



Designation: ~~F2592-08~~ Designation: F 2592 - 09

Standard Test Method for Measuring the Force-Displacement of a Membrane Switch¹

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.

1.1.1 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 hysteresis 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:~~

~~F1570 Test Method for Determining the Tactile Ratio of a Membrane Switch~~

~~F1597~~

~~F1682 Test Method for Determining Travel of a Membrane Switch~~

~~F1997 Test Method for Determining the Sensitivity (Teasing) of a Tactile Membrane Switch~~

3. Terminology

~~3.1~~

2.1 Definitions:

~~3.1.1~~

2.1.1 break displacement (T_b)—the displacement at contact break.

~~3.1.2~~

2.1.2 break force (F_b)—the force at contact break.

~~3.1.3~~

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

~~3.1.4~~

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

~~3.1.5~~

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

~~3.1.6~~

2.1.6 contact displacement (T_c)—the displacement at contact closure.

~~3.1.7~~

2.1.7 contact force (F_c)—the force at contact closure.

~~3.1.8~~

2.1.8 displacement—displacement is sometimes referred to as “switch travel.”

~~3.1.9~~—measured distance of movement when membrane is depressed.

2.1.8.1 Discussion—Displacement is sometimes referred to as “switch travel.”

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2.1.9 F_{max} —an applied force, maximum force measured prior to or including point (F_{min}) (see Fig. 1).

3.1.9.1

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

3.1.10

2.1.10 F_{min} —an applied force, minimum force seen between F_{max} and point at which probe movement ceases.

3.1.10.1

2.1.10.1 *Discussion*— F_{max} can equal F_{min} .

3.1.11

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

3.1.11.1

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

3.1.12

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

3.1.13

2.1.13 *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).

3.1.14

2.1.14 *return min force (F_{rmin})*—minimum force seen during return cycle before reaching F_{rmax} .

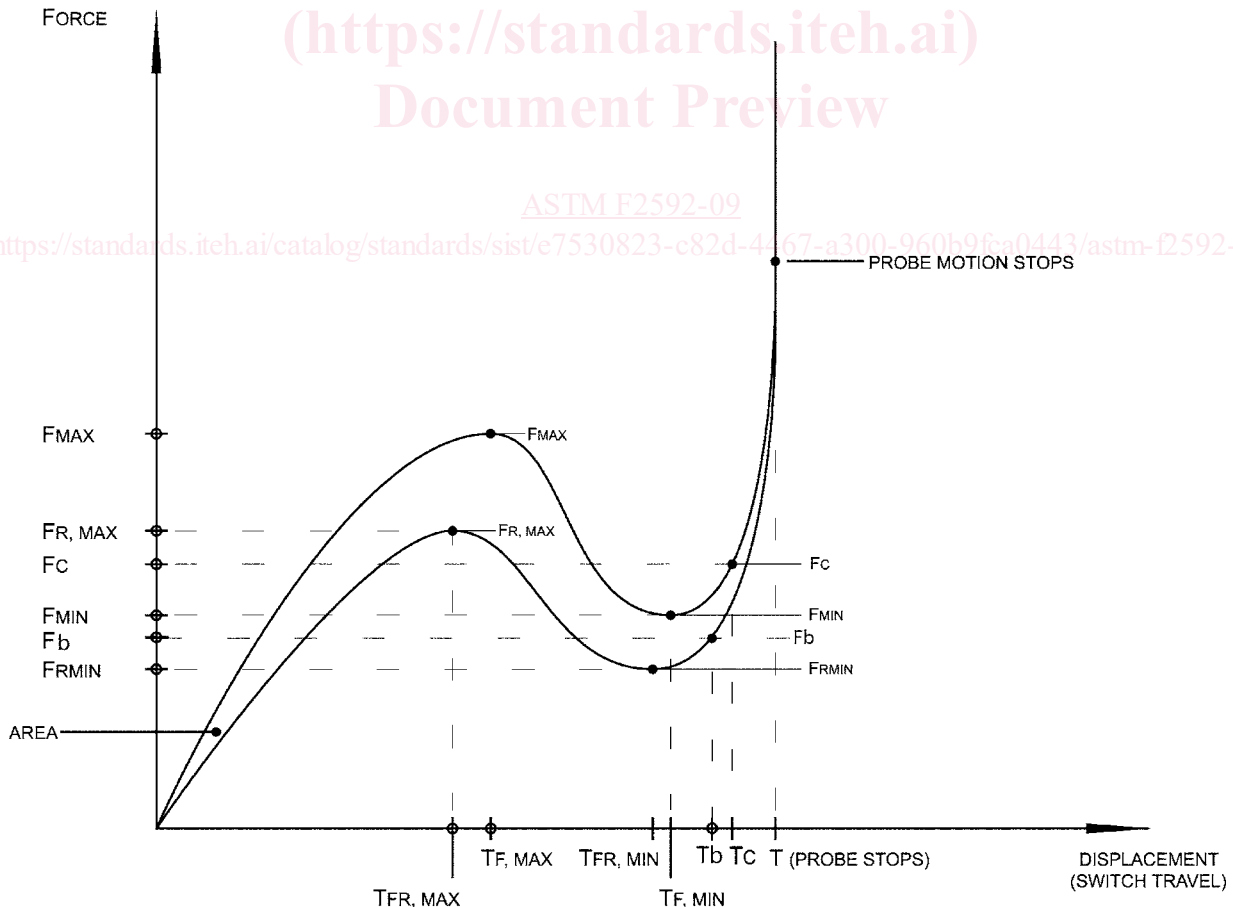
3.1.15

2.1.15 *return max force (F_{rmax})*—maximum force measured during return cycle after achieving F_{rmin} .

3.1.16

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

3.1.17



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

FIG. 1 Force Displacement Hysteresis Loop

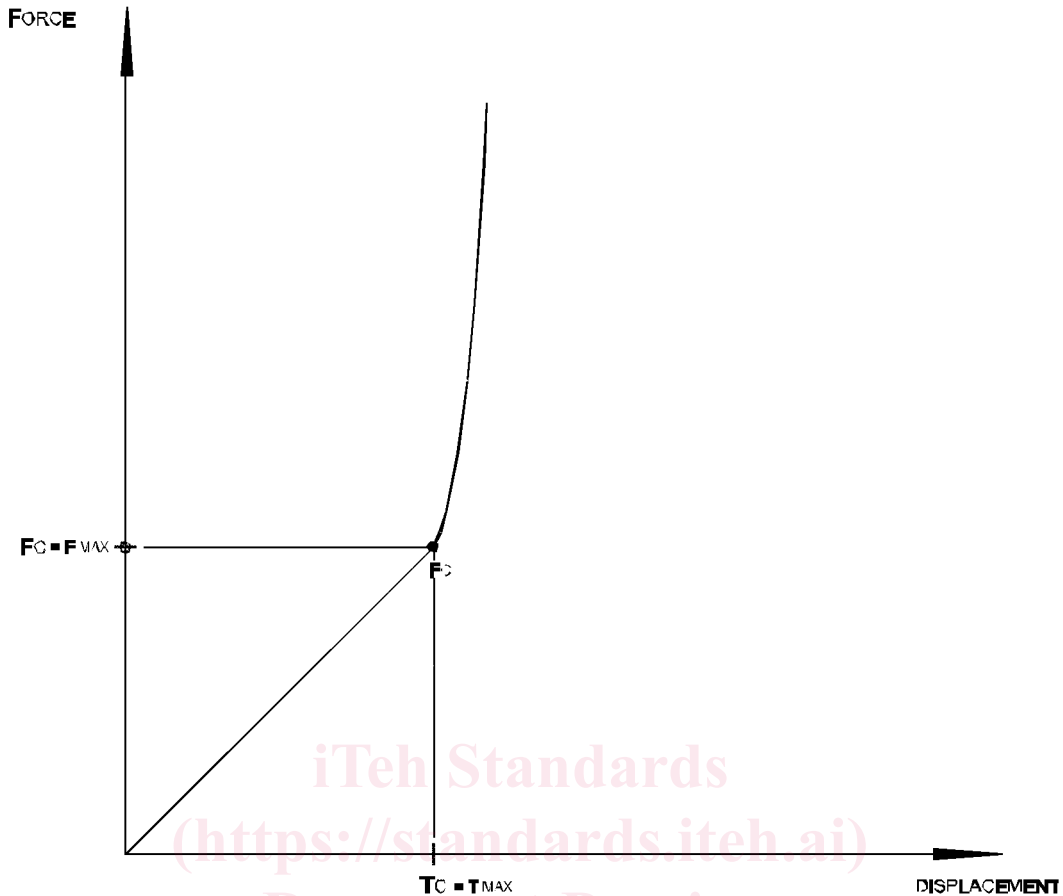


FIG. 2 Non-Tactile Switch Force Displacement

2.1.17 *switch teasing (break)*—the displacement measurement on the force-displacement curve between contact break (F_b) and return force (F_{rmin}).

3.1.18

2.1.18 *switch teasing (make)*—the displacement measurement on the force-displacement curve between contact force (F_c) and minimum force (F_{min}).

3.1.19

2.1.19 *tactile recovery slope*—rate of change of return force with respect to displacement, as measured between TF_{rmin} and TF_{rmax} (see Fig. 3).

3.1.20

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

3.1.21

2.1.21 *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).

3.1.22

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

3.1.23

2.1.23 Tf_{max} —Displacement at F_{max} .

3.1.24

2.1.24 Tf_{min} —Displacement at F_{min} .

3.1.25

2.1.25 Tf_{rmax} —displacement at F_{rmax} .

3.1.26

2.1.26 Tf_{rmin} —displacement at F_{rmin} .