Designation: F 1661 – 96 (Reapproved 2002)

Standard Test Method for Determining the Contact Bounce Time of a Membrane Switch[1]

This standard is issued under the fixed designation F 1661; 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 determination of the contact bounce time of a membrane switch.

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]

3. Terminology

3.1 *Definitions:*

3.1.1 *contact bounce*—intermittent contact opening and contact closure that may occur after switch operation.

3.1.2 *contact bounce time (break), T_{CBB}*—the time period measured from the first instant V_M is equal to the SLTV until the first instant it again falls below the SLTV after the last instant it rises above the SUTV. If V_M does not rise above SUTV during the time interval, $T_{CBB} = 0$, (see Fig. 1).

3.1.3 *contact bounce time (make), T_{CBM}*—the time period measured from the first instant V_M is equal to the SUTV until the first instant it again rises above the SUTV after the last instant it falls below the SLTV. If V_M does not fall below SLTV during the time interval, $T_{CBM} = 0$, (see Fig. 2).

3.1.4 *lower transition voltage, LTV*—the voltage at which the switched logic device transitions to an "off" state.

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 *resistor, load, R_L*—load resistance in series with switch under test.

3.1.7 *specified lower transition voltage, SLTV*—minimum allowable LTV.

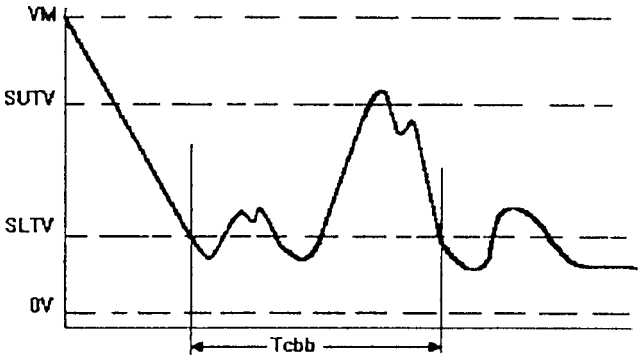

FIG. 1 Contact Bounce on Switch Break

3.1.8 *specified resistance, R_S*—maximum allowable resistance measured between two terminations whose internal switch contacts, when held closed, complete a circuit.

3.1.9 *specified upper transition voltage, SUTV*—minimum allowable UTV.

3.1.10 *upper transition voltage, UTV*—the voltage at which the switched logic device transitions to an ″on" state.

3.1.11 *voltage, measured, V_M*—voltage measured across load Resistor (R_L) by the oscilloscope and measured on it's screen or voltage measured across the switch under test when a contact bounce measuring device is used.

4. Significance and Use

4.1 Contact bounce time is essential to manufacturers and users when designing interface circuitry because it specifies the time delay necessary in the decoder circuitry to avoid any false

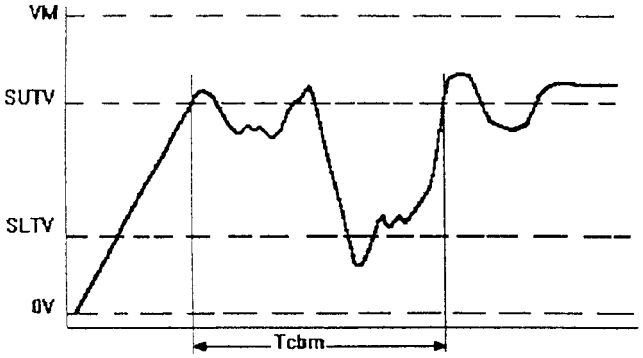

FIG. 2 Contact Bounce on Switch Make

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

signals caused by contact bounce. Allowing for time delay makes the switch operation considerably more reliable.

5. Interference

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

5.1.1 If a human finger is used in place of a mechanical probe the results are more varied and larger sample sizes should be used, and

5.1.2 Mechanical probe materials (hardness) and speed will affect results.

6. Apparatus

6.1 *Test Probe*, built to either of the configuration shown in Fig. 3 and Fig. 4 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 D 2240. Test probes that do not meet the above criteria must be fully specified and recorded.

6.2 *Test Surface*—flat, smooth, unyielding, and larger than switch under test.

6.3 *Oscilloscope*, with recording capabilities and power supply, or suitable contact bounce time measuring instrument.

6.4 *Device*, which will consistently move probe into and away from the switch at a controlled speed. Also capable of applying a specified force.

CONTACT BOUNCE TIME MEASURING INSTRUMENT METHOD

7. Procedure

7.1 *Pre Test Setup*:

7.1.1 Secure switch on test surface.

7.1.2 Connect switch terminals as shown in Fig. 5 or as specified by manufacturer.

7.2 *In Process Test (T_{CBM} and T_{CBB})—Contact Bounce Time Measuring Instrument Method*:

7.2.1 Activate switch in a consistent, repeatable, controlled manner. If a mechanical probe is used apply force with a preselected value (to be reported later).

