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Standard Test Method for Measuring the Force-Displacement of a Membrane Switch[1]

This standard is issued under the fixed designation F 2592; 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 measurement of force displacement characteristics of a membrane switch.

~~1.1.1This test method replaces Test Method F1570. The Tactile Response Slope has been determined to be a more representative characterization of a tactile sensation.~~

~~1.1.2This test method replaces Test Method F1682.~~

~~1.1.3This test method replaces Test Method F1597.~~

~~1.1.4This test method replaces Test Method F1997.~~

1.1.1 This test method replaces Test Method F 1570 (Tactile Ratio). Tactile Response Slope better represents the characterization of tactile sensation, previously called "Tactile Ratio" in Test Method F 1570.

1.1.2 This test method replaces Test Method F 1682 (Travel).

1.1.3 This test method replaces Test Method F 1597 (Actuation and Contact Force).

1.1.4 This test method replaces Test Method F 1997 (Switch Sensitivity).

1.2 Force displacement hysterisis loop curve can be used in the determination of Actuation Force, Displacement, Contact Force, Return Force, and Tactile Response Slope.

1.3 *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:*

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

F 1597 Test Method for Determining the Actuation Force and Contact Force of a Membrane Switch

F 1682 Test Method for Determining Travel of a Membrane Switch

F 1997 Test Method for Determining the Sensitivity (Teasing) of a Tactile Membrane Switch

3. Terminology

~~2.1~~

3.1 *Definitions:*

~~2.1.1~~

3.1.1 *break displacement (Tb)*—the displacement at contact break.

~~2.1.2~~

3.1.2 *break force (Fb)*—the force at contact break.

~~2.1.3~~

3.1.3 *circuit resistance*—electrical resistance as measured between two test points whose internal contacts, when held closed, complete a circuit.

~~2.1.4~~

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

~~2.1.5~~

3.1.5 *contact break*—point at which circuit resistance is higher than specified resistance on return.

~~2.1.6~~

3.1.6 *contact displacement (Tc)*—the displacement at contact closure.

~~2.1.7~~

[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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3.1.7 *contact force (Fc)*—the force at contact closure.

~~2.1.8~~

3.1.8 *displacement*~~—measured distance of movement when a membrane switch is depressed.~~

~~2.1.9~~*—displacement is sometimes referred to as "switch travel."*

3.1.9 *F*max—an applied force, maximum force measured prior to or including point (*F*min) (see Fig. 1).

~~2.1.9.1~~

3.1.9.1 *Discussion*—Sometimes referred to as Actuation Force.

~~2.1.10~~

3.1.10 *F*min—an applied force, minimum force seen between *F*max and point at which probe movement ceases.

~~2.1.10.1~~

3.1.10.1 *Discussion*—*F*max can equal *F*min.

~~2.1.11~~

3.1.11 *force-displacement hysteresis curve*—relationship between force applied and displacement of a membrane switch in terms of the actuation and return (recovery).

~~2.1.11.1~~

3.1.11.1 *Discussion*—Usually expressed as a line graph; sometimes referred to as Force-Travel curve (see Fig. 1).

~~2.1.12~~

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

~~2.1.13~~

3.1.13 *non-tactile switch*—switch that does not have a tactile response and therefore has a response slope equal to zero because *F*max and *F*min are the same (see Fig. 2).

