UL 61058-1-1

STANDARD FOR SAFETY

Switches for Appliances – Part 1-1: Requirements for Mechanical Switches

UL Standard for Safety for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, UL 61058-1-1

First Edition, Dated November 3, 2017

Summary of Topics

The First Edition of the Standard for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, UL 61058-1-1 has been published and reflects the latest approval date as an American National Standard and is harmonized with the First Edition of the Standard for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, IEC 61058-1-1. The First Edition of UL 61058-1-1 shall be used in conjunction with the Fifth Edition of the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1 and the First Edition of the Standard for Switches for Appliances – Part 1-2: Requirements for Electronic Switches, UL 61058-1-2.

The new requirements are substantially in accordance with Proposal(s) on this subject dated June 23, 2017.

No Text on This Page

CSA Group
CAN/CSA-C22.2 No. 61058-1-1:17
First Edition
(IEC 61058-1-1:2016, MOD)

Underwriters Laboratories Inc.
UL 61058-1-1
First Edition

Switches for Appliances – Part 1-1: Requirements for Mechanical Switches

November 3, 2017

This national standard is based on publication IEC 61058-1-1, First Edition (2016).

ANSI/UL 61058-1-1-2017

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as "CSA Group") and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

ISBN 978-1-4883-1300-4 © 2017 CSA Group

This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquires@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

To purchase CSA Group Standards and related publications, visit CSA Group's Online Store at shop.csa.ca or call toll-free 1-800-463-6727 or 416-747-4044.

This ANSI/UL Standard for Safety consists of the First Edition. The most recent designation of ANSI/UL 61058-1-1 as an American National Standard (ANSI) occurred on November 3, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

To purchase UL Standards, visit UL's Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call toll-free 1-888-853-3503.

CONTENTS

PREFACE

This is the harmonized CSA Group and UL standard for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches. It is the first edition of CAN/CSA-C22.2 No. 61058-1-1, and the first edition of UL 61058-1-1.

This harmonized standard is based on IEC Publication 61058-1-1: first edition Switches for Appliances – Part 1-1: Requirements for Mechanical Switches issued May 2016. IEC 61058-1-1 is copyrighted by the IEC.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the International Harmonization Committee on Switches for Appliances are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Integrated Committee on Wiring Devices, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

This standard has been approved as a National Standard of Canada by the Standards Council of Canada (SCC).

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

This CAN/CSA-C22.2 No. 61058-1-1, Standard for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, is to be used in conjunction with the Third edition of CAN/CSA-C22.2 No. 61058-1. The requirements for mechanical switches are contained in this Part 1-1 and CAN/CSA-C22.2 No. 61058-1. Requirements of this Part 1-1, where stated, amend the requirements of CAN/CSA-C22.2 No. 61058-1. Where a particular subclause of CAN/CSA-C22.2 No. 61058-1 is not mentioned in CAN/CSA-C22.2 No. 61058-1-1, the CAN/CSA-C22.2 No. 61058-1 subclause applies.

This UL 61058-1-1, Standard for Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, is to be used in conjunction with the Fifth edition of UL 61058-1. The requirements for mechanical switches are contained in this Part 1-1 and UL 61058-1. Requirements of this Part 1-1, where stated, amend the requirements of UL 61058-1. Where a particular subclause of UL 61058-1 is not mentioned in UL 61058-1-1, the UL 61058-1 subclause applies.

Level of Harmonization

This standard adopts the IEC text with national differences.

This standard is published as an identical standard for CSA Group and UL.

An identical standard is a standard that is exactly the same in technical content except for national differences resulting from conflicts in codes and governmental regulations and basic safety principles and requirements. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

National differences from the IEC are being added in order to address safety and regulatory situations present in the US and Canada.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 61058-1-1, Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, copyright 2016, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword is not a part of the requirements of this standard but is included for information purposes only.

For UL, the text, figures and tables of IEC publication 61058-1-1, Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, copyright 2016 are used in this standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword is not a part of the requirements of this standard but is included for information purposes only. Copies of IEC Publication 61058-1-1 may be purchased from ANSI, 25 West 43rd Street, 4th Floor, New York, New York, 10036, (212) 642-4900.

