IEC 61058-1-1

Edition 1.0 2016-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Switches for appliances –
Part 1-1: Requirements for mechanical switches

Interrupteurs pour appareils –
Partie 1-1: Exigences relatives aux interrupteurs mécaniques

IEC 61058-1-1:2016-05(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SWITCHES FOR APPLIANCES –

Part 1-1: Requirements for mechanical switches

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International Standard IEC 61058-1-1 has been prepared by subcommittee 23J: Switches for appliances, of IEC technical committee 23: Electrical accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
23J/399/FDIS	23J/403/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61058 series, published under the general title *Switches for appliances*, can be found on the IEC website.

This part of IEC 61058 is to be used in conjunction with IEC 61058-1(2016).

This Part 1-1 supplements or modifies the corresponding clauses in IEC 61058-1, so as to convert that publication into the IEC standard: *Requirements for mechanical switches*.

When a particular subclause of Part 1 is not mentioned in this Part 1-1, that subclause applies as far as reasonable. Where this standard states “addition”, “modification” or “replacement”, the relevant text of Part 1 is to be adapted accordingly.

In this standard:

1) the following print types are used:
   – requirements proper: in roman type;
   – *test specifications: in italic type*;
   – notes/explanatory matters: in small roman type.
2) subclauses, notes, figures and tables which are additional to those in Part 1 are numbered starting from 101. Annexes which are additional to those in Part 1 are lettered AA, BB, etc.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

SWITCHES FOR APPLIANCES –

Part 1-1: Requirements for mechanical switches

1 Scope

This clause of part 1 is applicable.

Add the following at the end of Clause 1.

This part of IEC 61058 applies to mechanical switching devices and shall be used in conjunction with the requirements of IEC 61058-1.

NOTE Additional requirements for particular switches may be found in the relevant part 2 of IEC 61058.

2 Normative references

This clause of part 1 is applicable.

3 Terms and definitions

This clause of part 1 is applicable.

4 General requirements

This clause of part 1 is applicable.

5 General information on tests

This clause of part 1 is applicable with the following addition.

Add the following at the end of 5.3.

Table 101 provides information on:

– The minimum number of specimens needed for each test.
– The minimum number of total specimens, when applicable tests are added, needed for each evaluation.
– Additional specimens that may be required as a result of additional electrical rating, unique construction or damage/breakage during testing.

Table 101 – Test specimens

Clause	Description	Minimum number of specimens for each test [a]			Notes
5	General information on tests	–	i	ii	b)
6	Rating	1			c)
7	Classification				
8	Marking and documentation				
9	Protection against electric shock				
10	Provision for earthing				
11	Terminals				
12	Construction				
13	Mechanism				
14.1	Protection against ingress of solid foreign objects	1			d)
14.2	Protection against ingress of water	1			d)
14.3 to 15	Protection against humid conditions Insulation resistance and dielectric strength	3			e), m)
16	Heating	–	3	3	f), m)
17	Endurance	–	3	3	f), m)
18	Mechanical strength	1			c)
19	Screws, current-carrying parts and connections	1			c)
20	Clearance, creepage distances	1			g), h)
21	Fire hazard	2			i), c)
22	Resistance to rusting	1			c)
23	Abnormal operation and fault conditions for switches	1			l)
24	Components for switches	3			j)
25	EMC requirements	–			k)

a) Additional specimens may be required depending on the construction and declaration of the switch.

b) Each electrical rating submitted to the testing of Clauses 16 and 17 requires an additional 3 specimens (such as rating i =3 specimens, rating ii = additional 3 specimens).

c) The specimen may be used for more than 1 test, if cumulative stress as a result of sequential testing is avoided. When a specimen is damaged a new specimen shall be used for the next test.

d) In general 1 specimen for ingress of solid foreign objects (dust), and 1 specimen for ingress of water. Specific IP ratings (such as IP 5x, IP6x and protection against water) require a special enclosure to be provided with the switch specimen in order to complete the testing.

e) The same test specimens are used to complete the testing of 14.3 and 15. The tests are completed in immediate sequence.

f) Heating according to Clause 16 and endurance according to Clause 17 is recommended to be tested on the same specimens. If declared, different specimens may be used when noted on the test record.

g) Three additional new specimens may be required according to Clause 20, for the test according to annex G.

h) For testing coatings on printed boards according to 20.4, the number of printed boards needed is determined by the testing of IEC 60664-3.

i) For testing glow wire and ball pressure special test specimens according to 60695-2-11 and 60695-10-2, respectively may be required.

j) The number of specimens for specific test and examination of Clause 24 is according to the individual subclasses.

k) Mechanical switches in general do not require EMC testing, however in the event the mechanical switch has electronic circuitry requiring EMC, additional specimens may be required according to the EMC test program and switch construction.

l) Abnormal operation and fault conditions are generally destructive, typically the switch cannot be repaired and reused for the next fault. Specially prepared specimens (such as with wires soldered to the internal circuit) may be necessary in order to complete the testing. The total number of specimens depends on the switch construction, for details see Clause 23.

m) This test is part of a sequence, and a new set of 3 specimens shall not be used except as permitted by 5.1.