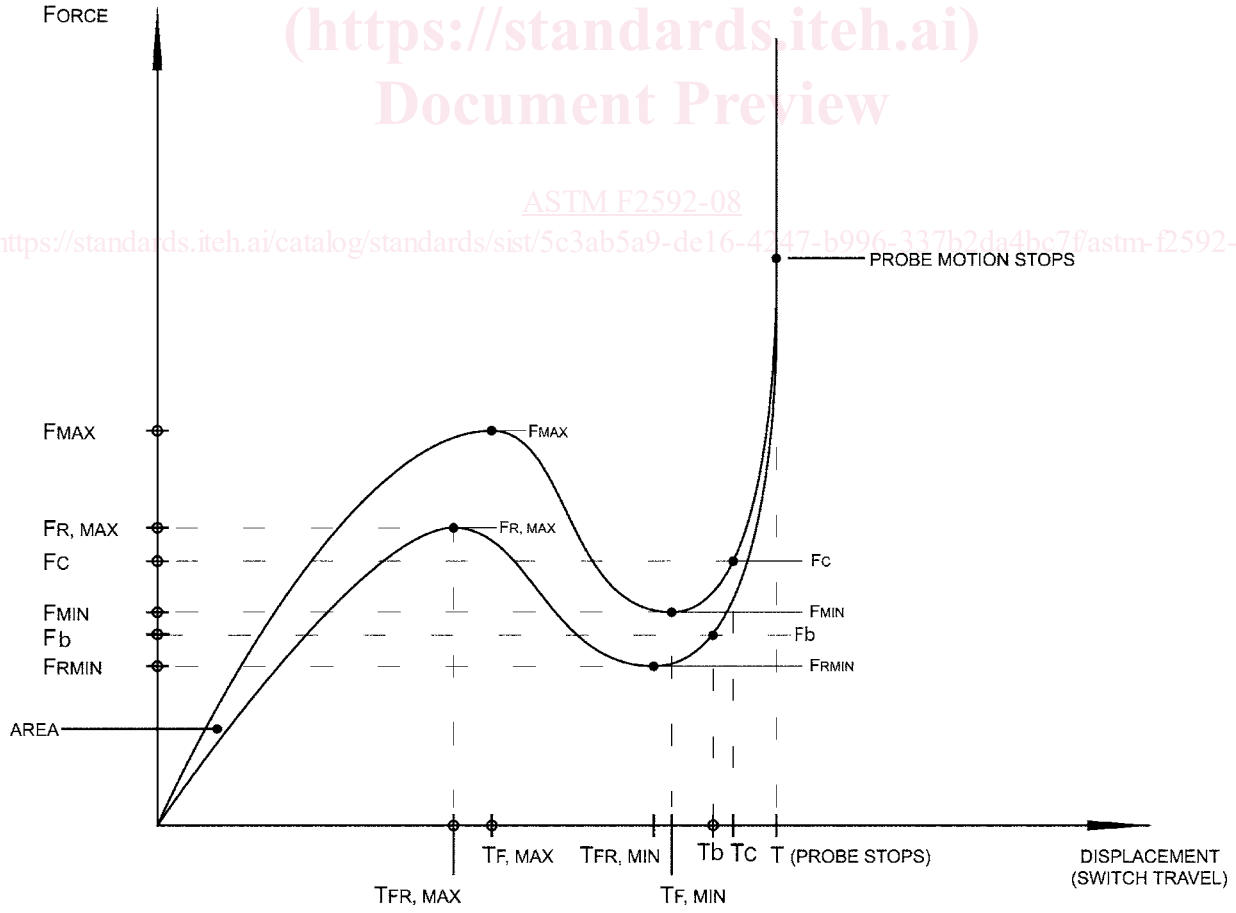
~~2.1.14~~

3.1.14 *return min force (Fr*min)—minimum force seen during return cycle before reaching *Fr*max.

~~2.1.15~~

3.1.15 *return max force (Fr*max)—maximum force measured during return cycle after achieving *Fr*min.

~~2.1.16~~



NOTE—Area between forward and return curves is the difference in work by the tactile mechanism showing hysterisis in the tactile system.