7.2.2 Record T_{CBM}.

7.2.3 Release switch after desired interval in a consistent, repeatable, controlled manner (to be reported later).

7.2.4 Record T_{CBB}.

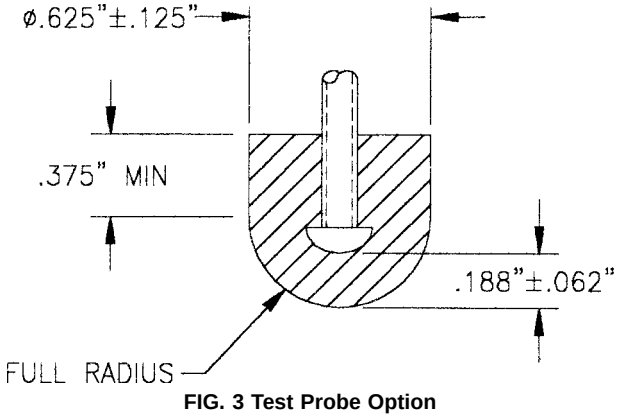

FIG. 3 Test Probe Option

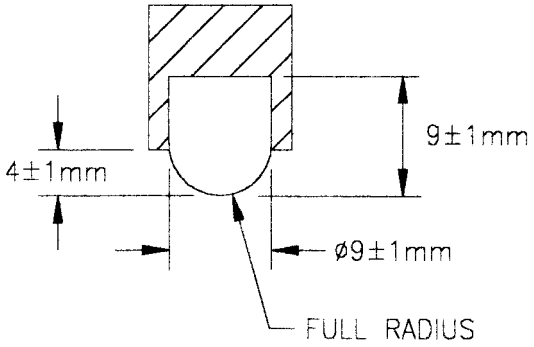

FIG. 4 Test Probe Option

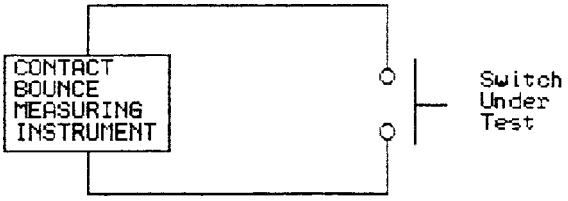

FIG. 5 Test Setup Option

7.2.5 Repeat 7.2.1-7.2.4 four more times.

OSCILLOSCOPE METHOD

8. Procedure

8.1 *Pretest Setup*:

8.1.1 Secure switch on test surface.

8.1.2 Connect switch terminals as shown in Fig. 6 so that:

$$R_L = 10 \text{ to } 100 \text{ times } R_S$$

8.1.3 Adjust oscilloscope to initial settings as follows:

8.1.3.1 One half to 1.0 V/cm vertical, and

8.1.3.2 Two to 3 ms/cm horizontal.

8.1.4 Adjust to rising waveform when measuring T_{CBM}.

8.1.5 Adjust to falling waveform when measuring T_{CBB}.

8.2 *In Process Test (T_{CBM})*:

8.2.1 Activate switch in a consistent, repeatable, controlled manner. If a mechanical probe is used apply force with a preselected value (to be reported later).

8.2.2 Release switch.

8.2.3 Record T_{CBM} (see Fig. 2) from oscilloscope display.

8.2.4 Repeat 8.2.1-8.2.3 four more times.

8.3 *In Process Test (T_{CBB})*:

8.3.1 Start test with switch activated.

8.3.2 Release switch in a consistent, repeatable, controlled manner (to be reported later).

8.3.3 Record T_{CBB} from oscilloscope display.

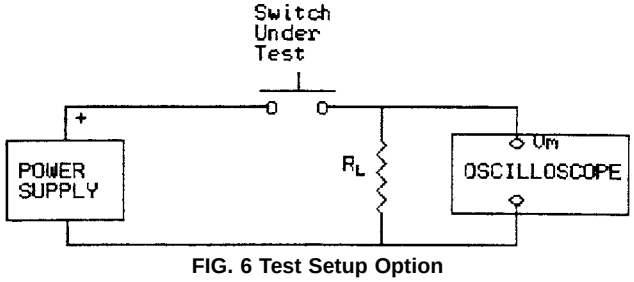

FIG. 6 Test Setup Option

8.3.4 Repeat 8.3.1-8.3.3 four more times.

9. Report

9.1 Report the following information:

9.1.1 Temperature,

9.1.2 Humidity,

9.1.3 Barometric pressure,

9.1.4 Specified resistance (R_S),

9.1.5 Load resistance (R_L) (if using oscilloscope method),

9.1.6 T_{CBM}(min), T_{CBM}(max),

9.1.7 T_{CBB}(min), T_{CBB}(max),

9.1.8 Part number or description of switch under test, or both,

9.1.9 Date of test,

9.1.10 Description of oscilloscope or contact bounce time measuring instrument,

9.1.11 SUTV for oscilloscope method, UTV for contact bounce time measuring instrument method,

9.1.12 SLTV for oscilloscope method, LTV for contact bounce time measuring instrument method,

9.1.13 Completely describe means of activating switch, include details such as:

9.1.13.1 Size, shape and durometer of probe,

9.1.13.2 Actuation force,

9.1.13.3 Velocity of probe, and

9.1.13.4 Any other relevant information needed to duplicate test.

10. Precision and Bias

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

11. Keywords

11.1 contact bounce; membrane switch