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EIA STANDARD

RS-448

**STANDARD TEST METHODS
FOR
ELECTROMECHANICAL SWITCHES**



MARCH 1978



Engineering Department

ELECTRONIC INDUSTRIES ASSOCIATION

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This Standard contains the major technical contents of International Electrotechnical Commission recommendation IEC 512, Basic Testing Procedures and Measuring Methods for Electromechanical Components for Electronic Equipment. It differs from IEC 512 in certain important respects as given in Appendix B hereto. These differences have been called to the attention of the U.S. Committee of Technical Experts for IEC Technical Committee TC48, and resolution of these differences will be solved in future meetings of TC48.

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STANDARD TEST METHODS FOR ELECTROMECHANICAL SWITCHES

(From Standards Proposal No. 1244, formulated under the cognizance of EIA Working Groups P-5.5 on Rotary Switches, P-5.8 on Slide, Rocker & Toggle Switches, P-5.9 on Non-Sensitive Push-button & Keyboard Switches, and P-5.11 on Sensitive & Thumbwheel Switches.)

1. INTRODUCTION

1.1 Scope

This standard establishes uniform test methods for those tests which are peculiar to electromechanical switches, except those classified as industrial controls (as defined in ANSI C19.3). In case of conflict between this standard and any individual component standards or detail specifications, the requirements of the individual component standards or detail specifications shall govern.

1.1.1 These test methods provide a number of test conditions of varying degrees of severity so that appropriate test conditions may be selected for any particular switch type.

1.2 Similarity With IEC Recommendations

See Appendix B.

These differences have been brought to the attention of the Chief Technical Expert of the U. S. National Committee for IEC Technical Committee TC48, and resolution or differences will be sought in future meetings.

2. DEFINITIONS

2.1 Electromechanical Switch — A switch having mechanical motion and intended for opening and closing, or for changing connections, of one or more electrical circuits by means of separable mechanical contacts.

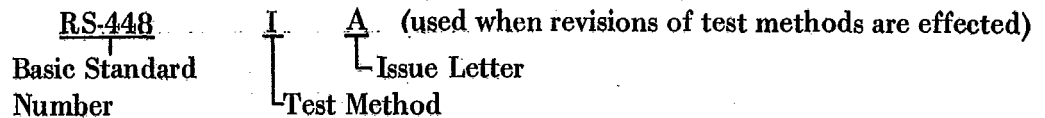
2.2 “Detail Specifications: The part of an applicable specification or standard in which all requirements, sample sizes, reject criteria, test methods, and other information valid for a particular component have been stated or made accessible, and all relevant numerical values are given.”

2.2.1 Herein after, the term “individual component standard” will be used and shall be construed to mean other EIA component standards or any detail specification or drawing which refers to this test-method Standard.

2.3 Referee Test — A referee test is a retest under specific referee conditions of a component part which has failed to meet requirements under standard atmospheric conditions.

3. NUMBERING SYSTEM

Individual test methods are designated by the basic standard number followed by the number of the test method (assigned serially) and an issue letter (capital-letter designation). Thus, a test method may be specified as follows:



4. APPLICATION

Individual switch standards developed by EIA Committees should employ the standard test methods contained herein in preference to other test methods differing in details.

Individual switch standards should refer to particular test methods as shown in the following example:

For Method 6, Terminal Temperature Rise, Issue A "EIA RS-448, Method 6A" and specify the necessary details and options listed at the end of the particular method.

5. STANDARD ATMOSPHERIC CONDITIONS AND REFEREE TESTS

Usual Conditions — Unless specific atmospheric conditions of test are specified in the individual test method, all measurements and tests are to be made under the following conditions:

Temperature	+15 to +35°C (+59 to 95°F)
Relative Humidity	45% to 75%
Air Pressure	860 to 1060 mbar. (650 to 800 mm. of Mercury)

6. STANDARD ATMOSPHERE FOR CONDITIONING AND REFEREE TESTS

If the parameters to be measured depend on temperature, air pressure and humidity, and the law of dependence is unknown, measurements shall be made under the following controlled conditions:

If switches fail to meet the specification requirements under the standard atmospheric conditions above, they may be retested under the controlled conditions below.

If switches are to be conditioned prior to testing to bring them into equilibrium with the test atmosphere, the following controlled conditions should be used:

	<i>Ordinary Tolerance</i>	<i>Close Tolerance</i>
Temperature	$23 \pm 2^{\circ}\text{C}$ ($73 \pm 3.6^{\circ}\text{F}$)	$23 \pm 1^{\circ}\text{C}$ ($73 \pm 1.8^{\circ}\text{F}$)
Relative Humidity	45 to 55%	48 to 52%
Air Pressure	As specified under Standard Atmospheric Conditions	

NOTE: Before measurements are made, the switches shall be stored at measuring temperature and humidity for a time indicated in the individual component standard to allow the test specimens to reach equilibrium with the testing environment.