6 Rating

This clause of part 1 is applicable.

7 Classification

This clause of part 1 is applicable.

8 Marking and documentation

This clause of part 1 is applicable.

9 Protection against electric shock

This clause of part 1 is applicable.

10 Provision for earthing

This clause of part 1 is applicable.

11 Terminals and terminations

This clause of part 1 is applicable.

12 Construction

This clause of part 1 is applicable.

13 Mechanism

This clause of part 1 is applicable.

14 Protection against ingress of solid foreign objects, ingress of water and humid conditions

This clause of part 1 is applicable.

15 Insulation resistance and dielectric strength

This clause of part 1 is applicable.

16 Heating

This clause of part 1 is applicable.

17 Endurance

Replace the existing text by the following:

17.1 General requirements

17.1.1 Switches shall withstand without excessive wear or other harmful effect the electrical, thermal and mechanical stresses that occur in normal use.

17.1.2 *The sequence of tests to be completed on the same 3 specimens is as follows:*

– *TC3: a test at high speed specified in 17.5.3; this test only applies to switches with more than one pole, and where the type of connection is of polarity reversal;*

– *TC2: a test at slow speed specified in 17.5.2,*

– *TC1: an increased-voltage test at accelerated speed as specified in 17.5.1; this test does not apply to switches classified according to 7.2.9;*

– *TC9: a locked-rotor test as specified in 17.5.5 at accelerated speed; this test only applies to switches classified according to 7.2.9;*

– *TC4: a test at accelerated speed as specified in 17.5.4;*

followed by the requirements of 17.6.

NOTE The different types of tests are specified in 17.5.

17.1.3 *When required by Clause 13, the following test, TC10, is conducted on a different set of 3 specimens:*

– TC10: a test at very slow speed as specified in 17.5.6; this test only applies to switches according to the requirements of 13.1.

The manufacturer may choose to complete TC10 in the sequence of 17.1.2 in place of TC2.

Compliance is checked by 17.6.1 (TE1) and 17.6.3 (TE3).

17.2 Electrical endurance tests

The switch shall be loaded as specified in Table 102 and/or Table 103 and connected in accordance with the circuit as given in 61058-1:2016, Table 2.

a) *Where, in IEC 61058-1:2016, Table 2, an auxiliary switch (A) is symbolized in the test circuit, the tests for the two ON-positions of the specimen (S) are performed on two separate sets of test samples. The connection to the test load to be performed for the two tests is symbolized in IEC 61058-1:2016, Table 2 by an auxiliary switch A.*

b) *Multiway switches are loaded according to 61058-1:2016, Table 1. The load for the other switch positions is that resulting from the loads necessary to achieve the conditions specified above.*

c) *For circuits according to 7.2.7 for specific lamp load, the connection and test load are as specified by the manufacturer using the maximum occurring inrush current at room temperature. For a specific lamp load, it is recommended that the specimen be operated with loads that are used in the field rather than with synthetic loads. Forced cooling of the specific lamp load may be applied in order to ensure cold resistance for each operating cycle and shorten the test time.*

d) *No electrical load is applied during the endurance tests for switches classified to 7.2.6 with a rating of 20 mA or less.*

Table 102 – Test loads for electrical endurance tests for a.c. circuits

Type of circuit as classified in 7.2	OPERATION of contacts	Test voltage	Test current r.m.s.	Power factor[c)]
Substantially resistive (classified in 7.2.1)	Making and breaking	Rated voltage	*I-R*	≥0,9
General Purpose (classified in 7.2.10)	Making and breaking	Rated voltage	*I-GP*	≥0,75 (+0,05)
Resistive and/or motor (classified in 7.2.2)	Making[b)]	Rated voltage	6 × *I-M* or	0,60 (+0,05)
			I-R[a)]	≥0,9
	Breaking	Rated voltage	*I-R* or	≥0,9
			I-M[a)]	≥0,9
Circuit for specific load of motor with a locked rotor and with a power factor not less than 0,6 (classified in 7.2.9)	Making	Rated voltage	6 × *I-M*	0,60 (+0,05)
	Breaking	Rated voltage	6 × *I-M*	0,60 (+0,05)
Circuit for an inductive load (classified in 7.2.8)	Making[2)]	Rated voltage	6 × *I-I*	0,60 (+0,05)
	Breaking	Rated voltage	*I-I*	0,60 (+0,05)
Resistive and capacitive (classified in 7.2.3)	Making and breaking	Tested in a circuit as shown in Figure 8		
Tungsten filament lamp load (classified in 7.2.4)	Making and breaking	Tested in a circuit as shown in Figure 8[d)]		
		Rated voltage ≥ 110 V a.c., *X* = 16		
		Rated voltage < 110 V a.c., *X* = 10		
Circuit for specific lamp load (classified in 7.2.7)	Making and breaking	Rated voltage	As determined by load	
Specified declared (classified in 7.2.5)	Making and breaking	Rated voltage	As determined by load	

