



Designation: F 1662 – 03

# Standard Test Method for Verifying the Specified Dielectric Withstand Voltage and Determining the Dielectric Breakdown Voltage of a Membrane Switch<sup>1</sup>

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## 1. Scope

1.1 This test method covers the verification of a specified dielectric withstand voltage or dielectric breakdown voltage of a membrane switch.

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

F 1680 Test Method for Determining Circuit Resistance of a Membrane Switch

F 1663 Test Method for Determining the Capacitance of a Membrane Switch

## 3. Terminology

3.1 *Definitions:*

3.1.1 *dielectric withstand voltage*—a voltage, above rated voltage, applied for a specific time between mutually insulated test points or between an insulated test point and ground, which results in no visual change or specified leakage current.

3.1.2 *dielectric breakdown voltage*—the voltage at which a disruptive discharge or excessive leakage current occurs.

3.1.3 *disruptive discharge*—flashover (surface discharge), spark over (air discharge), or breakdown (puncture discharge).

3.1.4 *leakage current*—current between mutually insulated test points when a voltage is applied.

3.1.5 *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

3.1.6 *test points*—two preselected mutually insulated locations on switch assembly.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee F01 on Electronics and is the direct responsibility of Subcommittee F01.18 on Membrane Switches.

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<sup>2</sup> 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.

## 4. Significance and Use

4.1 Dielectric withstand voltage testing is useful for design verification, quality control of materials, and workmanship.

4.2 This test method is used to verify that the membrane switch can operate safely at its rated voltage, and withstand momentary overpotentials due to switching, surges and other similar electrical phenomena.

4.3 Specific areas of testing are, but not limited to:

4.3.1 Conductor/dielectric/conductor crossing point,

4.3.2 Close proximity of conductors, and

4.3.3 Any other conductive surface such as shielding or metal backing panel.

4.4 Dielectric withstand voltage testing may be destructive and units that have been tested should be considered unreliable for future use.

## 5. Interferences

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

5.1.1 Humidity,

5.1.2 Contamination,

5.1.3 Barometric pressure, and

5.1.4 Temperature.

## 6. Apparatus

6.1 *Electric Device*, suitable to provide a controlled dc voltage, leakage current measurement.

## 7. Procedure

7.1 *Dielectric Withstand Test Method:*

7.1.1 Measure and record the following characteristics prior to performing test:

7.1.1.1 Open and closed circuit resistance of the test points in accordance with Test Method F 1680.

7.1.1.2 Capacitance of the test point in accordance with F 1663.

7.1.2 Connect two test points on the switch assembly, each to a separate polarity, on the voltage source.

7.1.3 Select test voltage from Table 1.

7.1.4 Apply the test voltage from zero to specified value as uniformly as possible, at a rate of approximately 1/2 of the test voltage per second (V/s), unless otherwise specified. For example, Level 2 in Table 1, the ramp rate is 250 V/s for a test voltage of 500 V dc.

7.1.5 Apply test voltage to switch assembly for 60 s.

7.1.6 Record visual changes or leakage current, or both, if any.

7.1.7 Dissipate all charges to ground using appropriate methods prior to continuing test to next test voltage (repeat 7.1.3 to 7.1.7 as needed).

7.1.8 Repeat measurements recorded in 7.1.1.

**7.2 Dielectric Breakdown Method:**

7.2.1 Connect two test points on the switch assembly, each to a separate polarity, on the voltage source.

7.2.2 Apply the voltage incrementally from zero to breakdown as uniformly as possible, at a rate of 250 V/s unless otherwise specified.

7.2.2.1 Apply test voltage to switch assembly for 60 s at each incremental test voltage.

7.2.3 Record visual changes and magnitude of breakdown voltage, if any.

7.2.4 Dissipate all charges to ground using appropriate methods prior to continuing test to next test voltage (repeat 7.2.2 to 7.2.3 as needed).

**8. Report**

8.1 Report the following information:

- 8.1.1 Temperature,
- 8.1.2 Relative humidity,
- 8.1.3 Barometric pressure,
- 8.1.4 Specified dielectric withstand voltage (pass or fail),
- 8.1.5 Circuit resistance pre and post (Dielectric Withstand Test),
- 8.1.6 Capacitance pre and post (Dielectric Withstand Test),
- 8.1.7 Dielectric breakdown voltage,
- 8.1.8 Actual applied voltage or failure voltage,
- 8.1.9 Duration of applied voltage,
- 8.1.10 Description of test equipment,
- 8.1.11 Voltage ramp rate,
- 8.1.12 Part number or description of switch, or both,
- 8.1.13 Description of test points,
- 8.1.14 Date of test,
- 8.1.15 Description of visual change (if applicable),

**9. Precision and Bias**

9.1 The precision and bias of this test method are under investigation.

**10. Keywords**

10.1 dielectric withstand voltage; insulation resistance; membrane switch

**TABLE 1 Test Voltage<sup>A</sup>**

	Test Voltage (dc)	Ramp Rate (V/s)
Level 1	250	125
Level 2	500	250
Level 3	1000	500
Level 4	As specified	As specified

<sup>A</sup>All dwell times at maximum dc voltage = 60 s.

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