

**AMERICAN NATIONAL
STANDARD**

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EIA RS-446-A

EIA STANDARD

NON-SENSITIVE
PUSHBUTTON SWITCHES

RS-446-A

(Revision of RS-446)

(Inclusion of RS-446-1 and RS-446-2)

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NON-SENSITIVE PUSHBUTTON SWITCHES

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NON-SENSITIVE PUSHBUTTON SWITCHES

(From EIA Standards Proposals No. 1441, 1441-A and 1502, formulated under the cognizance of EIA Working Group P-5.9 on Non-Sensitive Pushbutton and Keyboard Switches.)

RS-446-A is a revision of RS-446 and includes material previously found in RS-446-1 (Addendum No. 1 to RS-446) and RS-446-2 (Addendum No. 2 to RS-446).

INTRODUCTION

This Standard was formulated for the purpose of:

- (a) Promoting interchangeability of non-sensitive pushbutton switches, and
- (b) Eliminating misunderstandings or confusion between manufacturers and buyers with respect to product performance values.

EIA Recommended Standard RS-446-A applies to pushbutton switches intended to be installed in control circuits or auxiliary circuits of electronic equipment employing similar techniques. This Standard must be used in conjunction with a detail specification which defines specific values for the performance requirements. The detail specification takes precedence over the requirements of the Standard and may add, delete or modify the requirements of the Standard as long as the requirements outlined in Paragraph 7.0, Table 3, Test Group A are not deleted or diminished. The buyer may utilize the Detail Specification issued by EIA or, if necessary, prepare his own detail specification which references this Standard. The EIA Detail Specifications assign a unique part number to each particular switch configuration covered by the Detail Specification. This part number is adequate to use for procurement of a standard switch. For purposes of this EIA Standard, a standard switch is considered to be a switch which is described by an EIA Detail Specification, and a non-standard switch is considered to be a switch which is not described by an EIA Detail Specification.

When a description of a non-standard switch is required, the manufacturer or the buyer must prepare a detail specification which fully describes the non-standard switch. If the required non-standard switch differs from the switch types described by EIA Detail Specifications, a complete detail specification must be prepared. If the required non-standard switch is similar to the switch types described by the EIA Detail Specification, a detail specification may be prepared by referencing the part number of the standard switch and specifying the differences required from the standard switch.

1.0 SCOPE

This Standard relates to non-sensitive pushbutton switches for use in electrical and electronic equipment, and having a maximum voltage rating of 500 Vac or Vdc or a current rating not exceeding 25 amperes.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect form part of the Standard to the extent specified herein.

2.1 International Electrotechnical Commission (IEC)

Publication 341-1 Pushbutton Switches Part 1: General Requirements and Measuring Methods.

2.2 American National Standards (ANSI)

Standard C1 National Electrical Code (NFPA 70).

Standard S2.2 Method for the Calibration of Shock and Vibration Pickups.

Standard Z310.1 Determining Resistance of Synthetic Polymeric Materials to Fungi (ASTM G21).

2.3 Government Services Administration (GSA)

FED-STD-28 Screw Thread Standards for the Federal Government.

2.4 Electronic Industries Association (EIA)

RS-186E Standard Test Methods for Passive Electronic Component Parts.

RS-448 Standard Test Methods for Electromechanical Switches.

RS-476 Source and Date Code Marking

2.5 Underwriters Laboratories (UL)

UL94 Tests for Flammability of Plastic Materials

3.0 CLASSIFICATION

3.1 EIA Detail Specification

The individual switch requirements shall be as specified herein and in accordance with the applicable EIA Detail Specification. In the event of conflicts between this Standard and the Detail Specification, or other complementary documents, the latter shall govern.

3.2 Part Numbering

Each switch covered by this Standard, as outlined in an EIA Detail Specification (see 3.1), shall be assigned a discrete part number in accordance with Appendix D.

4.0 DEFINITIONS

4.1 Non-Sensitive Pushbutton Switch

A manually operated device containing an actuator and switch having non-critical force and travel characteristics.

4.2 Operating Characteristics

4.2.1 Actuator

The mechanism of the switch or housing which, when moved as intended, will operate the contacts.

4.2.2 Alternate Action (Maintained Position)

A mechanical system in which the button returns to the free position when the operating force is removed for any contact mode. The contact mode changes on successive actuations. The contact mode cannot be determined by the button position.

4.2.3 Alternate Action (Two-Level Maintained)

A mechanical system in which the button alternately assumes two distinct levels when the operating force is removed on successive actuations. The contact mode changes on successive actuations. The contact mode can be visually determined by the button position.

4.2.4 Button

Interface member between actuator and fingertip. The button may be an integral part of the actuator.

4.2.5 Contact Arrangement

The circuitry of the switch and/or the arrangement of the terminals and contacts on a switch station (see Appendix A).

4.2.6 Cycle

The actuation, or actuations, necessary to close or open a set, or sets, of contacts and return to the original mode.