METHOD 1**SWITCH RESISTANCE****1. PURPOSE**

The purpose of the switch resistance test is to determine the resistance offered to a flow of current during its passage through the conducting path of the switch. The millivolt level test is intended for switches to be utilized at that general level.

2. PROCEDURE

2.1 Switch resistance shall be measured directly using a Kelvin Bridge, or indirectly using the voltmeter-ammeter method, ammeter-potentiometer method, or other suitable means. The maximum allowable measurement error shall be ± 5 percent.

2.2 The points of measurement shall be those at which external leads are normally connected to the switch terminals. Connections to the measurement apparatus shall be made using suitable means, including jigs, clamps, or solder when required by the detail specification.

2.2.1 Switch resistance values are influenced by factors such as resistivity of the surface materials; contact force, shape, area, and condition (including relative cleanliness, smoothness, and hardness); current; open circuit voltage appearing at the contacts during interruption of current; temperature; and thermal conductivity of leads. These factors should be considered in the design of test jigs or clamps, and in performing switch resistance measurements. It is also important to keep the switch free from vibration and to prevent changes in normal contact force which might result from improper application of connections.

2.3 Unless otherwise specified, the test current and open circuit test voltage shall be as specified below. A series resistor may be used provided the specified open circuit test voltage is not exceeded.

2.3.1 Normal level: maximum open circuit test voltage shall be 2 volts DC or 6 volts DC, and test current shall be 100 milliamperes ± 2 percent.

2.3.2 Millivolt level: maximum open circuit test voltage shall be 30 millivolts, and test current shall be 10 milliamperes maximum.

2.4 The number of activations to cleanse the contacts prior to measurement shall be as specified in the detail specification.

2.5 The number of test activations for measurement shall be one, unless otherwise specified in the detail specification.

2.6 The number of measurements per test activation to be made on each contact shall be as specified in the detail specification.

3. SUMMARY

The following details must be specified on the detail specification:

- 3.1 Method of connection (See 2.2).
- 3.2 Number of activations prior to measurement (See 2.4).
- 3.3 Normal or millivolt level (See 2.3).
- 3.4 Open circuit test voltage (See 2.3.1).
- 3.5 Number of test activations if other than as specified in 2.5.
- 3.6 Number of measurements per test activation (See 2.6).
- 3.7 Maximum allowable resistance.

METHOD 2

CAPACITANCE

1. PURPOSE

The purpose of this test is to measure the capacitance of component parts. Preferred test frequencies for this measurement are 60 Hz, 120 Hz, 1kHz, 100kHz, and 1 MHz.

2. PROCEDURE

The capacitance of the specimen shall be measured at or referred to an ambient temperature of 25°C with a capacitance bridge or other suitable method at the frequency specified. The inherent accuracy of the measurement will be ± 0.5 percent ± 0.2 picofarad unless otherwise specified. Suitable measurement technique shall be used to minimize errors due to the connections between the measuring apparatus and the specimen. The alternating-current (AC) voltage actually impressed across the specimen shall be as low as practicable. When a direct-current (DC) polarizing voltage is required, it shall be as specified and shall exceed the peak AC voltage impressed across the specimen; however, the sum of the peak AC and the DC voltage shall not exceed the voltage rating of the specimen.

3. SUMMARY

The following details must be specified in the individual specification:

- A. Test frequency (See 2).
- B. Limit of accuracy, if other than that specified (See 2).
- C. Magnitude of polarizing voltage, if applicable (See 2).
- D. Switch Mounting: mounting plate, mounting screws.
- E. Points of measurement (connections to switch).
- F. Acceptable limits of capacitance.

METHOD 3
CHROMATICITY

Under consideration.

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METHOD 4
TRANSMITTANCY

Under consideration.

METHOD 5**STRENGTH OF MOUNTING MEANS****1. PURPOSE**

This test is intended to evaluate the ability of a threaded bushing mounted switch to withstand a specified mounting torque.

2. PROCEDURE

2.1 The switch shall be mounted to a metal panel using normal mounting means and specified hardware. A torque of 15 pound-inches, or as specified in the detail specification, shall be gradually applied to the mounting nut. Only one mounting nut shall be used in this test.

2.2 When the switch and/or associated mounting hardware incorporates a non-turn feature, the switch shall be mounted in a normal manner, with the mounting nut tightened with a torque of 5 oz.-in. maximum. A torque of 5 lb.-in., or as specified in the detail specification, shall then be applied to the mounted switch body.

3. MEASUREMENTS

After the test the switch shall be examined for damage to the switch, mounting bushing, or their positional locking means; loosening of parts; change in relative positions of parts; operating characteristics; or as specified in the detail specification.

4. SUMMARY

The following details shall be specified in the detail specification:

- 4.1 Use of Procedure 2.1, 2.2, or both.
- 4.2 Torque to be applied to the mounting nut if other than 15 pound-inches (See 2.1).
- 4.3 Torque to be applied to the mounted switch body if other than 5 pound-inches (See 2.2).
- 4.4 Measurements and examinations to be made after test.