NATIONAL DIFFERENCES

In the CSA Group and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 61058-1-1, Switches for Appliances – Part 1-1: Requirements for Mechanical Switches, copyright 2016, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SWITCHES FOR APPLIANCES – PART 1-1: REQUIREMENTS FOR MECHANICAL SWITCHES

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as ″IEC Publication(s)″). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and nongovernmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 61058-1 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.

DV.1 D2 *Addition of the following:*

This nationally adopted Part 1-1 standard shall be used in conjunction with the nationally adopted IEC 61058-1 Part 1 standard, the nationally adopted IEC 61058-1-2 Part 1-2 standard, and any relevant nationally adopted IEC 61058-2-x Part 2 standards. For references to IEC 61058, IEC 61058-1, or IEC 61058-1-2, replace the reference with CAN/CSA-C22.2 No. 61058/UL 61058, CAN/CSA-C22.2 No. 61058-1/UL 61058-1, or CAN/CSA-C22.2 No. 61058-1-2/UL 61058-1-2 accordingly.

DV.2 DE *Addition of the following:*

The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

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
		–	i	ii	
5	General information on tests				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 IP5x, 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.

b) For slow speed:

– Approximately 9°/s for rotary actuations at an angle of operation ≤45°;

– Approximately 18°/s for rotary actuations at an angle of operation >45°;

– Approximately 20 mm/s to 25 mm/s for linear actuations.

c) For high speed, the actuation member shall be actuated by hand as fast as possible or using the accelerated speed.

d) For accelerated speed:

– Approximately 45°/s for rotary actuations at an angle of operation ≤45°;

– Approximately 90°/s for rotary actuations at an angle of operation >45°;

– Approximately 80 mm/s for linear actuations.

17.4.2 For biased switches, the actuating member shall be moved to the limit of travel of the opposite position.

17.4.3 *During the testing, care is taken that the test apparatus drives the actuating member, without impeding the designed movements of the switch.*

17.4.4 *During the accelerated speed test*

a) Care shall be taken to ensure that the test apparatus allows the actuating member to operate freely, so that there is no interference with the normal action of the mechanism;

b) For switches designed for a rotary actuation where the movement is not limited in either direction, three-quarters of the total number of operating cycles in each test shall be made in a clockwise direction, and one-quarter in an anti-clockwise direction;

c) For switches which are designed for rotary actuation in one direction only, the test shall be performed in the designed direction, provided that it is not possible to rotate the actuating member in the reverse direction using the torques necessary for actuation in the designed direction;

d) Additional lubrication shall not be applied during these tests;

e) The forces applied to the end stops of the actuating members shall not exceed the declared values (if any) for rotary and linear actuation. The declared full travel of the actuating member (if any) shall be applied during these tests.

17.4.5 So far as the design allows, switches are operated with the following conditions:

Table 104 – Switch operating conditions

Load type	ON (s)	OFF (s)	Comments
Up to 10 A	1	3	Approximately 15 operating cycles per minute.
>10 up to 25 A	2	6	Approximately 7,5 operating cycles per minute.
>25 up to 63 A	4	12	Approximately 3,75 operating cycles per minute.
Capacitive and simulated lamp load	2	15	To allow for the discharge of the capacitive load. See IEC 61058-1:2016, Figures 8 and 9
Tungsten lamp loads	Minimum 1	Minimum 55	55 s to allow for cooling of the tungsten lamps for inrush current; in case of more than one load sets the minimum cooling time for each load set shall be 55 s and the cycle rate for the switch may be increased.
Required very slow speed TC10	Minimum 2	Minimum 6	To allow arcing at the make and break.
Locked rotor tests (TC9)	1	30	To allow for the inrush.

For switches with more than one load (throw), each operating in the test circuit such as Table 2 test codes 2.3, 2.5, 2.7 or 2.9, the ON periods will be approximately 50 %.

Multi-way switches may comply with the table above, or be actuated with the speed indicated in 17.4.1 and a minimum ON period of 25 %.

This requirement in Table 104 is not valid for very slow speed (TC10), the on time shall be sufficient to allow arcing.