4.2.7 Cycling Rate

The number of cycles of operation for a given time period.

- 4.2.8 **Diffuser**
A device to redirect or scatter the light from a source, primarily by the process of diffuse transmission.
- 4.2.9 **Divider**
A non-translucent device located between light sources to prevent light leakage between sections of a divided button or lens.
- 4.2.10 **Duty Cycle**
A statement of conducting and/or non-conducting times in repetitious operation, normally expressed as a percentage of the total cycle (e.g., 30% on, 70% off).
- 4.2.11 **Filter, Color**
A device used to project color to the display screen or an illuminated button.
- 4.2.12 **Free Position**
The initial position of the actuator when no external force (other than gravity) is applied to it; applies to momentary switches only.
- 4.2.13 **Full Overtravel Force**
The straight line force required to move the switch actuator from the free position to the total travel position.
- 4.2.14 **Illuminated Button**
A button (actuator) with an associated light source(s) which can give visual indication by illumination. The light source(s) may be related to, or independent of, the button action.
- 4.2.15 **Lamp**
A generic term for a man-made light source. By extension, the term is also used to denote sources that radiate in regions of the spectrum adjacent to the visible.
- 4.2.16 **Legend**
Visual information such as numbers, words, abbreviations, or symbols displayed on a button.
- 4.2.17 **Latched Position**
The mechanical position of the actuator after operation to maintain the circuit transfer.

- 4.2.18 **Momentary**
A mechanical system in which the contacts transfer when the button is depressed through the operating position, and the button and contacts return to their original mode when the operating force is removed.
- 4.2.19 **Operating Force**
The force which must be applied to the actuator to cause it to move from the free position to the operating position.
- 4.2.20 **Operating Position**
The position of the actuator at which the circuit transfers.
- 4.2.21 **Overtravel**
The distance between the operating position and the total travel position.
- 4.2.22 **Pretravel**
The distance through which the actuator moves from the free position to the operating position.
- 4.2.23 **Poles**
The number of separate circuits which can conduct current through the switch at one time.
- 4.2.24 **Release Travel**
The distance between the release position and the free position, on non-latching switches.
- 4.2.25 **Reset Force**
The force required to release a two-level alternate action switch from its maintained position to its free position.
- 4.2.26 **Screen Display**
The surface of an illuminated button which displays color with or without legending.
- 4.2.27 **Split Display Screen**
A display screen divided into two or more sections which can be independently illuminated.
- 4.2.28 **Switch Resistance**
See paragraph 6.4.1.
- 4.2.29 **Switch Station**
A setting of the actuator which results in a particular circuit condition.
- 4.2.30 **Total Travel**
The distance which is the sum of the pretravel and the overtravel.
- 4.2.31 **Total Travel Position**
The position of the switch actuator beyond which further travel would cause damage to the switch.

4.2.32 Quality Conformance Inspection

An inspection carried out by or on behalf of the manufacturer on the components he manufactures, in order to establish that their quality is being maintained in accordance with the requirements of the applicable specification.

5.0 DESIGN REQUIREMENTS

5.1 Materials

Materials shall be capable of meeting the specified performance requirements.

5.2 Threads

Threads for removable parts shall be in accordance with FED-STD-28. The unified series of threads shall be used whenever possible.

5.3 Marking

Switches shall be legibly marked with the information noted below. If the switches are too small to be so marked, the containing package shall be marked with the same information.

5.3.1 Manufacturer's Name, Trademark, or Source Code
(Listed in order of preference.)

5.3.2 Identifying Number
(EIA part number, manufacturer's part number, or user's part number. The EIA part number shall only be used on EIA standard switches as defined in the Introduction.)

5.3.3 Terminal Identification

5.3.4 Electrical Rating(s)
To be marked when specified.

5.3.5 Date Code in Accordance with EIA RS-476

The date code shall be a four digit number consisting of the last two digits of the year followed by another two digits for the week of the year. Example: Date code 7632 denotes switches manufactured during the 32nd week of 1976.

5.4 Detail Requirements

Detail requirements shall be as specified in the detail specification.

Switches shall be of the design, construction, and physical dimensions specified by the detail specification, including the following:

5.4.1 Mounting Means

5.4.2 Electrical Terminations

5.4.3 Ratings

The detail specification shall specify:

- A. Rated Voltage
- B. Rated Current
- C. Circuit Conditions and Associated Voltage and Current

5.5 Fungus

Switch insulating materials shall have a rating of 0 to 1 when tested in accordance with the Fungus Test of ANSI Z310.1.

5.6 Flammability

Switch insulating material shall be certified as meeting the 94V-2 flammability requirement of UL94 or better.

5.7 Workmanship

- 5.7.1 Workmanship shall be of the uniformity and grade practicable in a well-equipped factory.

