Designation: F 1996 – 00~~0~~1

Standard Test Method for Silver Migration for Membrane Switch Circuitry[1]

This standard is issued under the fixed designation F 1996; 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 is used to determine the susceptibility of a membrane switch to the migration of the silver between circuit traces under dc voltage potential.

1.2 Silver migration will occur when special conditions of moisture and electrical energy are present.

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2. Referenced Documents

2.1 *ASTM Standards:* [2]

F 1596 Practice for Exposure of Membrane Switches to Temperature and Relative Humidity

F 1689 Test Method for Determining the Insulation Resistance of a Membrane Switch

3. Terminology

3.1 *Definitions:*

3.1.1 *silver migration*—A process by which silver, when in contact with insulating materials under electrical potential, is removed ionically from its original location, and is redeposit as a metal (silver dendrite) at some other location.

4. Significance and Use

4.1 The effects of silver migration are short circuiting or reduction in insulation resistance. It is evidenced by staining or dicoloration between the cathode and anode conductive traces.

4.2 Accelerated testing may be accomplished by increasing the voltage over the specified voltages. (A typical starting point would be 5Vdc 50mA).

5. Interferences

5.1 The following parameters may affect the results of this test:

5.1.1 Temperature.

5.1.2 Relative Humidity.

5.1.3 Electrical Load (that is, current and voltage).

5.1.4 Test surface.

5.1.5 Connector area may be susceptible to silver migration.

5.1.6 Post test handling may damage or destroy silver dendrites.

5.1.7 Dendrites normally grow from the cathode conductor to the anode. To test both electrodes of a switch design connect replicate specimens so that current flows through them in opposite directions.

5.1.8 Without limited current, the migration could occur, causing a short and a dramatic current surge, which then destroys the short and returns the circuit to a nonstandard, but functional condition. If an observer was not present (or the details were not continuously recorded) this most dramatic failure might go unnoticed.

6. Apparatus

6.1 *Closed Environmental System* , with temperature and humidity control (see Practice F 1596).

6.2 *Current-Limiting DC Power Source*. (Series current limiting resistor may be used with dc power supply).

6.3 *Milliamp Meter* (see Test Method F 1689).

6.4 *Megohm Meter*.

6.5 *Test Surface*, flat, smooth, unyielding, nonporous, and larger than switch under test.

7. Procedure

7.1 *Pretest Setup*:

7.1.1 Test specimen(s) shall be permitted to stabilize at 20 to 25°C and 40 to 60 % relative humidity (RH) for a minimum of 24 h.

7.2 *Test Setup (Fig. 1)*:

7.2.1 Secure switch on test surface and measure initial insulation resistance between test points and record results.

7.2.2 Place switch at a 90 ± 15° to horizontal (unless otherwise specified) in the test chamber to prevent condensate accumulation.

7.2.3 Connect power supply leads to test points.

7.3 *In Process Test*:

7.3.1 Apply voltage to the test points. Limit the current to prevent high current from disintegrating the dendrites caused by silver migration. Use a current limiting resistor to limit the current to 2 milliamps or less. (See Fig. 1)

7.3.2 Expose test specimen(s) to specified temperature and humidity while under electrical load for a specified duration, (for example, 10 days at 55°C/85 % RH).

7.3.3 After specified duration disconnect power supply and remove from chamber. Allow to stabilize following 7.1.1.

7.4 *Post Test*:

7.4.1 Measure final insulation resistance between test points and record results.

7.4.2 An insulation resistance measurement below specified value constitutes a failure of this test.

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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*, ~~Vol 10.05.~~ volume information, refer to the standard's Document Summary page on the ASTM website.

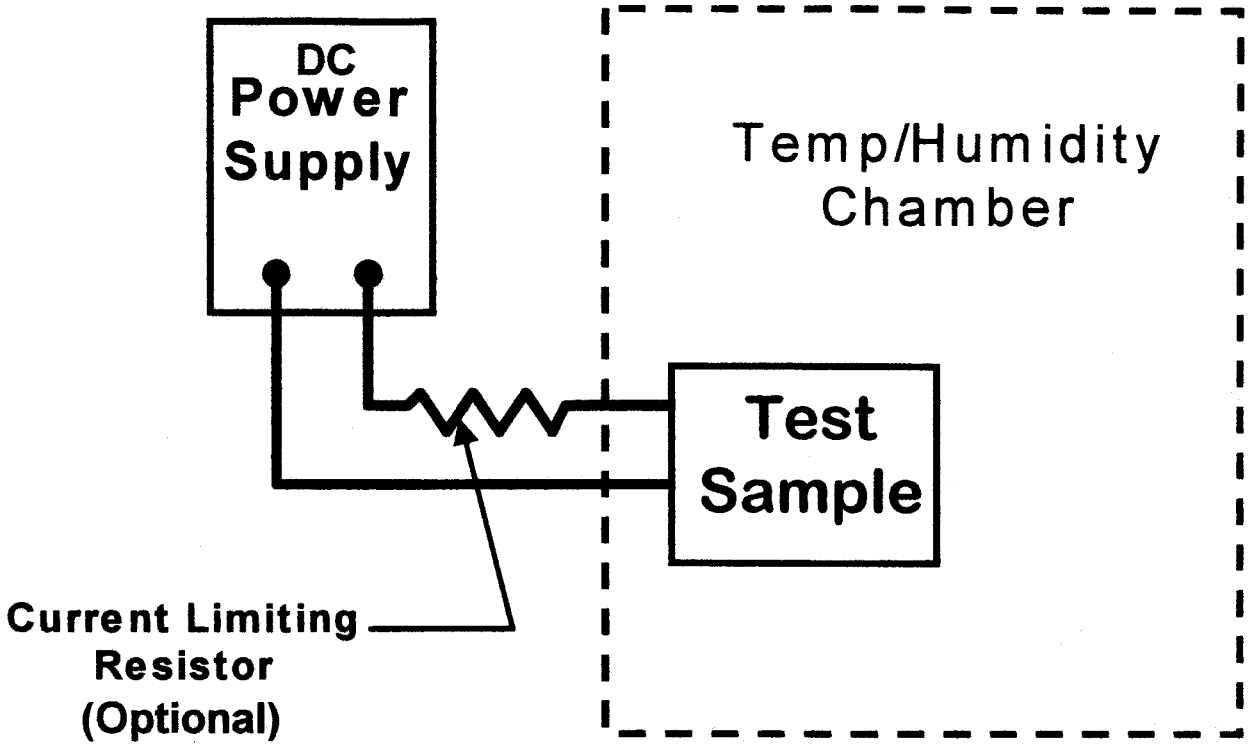

FIG. 1 Test Setup

7.4.3 If a failure, inspect visually (without magnification) for staining or discoloration.

8. Report

8.1 Report the following information:
8.1.1 Humidity,
8.1.2 Temperature,
8.1.3 Voltage,
8.1.4 Current limit value,
8.1.5 Specified duration,
8.1.6 Schematic of unit under test indicating circuit connections and polarity, and
8.1.7 Report initial insulation resistance, final insulation resistance, pass/fail.
8.1.8 Report results of visual inspection.

9. Keywords

9.1 membrane switch; silver dendrite; silver migration