



# Standard Test Method for Determining the Sensitivity (Teasing) of a Tactile Membrane Switch<sup>1</sup>

This standard is issued under the fixed designation F 1997; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method establishes procedures for depressing and releasing a tactile membrane switch to determine the amount of switch teasing, if any.

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:*<sup>2</sup>

**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

## 3. Terminology

3.1 *Definitions:* Refer to **Figs. 1 and 2** for the following terms.

3.1.1 *actuation force ( $F_{max}$  of  $F_a$ )*—maximum force measured prior to or including point at which contact closure is achieved (see Test Method **F 1597**).

3.1.2 *break force ( $F_b$ )*—the force at contact break.

3.1.3 *break travel ( $T_b$ )*—the travel at contact break.

3.1.4 *circuit resistance*—electrical resistance as measured between two terminations whose internal contacts, when held closed, complete a circuit.

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

3.1.6 *contact closure (make)*—point at which specified resistance is achieved.

3.1.7 *contact force ( $F_c$ )*—the force at contact closure (see Test Method **F 1597**).

3.1.8 *contact travel ( $T_c$ )*—the travel at contact closure.

3.1.9  *$F_{min}$* —minimum force seen between  $F_{max}$  and point at which probe movement ceases.

3.1.10 *force-displacement curve*—relationship between force applied and displacement of a membrane switch. Sometimes referred to as “force-travel curve”.

3.1.10.1 *Discussion*—usually expressed as a line graph.

3.1.11 *force-resistance curve*—the relationship between force applied and resistance of a membrane switch.

3.1.11.1 *Discussion*—usually expressed as a line graph.

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

3.1.13 *nontactile switch*—a switch assembly that has a tactile ratio equal to zero.

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

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

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

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

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

3.1.19 *tactile ratio*—a measure of tactile response (see Test Method **F 1570**).

3.1.20 *tactile response*—a sudden collapse or snapback of a membrane switch prior to contact closure or after contact break.

3.1.21 *tactile switch*—a switch assembly that provides a tactile ratio greater than zero.

3.1.22  *$T_b$* —travel at contact break.

3.1.23  *$T_{fm}$* —travel at  $F_{min}$ .

3.1.24  *$T_r$* —travel at  $F_r$ .