FIG. 1 Force Displacement Hysterisis Loop

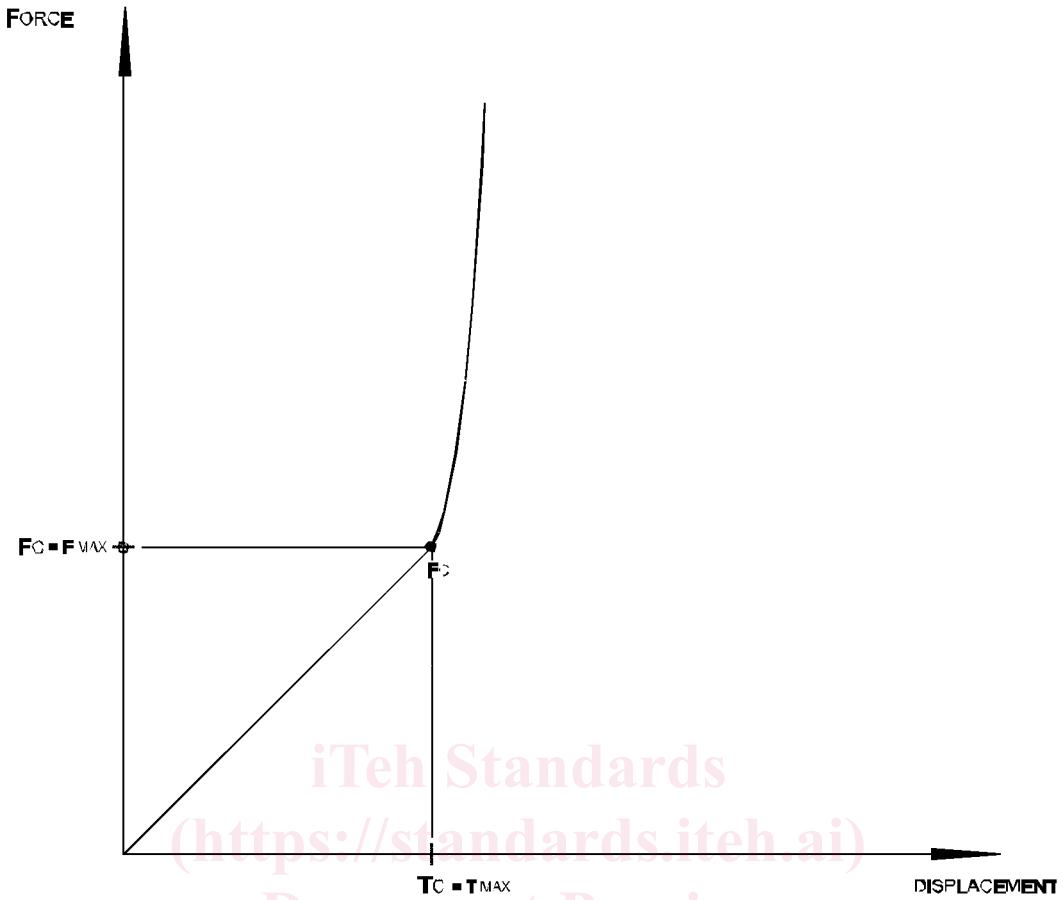


FIG. 2 Non-Tactile Switch Force Displacement

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

~~2.1.17~~

3.1.17 *switch teasing (break)*—the displacement measurement on the force-displacement curve between contact break (*Fb*) and return force (*F*rmin).

~~2.1.18~~

3.1.18 *switch teasing (make)*—the displacement measurement on the force-displacement curve between contact force (*Fc*) and minimum force (*F*min).

~~2.1.19~~

3.1.19 *tactile recovery slope*—rate of change of return force with respect to displacement, as measured between *TFr*min and *TFr*max (see Fig. 3).

~~2.1.20~~

3.1.20 *tactile response*—a physical sensation, caused by a sudden collapse or snapback, or both, of a membrane switch.

~~2.1.21~~

3.1.21 *tactile response slope*—rate of change of applied force with respect to displacement, as measured between *Tf*max and *Tf*min (see Figs. 3 and 4).

~~2.1.22~~

3.1.22 *tactile switch*—a switch that has a tactile response and therefore has a response slope less than zero (negative slope).

~~2.1.23~~

3.1.23 *Tf*max—Displacement at *F*max.

~~2.1.24~~

3.1.24 *Tf*min—Displacement at *F*min.

~~2.1.25~~

3.1.25 *Tfr*max—displacement at *F*rmax.

~~2.1.26~~

3.1.26 *Tfr*min—displacement at *Fr*min.