Designation: F1895 – 14

Standard Test Method for Submersion of a Membrane Switch[1]

This standard is issued under the fixed designation F1895; 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 establishes procedures for the submerging of a membrane switch to verify resistance to ingress of a specified liquid.

1.2 This test method can also be used to verify the ability of a membrane switch or graphics layer to act as a liquid seal for a finished product.

1.3 Additional test methods or practices can be incorporated to investigate specific results or capabilities.

1.4 This test method is a modification of National Electrical Manufacturers Assoc. (NEMA) Publication 250-1991 Section 6.10, which is a test for submersion of a finished product housing.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *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]

F1595 Practice for Viewing Conditions for Visual Inspection of Membrane Switches

F1663 Test Method for Determining the Capacitance of a Membrane Switch

F1680 Test Method for Determining Circuit Resistance of a Membrane Switch

F1689 Test Method for Determining the Insulation Resistance of a Membrane Switch

2.2 *National Electrical Manufacturers Assoc.:*[3]

(NEMA) Publication 250-1991

3. Terminology

3.1 *Definitions:*

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

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

3.1.3 *silver migration*—growth of fine crystals between silver conductors of a thick film circuit due to an ionic reaction to the presence of water and an applied dc voltage potential.

4. Significance and Use

4.1 The presence of water inside a membrane switch can affect its mechanical operation or electrical functionality, or both. Electrical failure can result as short circuits due to silver migration or exceeding the specified resistance due to oxidation.

4.2 This test method establishes a procedure to verify the ability of a membrane switch to resist the entry of liquid in itself or a finished product, or both. It is useful in identifying design deficiencies.

4.3 Submersion testing may be destructive, therefore any samples tested should be considered unfit for future use.

5. Interferences

5.1 *External Venting*—any deliberate external venting of the switch will allow liquid to enter.

5.2 *Atmospheric Pressure*—significant changes in atmospheric pressure during the test or at different facilities may alter the time in which leakage might occur.

5.3 *Duration of Test*—longer submersion time increases the possibility of leakage.

[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.

Current edition approved Jan. 1, 2014. Published January 2014. Originally approved in 1998. Last previous edition approved in 2010 as F1895 - 10a. DOI: 10.1520/F1895-14.

[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.

[3] Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1752, Rosslyn, VA 22209, http://www.nema.org.

5.4 *Dye Coloring*—chose a dye coloring that will not chemically attack the materials.

6. Apparatus

6.1 *Tub* of sufficient size and depth (w/cover) for the entire switch, including any mounting surface to be submerged by at least 1 in. (25.4 mm) or as specified.

6.2 An appropriate device of fixture to hold the switch in a fixed position.

6.3 Any additional equipment as required by other test methods employed.

7. Test Specimen

7.1 The test specimens may be membrane switches with or without graphics.

7.2 Laminate to specified material or to a rigid clear material (using a clear material will facilitate visual inspection).

7.3 Membrane switches or graphic overlays designed to act as a liquid seal for the finished product are to be applied to a rigid material.

8. Conditioning

8.1 Condition specimens by exposure to ambient conditions for 72 h prior to submersion to allow full cure of adhesives.

8.2 Consideration should be given to mechanically conditioning the switch to simulate the stress and strain of handling and assembly.

9. Procedure

9.1 *Pre-Test Setup:*

9.1.1 Fixture Unit Under Test (UUT) horizontally (or as specified) and perform the following tests:

9.1.1.1 Measure circuit resistance in accordance with Test Method F1680 of preselected (or all) switches.

9.1.1.2 Measure capacitance in accordance with Test Method F1663 of preselected (or all) mutually isolated test points.

9.1.1.3 Measure insulation resistance in accordance with Test Method F1689 of preselected (or all) conductive points.

9.1.1.4 Visually inspect in accordance with Practice F1595 and note anything that could affect results or of interest to compare after test. Pictures of UUT may be useful as well but not required.

9.1.2 Fill tub with specified liquid to provide a level of approximately 1 in. (25.4 mm) above the uppermost surface of UUT or as specified.

9.1.3 Add dye coloring and stir for consistency (optional). Add dyed saline solution and stir for consistency (other trace methods i.e. fluroescein)

9.1.4 Allow liquid bath to stabilize to ambient temperature.

9.2 *In-Process Test*

9.2.1 Position UUT in tub using appropriate fixturing; cover tub.

9.2.2 Keep UUT submerged for 24 h or as specified.

9.2.3 Remove UUT and allow to air dry.

9.2.4 Test switch for proper function is required.

9.2.5 Test the same characteristics as performed in 9.1.1 and if liquid has penetrated the UUT record as much detail as possible the extent of penetration seen by visual inspection. Pictures of UUT may be useful as well but not required.

10. Report

10.1 Report the following information:

10.1.1 Bath temperature.

10.1.2 Liquid used.

10.1.3 Atmospheric Pressure.

10.1.4 Duration of Test.

10.1.5 Physical/Aesthetic Changes.

10.1.5.1 Visual inspection (Practice F1595).

10.1.5.2 Liquid penetration description.

10.1.5.3 Pictures of UUT (if available).

10.1.6 *Electrical Characteristic Changes:*

10.1.6.1 Circuit resistance (Test Method F1680).

10.1.6.2 Capacitance (Test Method F1663).

10.1.6.3 Insulation resistance (Test Method F1689).

10.1.7 Method of mechanically conditioning, if any.

11. Precision and Bias

11.1 Precision and bias for non-quantitative results, such as visual changes, are not required.

12. Keywords

12.1 immersion; membrane switch; submersion; water immersion