



Designation: F2865 – 13

Standard Guide for Classifying the Degrees of Ingress of Dust and Water into a Membrane Switch¹

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1. Scope

1.1 This guide establishes a classification system and references test methods for verifying the degrees of:

1.1.1 The ingress of dust into the internal layers of a membrane switch.

1.1.2 Ingress of water into the internal layers of a membrane switch.

1.1.3 Where external test methods are referenced, this guide specifies the special conditions that shall be considered in applying these tests to membrane switches and how the results are interpreted.

1.2 This guide references test methods that can be used to establish the ingress classification of a membrane switch.

1.3 This guide utilizes the test methods and reporting structure of IEC 60529 – (Degrees of Protection Provided by Enclosures) modified for membrane switches.

2. Referenced Documents

2.1 ASTM Standards:²

F1578 Test Method for Contact Closure Cycling of a Membrane Switch

F1595 Practice for Viewing Conditions for Visual Inspection of Membrane Switches

F1680 Test Method for Determining Circuit Resistance of a Membrane Switch

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

F2592 Test Method for Measuring the Force-Displacement of a Membrane Switch

2.2 IEC Standard:³

60529 Degrees of Protection Provided by Enclosures

¹ This guide 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 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 International Electrotechnical Commission (IEC), 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, <http://www.iec.ch>.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

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

4. Classification System

4.1 The ingress classification of a membrane switch is designated by the MSIP code:

4.1.1 MSIP 6 5 A

4.1.1.1 MSIP = Membrane Switch Ingress classification.

4.1.1.2 1st Numeral = Dust Protection Code (see Table 1).

4.1.1.3 2nd Numeral = Water (Liquid) Protection Code (see Table 2).

4.1.1.4 A = If “A” is present then method or media deviates from this guide and is reported.

4.1.2 The MSIP code comprises a series of numerals. Each numeral represents the level of ingress offered by the membrane switch to each contaminant. In this guide when addressing only the 1st or 2nd numeral the other numeral is replaced with an “X” for clarity. For example, MSIP X5 refers only to testing for water ingression. The “X” notation is not used as a final designation. If testing is not completed a “0” is used for that numeral (see Table 1 and Table 2).

4.1.3 The numeric designations for dust and water are based on those classified under IEC 60529.

5. Significance and Use

5.1 Ingression protection classifications are widely used by manufacturers for specifying the level of protection offered by enclosures.

5.2 An example of such a classification scheme is IEC 60529. Membrane switch manufacturers are often asked to meet these standards, however the test methods specified within these standards do not address considerations specific to membrane switches.

5.3 The MSIP classification system considers the membrane switch separately from the testing and IP codes used for classifying the enclosure when subject to similar test conditions.

TABLE 1 1st Numeral = Dust Protection Code

Numerals or Letters	Degree of Ingress	Requirement Summary		Test Equipment
0	Not tested or no ingress prevention demonstrated	none	N/A	
1,2,3,4 ^A	Not applicable to membrane switches	none	N/A	
5	Dust protected	Ingress of dust is not totally prevented. The switch operates as declared and the post-test circuit resistance change is less than +30 % of pre-test, and below the maximum circuit resistance as specified by the manufacturer.	IEC 60529 – Dust Chamber	Category 2 – No pressure difference created in the chamber
6	Dust tight	No Ingress of Dust in the internal switch cavities. The switch operates as declared and the post-test circuit resistance change is less than +30 % of pre-test, and below the maximum circuit resistance as specified by the manufacturer.	IEC 60529 – Dust Chamber	Category 2 – No pressure difference created in the test chamber

^AIP codes 1,2,3 and 4 are not applicable to membrane switches because they indicate a level of protection for objects of 50 mm, 12 mm, 2.5 mm and 1.0 mm diameter respectively.

TABLE 2 2nd Numeral = Water (Liquid) Protection Code

Numerals or Letters	Degree of Ingress	Test Equipment	
0	Not tested or no ingress prevention demonstrated	N/A	
1	Vertically dripping	IEC 60529 – Drip Box	
2	Dripping (15 deg tilted)	IEC 60529 – Drip Box	
3	Spraying	IEC 60529 – Oscillating Tube or Spray Nozzle	
4	Splashing	IEC 60529 – Oscillating Tube or Spray Nozzle	
5	Jetting	IEC 60529 – Test Nozzle with 6.3 mm nozzle	
6	Powerful Jetting	IEC 60529 – Test Nozzle with 12.5 mm nozzle	
7	Temporary immersion	IEC 60529 – Complete immersion in water	
8	Continuous immersion	IEC 60529 – Complete immersion in water	

5.4 Ingression testing can be useful to identify design deficiencies.

6. Interferences

6.1 The membrane switch shall be tested in a mounted state specified in this guide because this is a classification of the membrane switch only without consideration of the enclosure.

6.2 The length of time between the manufacture of the membrane switch and the performance of the test.

6.3 The temperature at which the test is being conducted.

7. Conditioning

7.1 Unless otherwise specified in a relevant product standard, the test samples for each test shall be in a clean and new condition, and mounted to the testing backer for 24 h.

7.2 The testing backer must be a rigid transparent backer to better observe the ingression of dust or water into the switch. Testing backer with geometries other than flat shall be reported.

8. Test Method for Ingress of Dust into a Membrane Switch

8.1 Apparatus:

8.1.1 Dust Chamber: Reference IEC 60529 Section 13.4.

8.1.2 Dust Media:

8.1.2.1 For MSIP5X and MSIP6X : Reference IEC 60529 Section 13.4.

8.1.2.2 *MSIP5XA and MSIP6XA*: Media to be specified.

8.1.2.3 *Mounting Surface*—The testing backer must be rigid and transparent and compatible with the mounting adhesive. Testing backer with geometries other than flat shall be reported.

8.2 Pre-Test Setup:

8.2.1 Measurements and Process Testing should be conducted on switches nearest the weakest point for ingress of dust, such as the first switch cavity adjacent to an external vent channel.

8.2.2 Measure the circuit resistance per Test Method **F1680**.

8.2.3 Measure the insulation resistance per Test Method **F1680**.

8.2.4 For additional setup requirement see IEC 60529 Section 13.4.

8.2.5 Perform visual inspection per Practice **F1595** and establish visual baseline to establish pre-test condition.

8.3 In Process Test:

8.3.1 For ingress of dust, numerals 5 and 6, the test is carried out according to Category 2 (testing at atmospheric pressure) per IEC 60529 Section 13.4.