I-I: inductive-load current

I-M: motor-load current

I-R: resistive-load current

a) Whichever is arithmetically greater or the most unfavourable value in case of equal values.

b) The specified making conditions are maintained for a period between 50 ms and 100 ms, and are then reduced by an auxiliary switch to the specified breaking conditions.

For mechanical switches the test current may be reduced to *I-R* by introducing a resistor in the circuit. Short interruptions of the test current during the reduction to *I-R* not exceeding a period of 50 ms to 100 ms are permitted.

A typical method of achieving this is shown in Figure 16.

c) Resistors and inductors are not connected in parallel except that if any air-core inductor is used, a resistor taking approximately 1 % of the current through the inductor is connected in parallel with it. Iron-core inductors may be used provided that the current has a substantial sine-wave form. For three-phase tests, three-core inductors are used.

d) In the case where the tests are performed with tungsten filament lamp bulbs, the following test conditions apply:

- the ratio *X* = 16 or *X* = 10 shall be achieved;
- the cold resistance of the lamps shall be ensured for each operating cycle;
- the resistance of connections within the load circuit (for example lamp sockets) shall be constant;
- the proper function of the lamps performing the load set shall be ensured for each operating cycle.

Table 103 – Test loads for electrical endurance tests for d.c. circuits

Type of circuit as classified in 7.2	Operation of contacts	Test voltage	Test current	Time constant
Substantially resistive load	Making and breaking	Rated voltage	*I*-*R*	*L*/*R* < 1,15 ms
Tungsten filament lamp load (classified in 7.2.4)	Making and breaking	Rated voltage	Tested in a circuit as shown in Figure 9	
			Rated voltage ≥ 110 V d.c., *X* = 6	
			Rated voltage < 110 V d.c., *X* = 10	
			[a]	
Resistive and capacitive load (classified in 7.2.3)	Making and breaking	Tested in a circuit as shown in Figure 9b		
Circuit for specific lamp load (classified in 7.2.7)	Making and breaking	Rated voltage	As determined by load	
Declared specific load (classified in 7.2.5)	Making and breaking	Rated voltage	As determined by load	
I-*R*: resistive load current				

[a] In case where the tests are performed with tungsten filament lamp bulbs, the following test conditions apply:

- the ratio *X* = 16 or *X* = 10 shall be achieved;
- the cold resistance of the lamps shall be ensured for each operating cycle;
- the resistance of connections within the load circuit (for example lamp sockets) shall be constant;
- the proper function of the lamps performing the load set shall be ensured for each operating cycle.

17.3 Thermal conditions

17.3.1 For switches according to 7.3.2, during the tests in 17.5.4 (TC4) all parts are exposed to temperatures as follows:

- For the first half of the test period at maximum air temperature (T +5/0) °C.
- For the second half of the test period at 25 °C ± 10 °C or at the minimum air temperature (T 0/-5) °C if T is less than 0 °C.

17.3.2 For switches according to 7.3.3, during the tests in 17.5.4 (TC4), those parts that are declared for use at 0 °C to 55 °C shall be exposed to a temperature within this range for the complete test period.

- For the first half of the test period, the air temperature of the remainder of the switch shall, be maintained at the maximum air temperature (T +5/0) °C.
- For the second half of the test period the tests are carried out at 25 °C ± 10 °C or at the minimum air temperature (T 0/-5) °C if T is less than 0 °C.

17.3.3 For switches according to 7.3.1, during the tests in 17.5.4 (TC4), the switch shall be exposed to an air temperature of 25 °C ± 10 °C.

17.4 Actuating conditions

17.4.1 The switches are operated by means of their actuating member either manually or by an appropriate apparatus which is arranged to simulate normal actuation.

The operating speed for the operating cycles shall be as follows:

For the tests of mechanical switches:

a) for very slow speed:

- *approximately 1°/s for rotary actuation;*
- *approximately 0,5 mm/s for linear actuation.*