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EIA SPECIFICATION

Sectional Specification for Rotary Switches of Certified Quality (Low Current Capacity - 2 Amperes or Less)

EIA-520F000-A

(Revision of EIA-520F000)

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



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(From Standards Proposal No. 3505, formulated under the cognizance of EIA P-13.1 Subcommittee Rotary and Thumbwheel Switches.)

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SECTIONAL SPECIFICATION

Rotary Switches of Certified Quality
(Low Current Capacity - 2 Amperes or Less)

1 SCOPE AND OBJECT

1.1 Scope

This sectional specification relates to electromechanical rotary switches of certified quality. These families of switches are for use in electronic, communication and other low power applications.

Switches covered by this specification have rated voltages not exceeding 250 volts and a rated current not exceeding two amperes (dc or rms values).

1.2 Object

The object of this specification is to:

- a) Prescribe applicable preferred ratings and characteristics
- b) Select the appropriate quality certification procedures and test methods from EIA 5200000
- c) Prescribe general performance requirements for rotary switches

2 GENERAL

2.1 Related Documents

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

EIA-5200000 Generic Specification for special-use
Electromechanical Switches of Certified
Quality

2.2 Units and Symbols

The requirements of EIA-5200000 shall apply for units and symbols.

2.3 Terminology

Terminology shall be in accordance with EIA-5200000 and Appendix A to this specification.

2.4 Preferred Values

2.4.1 Rated Voltage:

The following voltage ratings are preferred: 28 volts, 115 volts, 125 volts and 250 volts. For logic level rated switches, the preferred voltage is 5 volts dc. For low level rated switches, the preferred voltage is 30 millivolts dc or peak ac.

2.4.2 Rated Current:

The following current ratings are preferred:

Less than 250 milliamperes - manufacturer's
option
250, 500, 750 milliamperes
1 and 2 amperes

The preferred low level current rating is 10 milliamperes.

2.4.3 Low Temperature Rating:

The following low temperature ratings are preferred:

-10°C, -25°C, -40°C, -55°C and -65°C

2.4.4 High Temperature Rating:

The following high temperature ratings are preferred:

+55°C, 70°C, 85°C, 100°C, 125°C



2.4.5 Indexing Angle (Angle of throw):

Preferred indexing angles (angle of throw) (the angle through which the shaft rotates between adjacent detent positions) are 15° , $22\ 1/2^{\circ}$, 30° , 36° , 45° , 60° , 90°

2.5 Marking

The marking requirements of EIA-5200000 shall apply.

2.6 Detail Specification

Detail specifications shall be derived from the relevant blank detail specification.

If the technical requirements of this standard which are related to inspection are not entirely suitable (either for technical reasons or for special applications) for the rotary switch described in the detail specification, the detail specification shall clearly describe the various amendments which are to be made to these requirements.

The following information shall be given in each detail specification and the values prescribed shall preferably be selected from those given in the applicable clause of this standard.

2.6.1 Outline Drawing & Dimensions

There shall be an illustration of the switch as an aid to easy recognition and for comparison with other types of rotary switches. The illustration shall preferably be an orthographic projection, with at least two views using third angle projection.

The dimensional limits necessary for mounting and interchangeability shall be prescribed. All dimensions shall be stated in millimeters, with the equivalent inch dimensions given in parentheses. It shall be noted whether the original dimensions are in inches or millimeters.

2.6.2 Mounting

The method of mounting for normal use shall be specified.

2.6.3 Operating Shaft Configuration

Preferred dimensions are shown in Annex B.

2.6.4 Electrical Ratings

The rated voltage(s) and the rated current(s) shall be specified.

2.6.5 Functional Operation

The switching circuitry, the actuator operation (detent, self-return, etc.) and any other electrical switching and nonswitching operation (lamps, solenoids, etc.) shall be completely described. Preferred circuits associated with truth tables are shown in Annex C.

2.6.6 Operating Characteristics

The angular travel (in degrees) and the operating torque shall be stated.

2.6.7 Electrical Terminations

The electrical termination designations, if any, shall be specified.

2.6.8 Special Characteristics

Any special characteristics (sealing, altitude ratings, etc.) shall be listed when they are considered necessary to adequately specify the switch for design and application purposes.