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

## Tease on Make

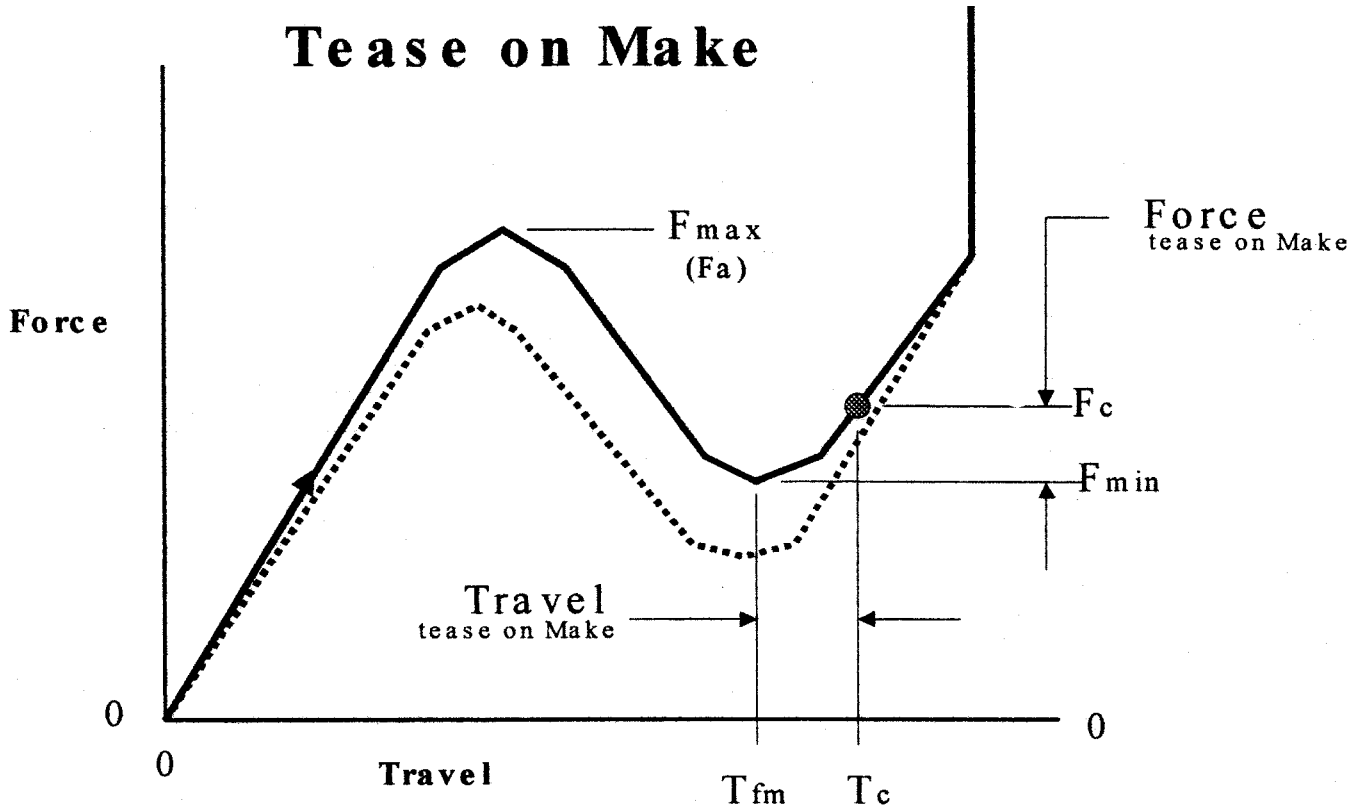


FIG. 1 Tease on Make

## Tease on Break

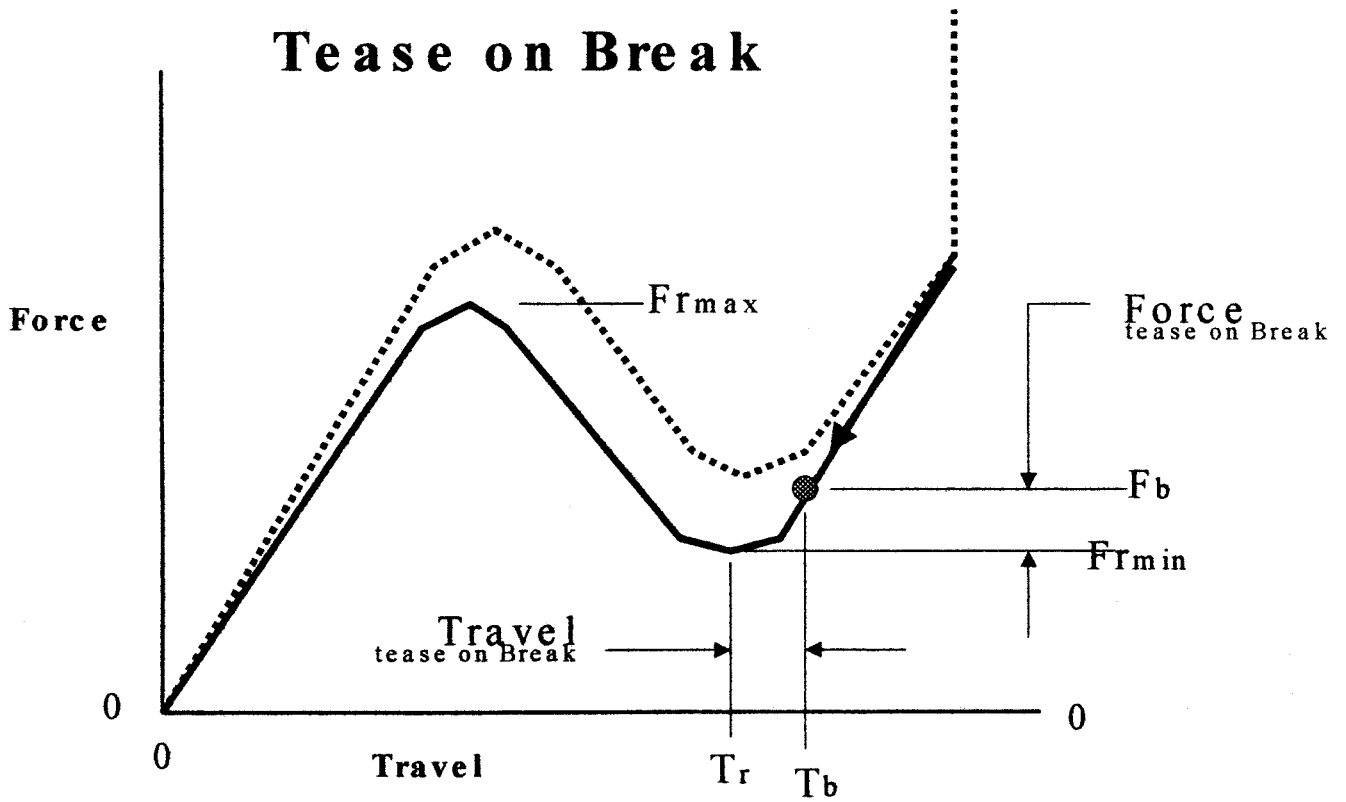


FIG. 2 Tease on Break

3.1.25 *Travel (displacement)*—distance traveled by the surface in contact with the test probe.

#### 4. Significance and Use

4.1 The tendency of a switch to make or break electrical contact at unexpected moments during closure or release can be a sign of a poor design. The degree of teasing can range from a simple annoyance to a failure of critical control process.

4.2 The amount of switch sensitivity or teasing can also be a result of poor surface conductivity that will prevent an electrical event even when switch poles are in partial contact.

#### 5. Apparatus

5.1 *Test Probe*: non-elastic, size and shape to be 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.

5.6 *Suitable Monitoring Device*, to measure travel.

#### 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 Connect switch terminals to resistance measuring device.

6.1.4 Zero gages.

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

6.2 *In-Process 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 During probe movement record  $F_{max}$  and  $F_{min}$ .

6.2.4 Record  $T_{fm}$  (travel at  $F_{min}$ ).

6.2.5 Monitor resistance during probe movement and note when specified resistance is achieved:

6.2.5.1 Record force on probe as  $F_c$ .

6.2.5.2 Record travel as  $T_c$ .

6.2.6 Continue probe movement downward until probe movement stops or when force on probe is a minimum of 110 % of  $F_{max}$ .

6.2.7 Reverse direction of test probe at a rate not to exceed 13 mm/s.

6.2.8 Record  $F_{rmin}$  and  $T_r$ .

6.2.9 Monitor resistance during probe movement and note when resistance is higher than the specified resistance and:

6.2.9.1 Record force on probe as  $F_b$ , and

6.2.9.2 Record travel as  $T_b$ .

#### 7. Calculation

7.1 Determine switch teasing at make:

7.1.1 Travel switch tease (make) =  $T_c - T_{fm}$

7.1.2 Force switch tease (make) =  $F_c - F_{min}$

7.2 Determine switch teasing at break:

7.2.1 Travel switch tease (break) =  $T_b - T_r$

7.2.2 Force switch tease (break) =  $F_b - F_{rmin}$

#### 8. Report

8.1 Report the following information:

8.1.1 Travel switch tease (make).

8.1.2 Force switch tease (make).

8.1.3 Travel switch tease (break).

8.1.4 Force switch tease (break).

8.1.5 Temperature.

8.1.6 Relative humidity.

8.1.7 Barometric pressure.

8.1.8 Shape and size of probe.

8.1.9 Probe speed.

8.1.10 Description of probe holding fixture and monitoring devices.

8.1.11 Part number or description of switch, or both, and

8.1.12 Date of test.

#### 9. Keywords

9.1 displacement; membrane switch; switch sensitivity; switch tease; travel

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