



Standard Test Method for Determining the Actuation Force and Contact Force of a Membrane Switch ¹

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1. Scope

1.1 This test method covers the measurement of actuation force or contact force, or both, of a membrane switch utilizing a pre-determined resistance value.

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:* ²

D 2240 Test Method for Rubber Property-Durometer Hardness

F 1570 Test Method for Determining the Tactile Ratio of a Membrane Switch

3. Terminology

3.1 *Definitions:*

3.1.1 *actuation force (Fa)*—the maximum force measure prior to or including point at which contact closure is achieved on a membrane switch.

3.1.2 *contact closure (make)*—the event at which a specified resistance is achieved.

3.1.3 *contact force (Fc)*—the force at contact closure.

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

3.1.5 *non-tactile switch*—a switch assembly that has a tactile ratio equal to zero (see Test Method F 1570).

3.1.6 *specified resistance*—maximum allowable resistance as measured between two terminations whose internal switch contacts are held closed to complete a circuit.

3.1.7 *tactile switch*—a switch assembly that provides a tactile ratio greater than zero (see Test Method F 1570).

4. Significance and Use

4.1 Specified resistance is useful to manufacturers and users when designing membrane switch interface circuitry.

4.2 Actuation force and contact force are useful to manufacturers and users in determining the suitability, preference and aesthetics of a membrane switch in a given application.

5. Apparatus

5.1 *Test Probe*—Test probes that do not meet the following criteria must be fully specified and recorded. Do not change probe type throughout the duration of the test.

Switch to be measured	Material	Size and Shape
Tactile switch	Metal or non-elastic	Flat tip 25 to 50 % of tactile element diameter recommended. See Fig. 1.
Non-tactile switch	Inert elastomeric material Hardness = A/45 ± 5 per Test Method D 2240	Fig. 2 or Fig. 3 or specified

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

5.3 *Device*, to hold test probe securely and provide perpendicular movement into and away from switch under test.

5.4 *Resistance Measuring Device*, that is, ohm meter. The device should not apply a voltage outside the operating range of the switch contacts.

5.5 *Suitable Monitoring Device*, to measure force on test probe.

6. Procedure

6.1 *Pre-Test Setup:*

6.1.1 Secure switch on test surface.

6.1.1.1 Precondition switch by depressing manually 25 times.

6.1.2 Position test probe over desired area of switch.

6.1.3 Lower probe until tip is just above top surface of switch without touching.

6.1.4 Connect switch terminals to resistance measuring device (see Fig. 4).

6.2 *In-Process 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* volume information, refer to the standard's Document Summary page on the ASTM website.

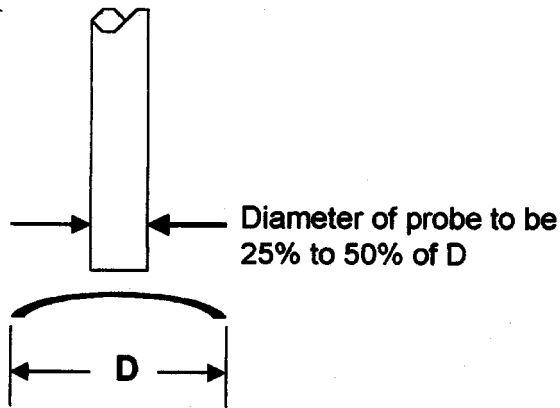


FIG. 1 Test Probe Option

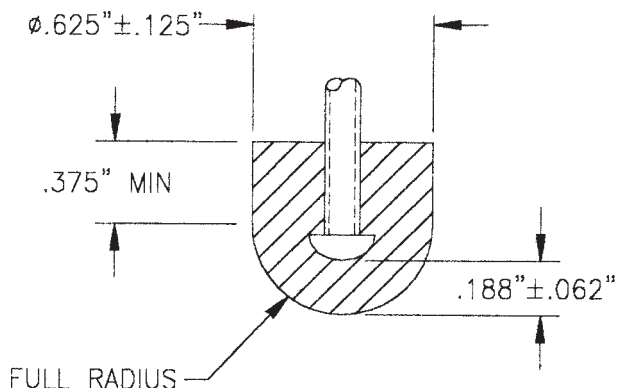


FIG. 2 Test Probe Option

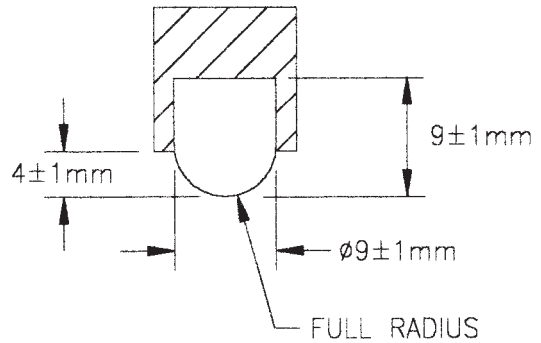


FIG. 3 Test Probe Option

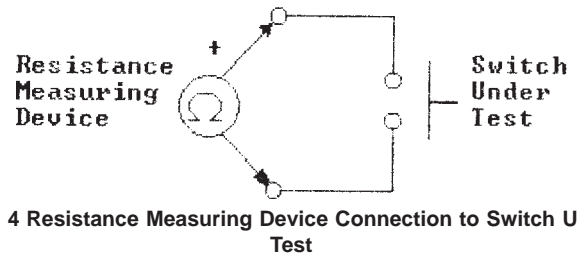


FIG. 4 Resistance Measuring Device Connection to Switch Under Test

- 6.2.1 Begin by activating test probe movement down at a rate not to exceed 13 mm/s.
- 6.2.2 Monitor force and resistance during probe movement.
- 6.2.3 When specified resistance is achieved, record force on probe as contact force (F_c).
- 6.2.3.1 Stop downward movement of test probe.
- 6.2.4 Record maximum force on probe seen during probe movement as actuation force (F_a). This value can be greater than or equal to F_c .
- 6.2.5 Retract test probe to the same position as 6.1.3.
- 6.2.6 Repeat 6.2.1-6.2.5 four more times.

7. Calculations

- 7.1 Determine the averages of five readings and record as F_c and F_a .

8. Report

- 8.1 Report the following information:
 - 8.1.1 Temperature,
 - 8.1.2 Humidity,
 - 8.1.3 Barometric Pressure,
 - 8.1.4 Test probe shape and durometer,
 - 8.1.5 Actuation force (F_a) (may equal contact force),
 - 8.1.6 Contact force (F_c),
 - 8.1.7 Specified resistance,
 - 8.1.8 Description of probe holding fixture and monitoring device,
 - 8.1.9 Part number or description of switch, or both, and
 - 8.1.10 Date of test.

9. Precision and Bias

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

10. Keywords

- 10.1 actuation force; contact force; membrane switch

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