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Practice for Submersion of a Membrane Switch[1]

This standard is issued under the fixed designation F 1895; 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 practice establishes procedures for the submerging of a membrane switch to verify resistance to ingress of a specified liquid.

1.2 This practice 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 practice is a modification of National Electrical Manufacturers Assoc. (NEMA) Publication Number 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 the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *National Electrical Manufacturers Assoc.:*
NEMA Publication 250-1991[2]

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 practice 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.

5.4 *Dye Coloring*—chose a dye coloring that will not chemical 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.

9. Procedure

9.1 *Pre-Test Setup*:

9.1.1 Fixture Unit Under Test (UUT) horizontally (or as specified).

[1] This practice 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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[2] Available from NEMA, 1300 N 17th St., Suite 1847, Rosslyn, VA 22209.

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).

9.1.4 Allow liquid bath to stabilize to ambient temperature.

9.2 *In-Process Test*

9.2.1 Test switch for proper function if required.

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

9.2.3 Keep UUT submerged for 24 h or as specified.

9.2.4 Remove UUT and allow to air dry.

9.2.5 Test switch for proper function if required.

9.2.6 Perform visual inspection to determine if liquid has penetrated the UUT.

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

10.1.6 Functional Test Data if required.

11. Keywords

11.1 immersion; membrane switch; submersion; water immersion