2.6.9 Quality Assessment Level

The quality assessment level (see subclause 3.1) shall be specified.

3 QUALITY ASSESSMENT PROCEDURES

3.1 Qualification Approval Procedures

Qualification approval procedures shall be as prescribed by EIA-5200000 and the following requirements:

- a) The tests required for qualification approval are prescribed in Table I herein. The actual test requirements referenced (i.e., 1-1, 2-4) are selected from EIA 5200000), except as modified in 4.0.
- b) Test specimens shall be as specified in the detail specification, and shall be representative of the product described therein.

TABLE I
QUALIFICATION APPROVAL TEST SEQUENCE

Test Method & Group	M, MIA					
	Test or No. WS	D or ND	t.s.	t.d.	g.d.	

(All test specimens unless otherwise specified)

Group A

1

Visual Examination	1-1	M	ND	(1)	1
Dimensions	1-2	M	ND	2	0
Gauging	1-3	WS	ND	(1)	1
Mass	1-4	WS	ND	4	0
Functional Operation	1-5	M	ND	(1)	0
Switch Resistance (Millivolt Level)	2-1	MIA	ND	(1) (4)	0
Switch Resistance (Specified Current)	2-2	MIA	ND	(1) (4)	0
Switch Resistance (Rated Load)	2-3	MIA	ND	(1) (4)	0
Actuator Grounding	2-4	MIA	ND	(1) (4)	0
Insulation					
Resistance	2-5	M	ND	4	0
Voltage Proof	3-1	M	ND	(1)	0
Altitude Voltage					
Proof	3-2	MIA	ND	(1)	0
Operating					
Characteristics	1-6	WS	ND	(1)	0

Group B

1

Solderability	11-1	MIA	D	2	0
Strength of					
Terminations	6-4	M	D	4	0
Strength of					
Actuator	6-1	M	D	4	0
Electrical					
Endurance	8	M	D	(2) (3)	0
Switch Resistance					
(Rated Load)	2-3	M	D	4	0
Temperature Rise	4-1	MIA	D	(2)	0
Voltage Proof	3-1	M	ND	(2)	0
Operating					
Characteristics	1-6	MIA	ND	(1)	1

Test Method & Group	Test No.	M, MIA, or WS	D or ND	t.s.	t.d.	g.d.
<u>Group C</u>						0
Thermal Shock	10-2	WS	ND	4	0	
Acceleration	5-1	WS	D	4	0	
Vibration	5-3	WS	D	4	0	
Shock	5-2	WS	D	4	0	
Moisture						
Resistance	10-1	WS	D	4	0	
Operating						
Characteristics	1-6	WS	ND	4	0	
Voltage Proof	3-1	WS	ND	4	0	
Panel Seal	13-1	WS	D	4	0	
<u>Group D</u>						1
Strength of Mounting						
Bushing	6-2	WS	D	4	0	
Strength of Screw						
Mounting	6-3	WS	D	4	0	
Immersion in						
Solvents	15-1	WS	D	4	0	
Random Vibration	5-4	WS	D	4	0	
Switch Resistance						
(Specified Current)	2-2	M	ND	4	0	
Operating						
Characteristics	1-6	MIA	ND	4	1	
Insulation						
Resistance	2-5	M	ND	4	0	
<u>Group E</u>						1
Capacitance	17-1	WS	ND	4	0	
Contact Bounce	1-7	WS	ND	4	0	
Hi/Low Temperature						
Mechanical						
Endurance	7-1	M	D	4	0	
Switch Resistance						
Milli-volt Level	2-1	MIA	ND	[1]	0	
Capacitance	17-1	WS	ND	4	1	
Operating						
Characteristics	1-6	MIA	ND	4	0	
Panel Seal	13-1	WS	D	4	0	
<u>Group F</u>						0
Salt Spray	10-4	WS	D	4	0	

Test Method & Group	Test No.	M, MIA, or WS	D or ND	t.s.	t.d.	g.d.
<u>Group G</u>						0
Fungus Resistance	10-3	WS	D	1	0	
<u>Group J</u>						0
Flammability	16-1	WS	D	1	0	
<u>Group K</u>						
EMI Shielding	19-1	WS	ND	2	1	

Key:

M	=	Mandatory Test
WS	=	When Specified Test
MIA	=	Mandatory if Applicable
D	=	Destructive Test
ND	=	Nondestructive Test
t.s.	=	Minimum Quantity of Test Specimens
t.d.	=	Maximum Permissible Number of Defective Units Per Test
g.d.	=	Maximum Permissible Number of Defective Units Per Group

- Notes:
- (1) All Test Specimens
 - (2) As a minimum there shall be two separate test specimens for each electrical rating; but in no cases shall there be less than four test specimens total.
 - (3) The appropriate electrical endurance test(s) shall be selected based upon the specified electrical ratings.
 - (4) Only one switch resistance test is needed; the appropriate method should be selected for inclusion in the detail specification.

3.2 Quality Conformance Inspection

Quality conformance inspection shall be as prescribed in EIA-5200000 and the following requirements:

- a) Lot by Lot Inspection Tests:
The lot by lot inspection tests are prescribed in Table II herein. The sequence of tests is optional unless otherwise specified by the detail specification.
- b) Periodic Inspection Tests:
The periodic inspection tests are prescribed in Table IV herein.



Documents

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TABLE II
LOT-BY-LOT INSPECTION TESTS

TEST METHODS AND PLAN GROUPS (TEST FREQUENCY)	TEST NO.	M or WS	SAMPLING
ACCEPTANCE TESTS			
GROUP A (lot-by-lot)			
Visual examination	1 - 1	M	See sampling plan below
Functional operation	1 - 5	M	
Switch resistance	2-1 or 2-2	M	
Actuator grounding	2 - 4	WS	
Voltage proof	3 - 1	M	
Operating characteristics	1 - 6	M	
Sealing (1)	1 4	WS	

Accept on zero" sampling plan

Lot size	Number of switches to be tested
1 - 8	All
9 - 150	13
151 - 280	20
281 - 500	29
501 - 1200	34
1201 - 3200	42
3201 - 10.000	50
10,001 - 35.000	60

TABLE III
MAJOR CHARACTERISTICS FOR VISUAL EXAMINATION

Specified Number of Sections
Specified Number of Positions Per Common Pole
Functioning Stops as Required
Good Detent Feel
Specified Termination
Specified Hardware
Specified Shaft Flat Orientation
Physical Damage (1)

Notes: (1) Physical damage indicates any broken or distorted parts that interfere with the normal operation of switch.

TABLE IV (1)
PERIODIC INSPECTION TESTS

Test Methods & Test Groups (Test Frequency)	Test No.	M, MIA, or WS	D or ND	Level "C" (2) t.s. t.d. g.d		
<u>Group A (Every 12 months)</u>						1
Dimensions	1-2	M	ND	2	0	
Gauging	1-3	M	ND	4	1	
Mass	1-4	WS	ND	4	0	
Insulation						
Resistance	2-5	M	ND	4	0	
Altitude Voltage						
Proof	3-2	WS	ND	4	0	
Panel Sealing	13-1	WS	ND	4	0	
Solderability	11-1	M	D	4	0	
Strength of						
Terminations	6-4	M	D	NA	0	
Strength of						
Actuator	6-1	M	D	NA	0	
Electrical						
Endurance	8 (3)	M	D	4	0	
<u>Group B (Every 36 Months)</u>						0
Electrical Endurance	8 (4)	M	D	(3)	0	(6)
Temperature Rise	4-1	MIA	D	(3)	0	
Voltage Proof	3-1	M	ND	(3)	0	
Operating						
Characteristics	1-6	M	ND	All	0	
<u>Group C (Every 36 Months)</u>						0
Thermal Shock	10-2	WS	ND	4	0	
Acceleration	5-1	WS	D	NA	0	
Vibration	5-3	M	D	NA	0	
Shock	5-2	M	ND	4	0	
Moisture Resistance	10-1	M	D	4	0	
Operating						
Characteristics	1-6	M	ND	4	0	
Voltage Proof	3-1	M	ND	4	0	
Panel Seal	13-1	WS	D	4	0	



Test Methods & Test Groups (Test Frequency)	Test No.	M, MIA, or WS	D or ND	Level "C" (2) t.s. t.d. g.d.		
<u>Group D (Every 36 Months)</u>						1
Robustness of mounting Bushings	6-2	MIA	D	4	1	
Robustness of Screw Mounting	6-3	MIA	D	4	1	
Immersion in Solvents	15-1	WS	D	4	1	
Random Vibration	5-4	WS	D	NA	-	
Operating Characteristics	1-6	M	ND	NA	-	
Voltage Proof	3-1	M	ND	NA	-	
<u>Group E (Every 36 Months)</u>						1
Capacitance	17-1	WS	ND	4	1	
Contact Bounce	1-7	WS	ND	4	-	
Mechanical Endurance	7-1	M	D	4	1	
Switch Resistance (Millivolt Level)	2-1	MIA	ND	1 (5)	0	
Switch Resistance (Specified Current)	2-2	MIA	ND	1 (5)	0	
Switch Resistance (Rated Load)	2-3	MIA	ND	1 (5)	0	
Capacitance	17-1	WS	ND	4	1	
Operating Characteristics	12-1	M	ND	4	1	
Panel Seal	13-1	WS	D	4	1	
<u>Group F (Every 36 Months)</u>						-
Salt Spray	10-5	WS	D	NA	-	
<u>Group G (Every 36 Months)</u>						-
Fungus Resistance	10-4	WS	D	NA	-	
<u>Group H (Every 36 Months)</u>						-
Flammability	16-1	WS	D	NA	-	
<u>Group K (Every 36 Months)</u>						
EMI Shielding	19-1	WS	ND	NA		

D = Destructive test

ND = Nondestructive test

IL = Inspection Level

MIA = Mandatory if Applicable

t.s. = Minimum number of test samples

t.d. = Maximum permissible defective units per test

g.d. = Maximum permissible defective units per group

NA = Testing is not applicable if no changes have been made to the design or the manufacturing process

- Notes: (1) Samples shall be selected from lot(s) that have passed lot by lot inspection, Table II.
- (2) Assessment Level C is the minimum acceptable level. Additional higher levels may be developed as required for specific detail specifications.
- (3) The electrical endurance test shall be limited to the maximum current rating at standard atmospheric conditions.
- (4) The appropriate electrical endurance test(s) shall be selected based upon the specified electrical ratings.
- (5) Only one switch resistance test is needed; the appropriate method should be selected for inclusion in the detail specification.
- (6) The quantity of test specimens shall be the same as required for the qualification approval tests.

4 TEST AND MEASUREMENT PROCEDURE

4.1 Test 6-1 Strength of Actuator

This test is applicable only to switches having means of limiting the rotational movement (stops). The applicable rotational torque shall be specified in the detail specification.

4.2 Test 7-1 High/Low Temperature - Mechanical Endurance

If a switch is rated for millivolt level only (2.1), or in addition has other required resistance measurements (2.2 or 2.3), only the millivolt level need be conducted.

4.3 Test 19-1 EMI/RFI Shielding

Object: The object of the test is the assessment of the attenuation of a transmitted signal provided by a panel mounted switch.

Method: The switches shall be tested in accordance with the following details:

- a) The test equipment shall be in accordance with Figure 1.

- b) With the door open and the antennas in the "initial setup" position, establish a test level over the 200 MHz to 1 GHz range such that the received signal level is at least as many dB above the RF ambient level as that of the shielded enclosure attenuation.
- c) Record the received signal level and the signal generator output level. Repeat measurements at 100, 200, 400, 600, 800 and 1,000 MHz.

Move the antennas to the final test positions, close the door and with an RF-tight blank panel between the antennas, measure the integrity of the enclosure by setting the signal generator to the same output and record the received signal level for each frequency used in step b. The shielded enclosure attenuation is then calculated using the following equation:

$$\text{Attenuation (dB)} = 20 \log \frac{E_1}{E_2}$$

E1 = receiver reading in step b
E2 = receiver reading in step c

- d) Mount the test switch in the blank panel with the rear of the switch outside of the shielded enclosure (toward the signal generator antenna). The switch shall be mounted as it would be for normal installation using the mounting hardware supplied or recommended. Repeat the measurements of step c above and calculate the shielding attenuation of the switch using the new receiver readings.

Criteria: The attenuation shall not be less than 60 dB over the frequency range of 100 to 1,000 MHz, unless otherwise specified.