



Standard Test Method for Contact Closure Cycling of a Membrane Switch¹

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1. Scope

1.1 This test method covers the setup, procedure, and apparatus required to depress and release a membrane switch to a predetermined number of cycles.

1.2 This test method also covers the optional use of specified voltage and current during the cycling of the membrane switch.

1.3 This test method can be used in conjunction with other ASTM standards such as Test Method F1596.

1.4 *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
- F1596 Test Method for Exposure of Membrane Switches to Temperature and Relative Humidity
- F1661 Test Method for Determining the Contact Bounce Time of a Membrane Switch
- F1662 Test Method for Verifying the Specified Dielectric Withstand Voltage and Determining the Dielectric Breakdown Voltage of a Membrane Switch
- F1689 Test Method for Determining the Insulation Resistance of a Membrane Switch
- F1663 Test Method for Determining the Capacitance of a Membrane Switch
- F1680 Test Method for Determining Circuit Resistance of a Membrane Switch
- F2592 Test Method for Measuring the Force-Displacement

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.

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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.

of a Membrane Switch

3. Terminology

3.1 Definitions:

3.1.1 *contact closure*—the event at which a specified resistance is achieved.

3.1.2 *duty cycle*—the ratio of switch closed time to total cycle time.

3.1.3 *test rate*—the number of depressions and release cycles per second.

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

4. Significance and Use

4.1 This testing is performed to determine the electrical contact reliability under switching conditions and the physical changes caused by mechanical actuation of the switch assembly in the environments in which the assemblies operate. Evidence of deterioration, that is, cracking of substrate, domes both metal and polyester, ink delamination, etc., resulting from this test can at times be determined by visual examination. However, the effects may be more readily ascertained by measurements made prior to, during, and after exposure. Total circuit resistance, force-displacement, dielectric strength, insulation resistance, and capacitance are types of measurements that show the deleterious effects due to exposure.

5. Apparatus

5.1 *Suitable Electronic Monitoring Device*, to detect and count contact closure at a predetermined or specified test rate and duty cycle.

5.2 *Surface*, flat, smooth, unyielding, and larger than the switch.

5.3 *Test Probes*, built to either of the configurations shown in Fig. 1 or Fig. 2, are acceptable but must be made of an inert elastomeric material with a hardness number equivalent to A/45 ± 5 as measured in accordance with Test Method D2240. Test probes that do not meet this criteria must be specified and recorded fully.

5.4 *Device*, which will cycle the probe repeatedly into and away from the switch at a specified test rate and duty cycle, and

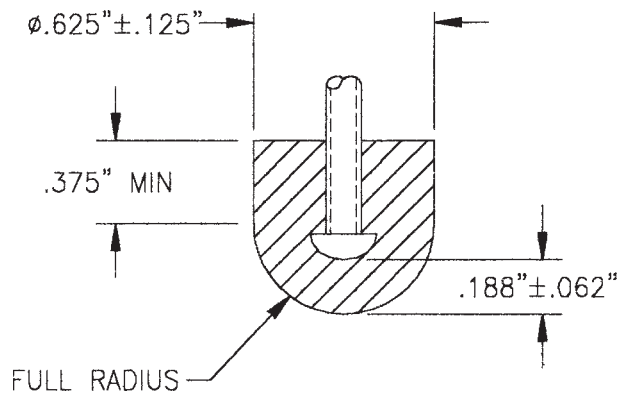


FIG. 1 Test Probe Option

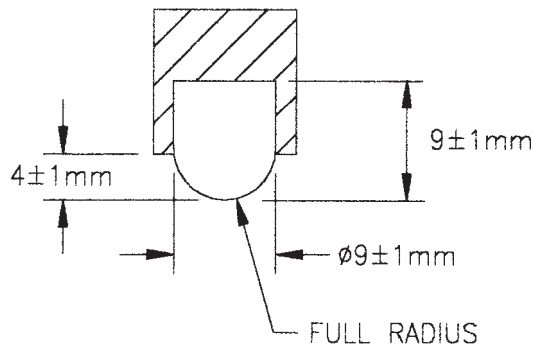


FIG. 2 Test Probe Option

which is capable of providing means for counting probe cycles. The motion of the probe should be perpendicular to the plane of the switch.

5.5 *Power Supply*, capable of supplying specified voltage or current, or both, if required.

6. Procedure

6.1 Pretest Setup:

6.1.1 Secure the switch on a test table.

6.1.2 Measure the F_{max} and F_c in accordance with Test Method F2592 and any other desired characteristics of the switch as specified in Section 7 and record.

6.1.3 Position the test probe over the desired area of the switch.

6.1.4 Position the test probe until the tip is just above the top surface of the switch without touching.

6.1.5 Connect the switch terminations to the contact closure monitoring device, and power supply, if applicable.

6.1.6 Adjust the probe in the full-down position to achieve 110 % of F_{max} or F_c (whichever is greater) or to a specified force.

6.1.7 Set the power supply voltage or current to the specified values, if applicable.

6.1.8 Testing should be done under standard laboratory conditions unless otherwise specified.

6.2 In-Process Test:

6.2.1 Begin cycling at specified test rate and duty cycle.

6.2.2 Measure the characteristics of the switch at desired intervals as performed in 6.1.2.

NOTE 1—If switch removal from the test table is necessary, return the switch to the exact location.

6.3 End test:

6.3.1 Stop the test at a preselected duration or at the point of failure.

6.3.2 Measure the final characteristics using the same method, equipment, and conditions as used in the pretest setup described in 6.1.2.

7. Report

7.1 Report the following information:

7.1.1 Visual changes.

7.1.2 Mechanical changes:

7.1.2.1 F_{max} , F_{min} , F_c mandatory (Test Method F2592) – Other force displacement supporting data and curves optional.

7.1.2.2 Contact Bounce Time Make & Break (TCBM & TCBB) (Test Method F1661).

7.1.3 Electrical Characteristic Changes:

7.1.3.1 Circuit resistance (Test Method F1680).

7.1.3.2 Switch capacitance (C_s) (Test Method F1663).

7.1.3.3 Dielectric withstand voltage (non-destructive) (Test Method F1662).

7.1.3.4 Insulation resistance (Test Method F1689).

7.1.4 Test Conditions:

7.1.4.1 Temperature.

7.1.4.2 Humidity.

7.1.4.3 Test probe – Shape and material (durometer if elastomeric probe is used).

(a) Test probed orientation if other than 90 degrees to sample.

(b) Location of contact point if other than center of switch.

7.1.4.4 Duty cycle.

7.1.4.5 Test rate.

7.1.4.6 Number of cycles.

7.1.4.7 Applied force.

7.1.4.8 Environmental test conditions other than standard control laboratory atmosphere.

8. Precision and Bias

8.1 Precision and bias for results from referenced standards are to be used without modification.

8.2 Precision and bias for nonquantitative results, such as visual changes, are not required.

9. Keywords

9.1 contact closure cycling; membrane switch

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