**Designation: ~~F 1662 – 95 (Reapproved 2002)~~ 1662 – 03**

# Standard Test Method for Verifying the Specified Dielectric Withstand Voltage and Determining the Dielectric Breakdown Voltage of a Membrane Switch[1]

This standard is issued under the fixed designation F 1662; 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 verification of a specified dielectric withstand voltage or dielectric breakdown voltage of a membrane switch.

[1] 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.

Current edition approved ~~Nov.~~ June 10, ~~1995.~~ 2003. Published ~~J~~ August 2003 Originally approved in 1995 as F 1662-95. Last previous edition approved in 1995 as F 1662-95(02).

## 2. Referenced Documents

2.1 *ASTM Standards:* [2]

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

~~2~~3.1 *Definitions:*

~~2~~3.1.1 *dielectric withstand voltage*~~—the maximum voltage~~—a voltage, above rated voltage, applied for a~~ dielectric can withstand without a~~ specific time between mutually insulated test points or between an insulated test point and ground, which results in no visual change~~ from a~~ or specified leakage current.

3.1.2 *dielectric breakdown voltage*—the voltage at which a disruptive discharge or~~ specified change of insulation resistance,~~ excessive leakage current occurs.

3.1.3 *disruptive discharge*—flashover (surface discharge), spark over (air discharge), or~~ both.~~

~~2.1.2 *insulation resistance, R* breakdown (puncture discharge).~~

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

~~2~~3.1.3~~5~~ *membrane switch*—a momentary switching device in which at least one contact is on, or made of, a flexible substrate.

~~2.1.4~~

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

## ~~3. Significance and Use~~

~~3.1 Dielectric withstand voltage testing is useful for design verification, quality control of materials, and workmanship.~~

~~3.2 This test is designed to determine product integrity and resistance at voltage levels that exceed normal operating levels.~~

~~3.3 Specific areas of testing are, but not limited to:~~

~~3.3.1 Conductor/dielectric/conductor crossing point,~~

~~3.3.2 Close proximity of conductors, and~~

~~3.3.3 Any other conductive surface such as shielding or metal backing panel.~~

~~3.4 Dielectric withstand voltage testing may be destructive and units that have been tested should be considered unreliable for future use.~~

## 4. ~~Interferences~~

~~4.1 The following parameters may affect~~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~~ this test:~~

~~4.1.1 Humidity,~~

~~4.1.2 Contamination,~~

~~4.1.3 Barometric pressure,~~ testing are, but not limited to:

4.3.1 Conductor/dielectric/conductor crossing point,

4.3.2 Close proximity of conductors, and

4.~~1~~3.~~4~~3 ~~T~~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

~~5~~6.1 *Electric Device*, suitable to provide a controlled dc~~ or ac voltage.~~

## ~~6.~~ voltage, leakage current measurement.

## 7. Procedure

~~6.1 *Pretest Setup*~~

[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.

7.1 *Dielectric Withstand Test Method* :

~~6~~7.1.1 Measure and record the ~~insulation~~ following characteristics prior to performing test:

7.1.1.1 Open and closed circuit resistance ~~between~~ 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. Record insulation resistance as $R_i$~~ points on the switch assembly, each to a separate polarity, on the voltage source.

7.1.3 Select test voltage from Table 1.

~~6.1.2 Connect two~~

7.1.4 Apply the test ~~points on~~ voltage from zero to specified value as uniformly as possible, at a rate of approximately ½ 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 ~~source.~~

~~6.2 *In-Process Test—Constant 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* :

~~6.2.1 Adjust voltage and frequency~~

7.2.1 Connect two test points on the switch assembly, each to a ~~specified level.~~

~~6.2.2 Apply~~ separate polarity, on the voltage source.

7.2.2 Apply the voltage incrementally from zero to ~~switch assembly for~~ breakdown as uniformly as possible, at a ~~specified interval.~~

~~6.3 *In Process Test—Ramp Voltage Method:*~~

~~6.3.1 Set the following parameters~~ rate of 250 V/s unless otherwise specified.

7.2.2.1 Apply test voltage to ~~specified levels (if applicable):~~

~~6.3.1.1 Voltage ramp rate, and~~

~~6.3.1.2 Maximum ramp voltage.~~

~~6.3.2 Perform test.~~

~~6.4 Disconnect~~ switch assembly ~~from power supply.~~

~~6.5 Inspect switch assembly~~ for 60 s at each incremental test voltage.

7.2.3 Record visual ~~change.~~

~~6.6 Measure the insulation resistance~~ changes and magnitude of breakdown voltage, if any.

7.2.4 Dissipate all charges to ground using ~~the same procedure used in 6.1.1.~~

~~6.7 Record insulation resistance~~ appropriate methods prior to continuing test to next test voltage (repeat 7.2.2 to 7.2.3 as ~~$R_f$.~~

## ~~7. Calculation~~

~~7.1 Calculate the change in the insulation resistance as follows:~~

~~$\Delta R$ = Change in Insulation Resistance = $|R_i - R_f|$~~

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 Delectric breakdown voltage,

8.1.5~~8~~ Actual applied voltage or failure voltage,

~~8.1.6 Frequency~~

**TABLE 1 Test Voltage[A]**

| | 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 |

[A] All dwell times at maximum dc voltage = 60 s.

8.1.9 Duration of applied voltage,
8.1.~~7~~10 D~~u~~esc~~r~~aiption of ~~applied voltage (if applicable),~~
~~8.1.8 Description of~~ test equipment,
~~8.1.9 Initial voltage and voltage~~
8.1.11 Voltage ramp ~~rate (if applicable),~~
~~8.1.10 Part~~ rate,
8.1.12 Part number or description of switch, or both,
8.1.1~~1~~3 Description of test points,
8.1.1~~2~~4 Date of test,
8.1.1~~3~~5 Description of visual change (if applicable),
~~8.1.14 Specified $\Delta R$ Limits, and~~
~~8.1.15 Change in insulation resistance $\Delta R$ (as calculated in 7.1).~~

## 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