6.0 PERFORMANCE REQUIREMENTS

Unless specific atmospheric conditions are specified in the individual test method, all measurements and tests are to be performed under the following standard atmospheric conditions:

Temperature:	15°C to 35°C (59°F to 95°F)
Relative Humidity:	45% to 75%
Air Pressure:	86 to 106 kPa (650 to 800 mm of mercury)

The switch shall be allowed sufficient time to reach thermal stability before performing measurements under standard atmospheric conditions. All tests and measurements shall be performed on switches as received from the supplier without any cleaning or other preparation except as specified by the individual test method. When the test requires the switch to be mounted, the switch shall be rigidly mounted directly on a metal plate by its normal mounting means. The mounting plate shall exceed the contour of the switch, including the terminations when they extend beyond the front panel plane profile of the switch.

6.1 Visual Inspection

6.1.1 Method of Measurement

The switches shall be visually examined for manufacturing defects which would adversely affect serviceability. The marking shall be examined for correctness and legibility.

6.1.2 Standard

The switch shall be manufactured in a careful workmanlike manner. The markings shall be correct and legible.

6.2 Dimensional Examination

6.2.1 Method of Measurement

The specified dimensions shall be measured by appropriate means.

6.2.2 Standard

The dimensions shall be in accordance with the detail specification.

6.3 Operating Characteristics

6.3.1 Method of Measurement

The specified operating characteristics shall be measured by any appropriate means.

6.3.2 Standard

The operating characteristics shall be in accordance with the detail specification.

6.4 Switch Resistance

6.4.1 Definition

Switch resistance is the total electrical resistance of the conducting parts of the switch which is determined by dividing the voltage drop across the switch terminations by the current flowing through the switch.

6.4.2 Method of Measurement

The switch shall be measured in accordance with EIA Recommended Standard RS-448 "Standard Test Methods for Electromechanical Switches", Method 1. The following details shall apply:

6.4.2.1 Method of Connection

Between the terminals of the contacts of the same pole forming a switch circuit.

6.4.2.2 Test Current 100 mA $\pm 2\%$.

- 6.4.2.3 Open Circuit Test Voltage
2 or 6 volts dc $\pm$ 10%, normal level.
- 6.4.2.4 Number of Activations Before Measurements
4 maximum.
- 6.4.2.5 Number of Test Activations
3 for qualification approval tests, and one for acceptance inspection tests.
- 6.4.2.6 Number of Measurement per Activation
One.

6.4.3 Standard

The switch resistance shall not exceed the value specified by the detail specification.

6.5 Insulation Resistance

- 6.5.1 Insulation resistance is the electrical resistance of a dielectric material measured at a specified dc potential.

6.5.2 Method of Measurement

The insulation resistance shall be measured in accordance with EIA Recommended Standard RS-186E, Method 13 "Insulation Resistance Test". The following details shall apply:

- 6.5.2.1 Test Voltage
100 Vdc or 500 Vdc, as specified in the detail specification.
- 6.5.2.2 Test Voltage Application
Between each terminal and exposed non-current carrying metal or grounded parts; between adjacent terminals of mutually insulated circuits; and between all unconnected contact terminals of the same pole. The test voltage shall not be applied across the light source(s).
- 6.5.2.3 Number of Measurements
One for each test voltage application specified in 6.5.2.2 for each operating position of the switch. Redundant measurements are not required.

6.5.3 Standard

The insulation resistance shall not be less than the value specified by the detail specification, or 1000 M Ω .

6.6 Voltage Proof

6.6.1 Definition

Voltage proof is a measure of the ability of an insulating material to resist breakdown when subjected to electrical stress.

6.6.2 Method of Measurement

Voltage proof shall be measured in accordance with EIA Recommended Standard RS-186E, Method 4. The following details shall apply:

6.6.2.1 Test Voltage

60 Hz essentially sinusoidal potential of 1000 volts (rms) for switches rated at 250 volts or less, 1500 volts (rms) for switches rated over 250 volts.

6.6.2.2 Test Conditions

The test shall be performed at sea level conditions.

6.6.2.3 Test Voltage Application

Between live parts of opposite polarity, and between live parts and non-current carrying metal parts or grounded metal parts. The test voltage shall not be applied across the light source(s).

6.6.2.4 Test Duration

The test voltage shall be applied for 60 seconds during qualification approval tests, and 1-5 seconds for acceptance inspection tests.

6.6.2.5 Number of Tests

One for each test voltage application specified in 6.6.2.3 for each operating position of the switch.

6.6.3 Standard

The switches shall withstand the application of the test voltage without sustained arcing, breakdown, or damage to insulation, and the leakage current shall not exceed 500 μ A.

6.7 Temperature Rise

6.7.1 Definition

The temperature rise is the difference between the temperature measured at the terminals of a switch carrying a constant current, and the ambient temperature.

6.7.2 Method of Measurement

This test shall be performed in accordance with EIA Recommended Standard RS-448, Method 6. The following details shall apply: