no individual measurement's value less than 10 000 Ω.

3.1.2 *static dissipative flooring*—resilient tile or sheet which, when tested in accordance with 8.1.2 or 8.2.2 shall have an average resistance greater that 1 000 000 Ω ($1.0 \times 10^6 \Omega$) and less than or equal to 1 000 000 000 Ω (1.0×10^9 Ω). When tested in accordance with 8.2.2 the average value shall be no less than 1 000 000 Ω ($1.0 \times 10^6 \Omega$) and less than or equal to 1 000 000 000 Ω ($1.0 \times 10^9 \Omega$).

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 (see Federal Test Method No. 501a, Method 8311).

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

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[2] *Annual Book of ASTM Standards*, Vol 09.01.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] Available from the Electrical Overstress/Electrostatic Discharge Association, Inc., Rome, NY.

[5] Available from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

[6] Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[7] Available from National Bureau of Standards, Dept. of Commerce, Washington, DC, March 1960.

capable of open circuit voltages of 500 ± 10 VDC or 100 ± 10 VDC, or both. Test leads should be isolated from ground.

5.2 *Electrodes*—Either style A or style B electrode may be used, but the same style shall be used together as a set.

5.2.1 *Style A*—Two metal electrodes with terminals for making connection to the ohmmeter. Each electrode shall weigh 5 lb ± 1 oz (2.27 kg ± 28 g) and shall have a dry, flat circular contact area 2.5 ± 0.062 in. (63.5 ± 1.58 mm) in diameter.

5.2.2 *Style B*—Two cylindrical 5 lb ± 1 oz (2.27 kg ± 28 g) metal electrodes shall have a diameter of 2.3 ± 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 D 2240). The resistance between the electrodes shall be less than 1 Kohms when measured at 10 V or less on a metallic surface.

5.3 *Preparation of Electrode Style A*—Place a piece of aluminum or tin foil 0.0005 to 0.0010 in. (0.0127 to 0.0254 mm) thick on a flat, hard, smooth surface. On top of the foil place a layer of rubber 2½ in. (64 mm) in diameter, ¼ in. (6.4 mm) thick and having a Shore-A(IRHD) durometer hardness of 50–70 (Test Method D 2440). Place the electrode on top of the rubber pad, draw the foil up around the rubber layer and electrode. Secure the foil with a rubber band or pressure-sensitive tape. Repeat procedure for second electrode.

6. Test Specimen

6.1 *Qualification Testing*—When mounting specimen, use insulative support material (¼ in. 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.

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*—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 500 VDC or 100 VDC) and take a reading 5 s after the application of voltage or once the reading has reached equilibrium.

NOTE 1—The voltage applied should be determined by the use of the floor. The conductive resistance range tested at 500 VDC generally should be used in areas where explosive gases, chemicals, or munitions are used or stored.

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. Apply the prescribed voltage (either 500 VDC or 100 VDC) and take a reading 5 s after the application of voltage or once the reading has reached equilibrium.

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.

8.2.1 *Surface to Surface Test*—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 500 VDC or 100 VDC) and take a reading 5 s after the application of voltage or once the reading has reached equilibrium.

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. Apply the prescribed voltage (either 500 VDC or 100 VDC) and take a reading 5 s after the application of voltage or once the reading has reached equilibrium.

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. 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.

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

NOTE 2—The ESD Association, ESD 7.1 uses 100 V. Underwriters Laboratories certifies static control flooring using 500 V.

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.

9.1.2 Average, minimum, and maximum values of measurements in ohms and voltage.

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