

BS EN 62246-1:2015



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Reed switches

Part 1: Generic specification

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National foreword

This British Standard is the UK implementation of EN 62246-1:2015. It is identical to IEC 62246-1:2015. It supersedes BS EN 62246-1:2011 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/94, General purpose relays and reed contact units.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2015.
Published by BSI Standards Limited 2015

ISBN 978 0 580 81977 3
ICS 29.120.70

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2015.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 62246-1

March 2015

ICS 29.120.70

Supersedes EN 62246-1:2011

English Version

Reed switches - Part 1: Generic specification (IEC 62246-1:2015)

Contacts à lames souples - Partie 1: Spécification
générique
(IEC 62246-1:2015)

Reedschalter - Teil 1: Fachgrundspezifikation
(IEC 62246-1:2015)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 94/377/FDIS, future edition 3 of IEC 62246-1, prepared by IEC TC 94 "All-or-nothing electrical relays" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62246-1:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-12-04
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-03-04

This document supersedes EN 62246-1:2011.

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Endorsement notice

The text of the International Standard IEC 62246-1:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60027 (series)	NOTE	Harmonized as EN 60027 (series).
IEC 61000-4-5:2014	NOTE	Harmonized as EN 61000-4-5:2014.
IEC 61810-1:2008	NOTE	Harmonized as EN 61810-1:2008.
IEC 61810-2	NOTE	Harmonized as EN 61810-2.
IEC 62246-1-1:2013	NOTE	Harmonized as EN 62246-1-1:2013.
IEC 61811-1	NOTE	Harmonized as EN 61811-1.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60068-1	2013	Environmental testing -- Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-1	2007	Environmental testing -- Part 2-1: Tests - Test A: Cold	EN 60068-2-1	2007
IEC 60068-2-2	2007	Environmental testing -- Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-6	2007	Environmental testing -- Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2008
IEC 60068-2-7	1983	Basic environmental testing procedures - Part 2-7: Tests - Test Ga and guidance: Acceleration, steady state	EN 60068-2-7	1993
IEC 60068-2-11	1981	Environmental testing -- Part 2: Tests - Test Ka: Salt mist	EN 60068-2-11	1999
IEC 60068-2-13	1983	Environmental testing -- Part 2: Tests - Test M: Low air pressure	EN 60068-2-13	1999
IEC 60068-2-14	2009	Environmental testing -- Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	2009
IEC 60068-2-17	1994	Basic environmental testing procedures -- Part 2: Tests - Test Q: Sealing	EN 60068-2-17	1994
IEC 60068-2-20	2008	Environmental testing -- Part 2-20: Tests - Test T: Test methods for solderability and resistance to soldering heat of devices with leads	EN 60068-2-20	2008
IEC 60068-2-21	2006	Environmental testing -- Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	2006
IEC 60068-2-27	2008	Environmental testing -- Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-30	2005	Environmental testing -- Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-2-78	-	Environmental testing -- Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60096	series	Radio-frequency cables	-	series
IEC 60947-5-1	2003	Low-voltage switchgear and controlgear -- Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices	EN 60947-5-1	2004
-	-		+corrigendum Nov.	2004
-	-		+corrigendum Jul.	2005

CONTENTS

INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms and definitions	11
3.1 Reed switch types.....	11
3.2 Operating values.....	12
3.3 Operating times (see Figure 4).....	14
3.4 Contacts	17
4 Rated values	20
4.1 General.....	20
4.2 Frequency of operation	20
4.3 Duty factor	20
4.4 Open-circuit voltage across contacts.....	20
4.5 Current rating	20
4.6 Load ratings.....	20
4.7 Number of operations	20
4.8 Climatic category	21
4.9 Environmental severities	21
4.10 Surge voltage	22
4.11 Classification	22
4.12 Contact reliability	22
5 Marking	22
6 Test and measurement procedures.....	23
6.1 General.....	23
6.2 Alternative procedures	23
6.3 Standard conditions for testing.....	23
6.4 Visual inspection and check of dimensions	23
6.4.1 Visual inspection.....	23
6.4.2 Outline dimensions	24
6.4.3 Mass.....	24
6.4.4 Information to be stated in the detail specification.....	24
6.5 Functional tests	24
6.5.1 Procedures	24
6.5.2 Requirements	25
6.5.3 Information to be stated in the detail specification.....	25
6.6 Remanence test (see Figure 8).....	26
6.6.1 Procedure.....	26
6.6.2 Requirements	26
6.6.3 Information to be stated in the detail specification.....	26
6.7 Contact circuit resistance.....	27
6.7.1 Procedure.....	27
6.7.2 Requirements	27
6.7.3 Information to be stated in the detail specification.....	28
6.8 Dielectric test.....	28
6.8.1 Procedures	28

6.8.2	Requirements	29
6.8.3	Information to be stated in the detail specification	29
6.9	Insulation resistance	29
6.9.1	Procedure	29
6.9.2	Requirements	30
6.9.3	Information to be stated in the detail specification	30
6.10	Operating times (see Figures 4, 10 and 11)	30
6.10.1	Procedure	30
6.10.2	Requirements	31
6.10.3	Information to be stated in the detail specification	31
6.11	Contact sticking	32
6.11.1	Thermal sticking	32
6.11.2	Magnetostrictive sticking	34
6.12	Robustness of terminals	35
6.12.1	Procedure	35
6.12.2	Requirements	35
6.12.3	Information to be stated in the detail specification	35
6.13	Soldering (solderability and resistance to soldering heat)	35
6.13.1	Procedure	35
6.13.2	Requirements	35
6.13.3	Information to be stated in the detail specification	35
6.14	Climatic sequence	35
6.14.1	General	35
6.14.2	Procedure	36
6.14.3	Requirements	36
6.14.4	Information to be stated in the detail specification	36
6.15	Damp heat, steady state	37
6.15.1	Procedure	37
6.15.2	Requirements	37
6.15.3	Information to be stated in the detail specification	37
6.16	Rapid change of temperature	37
6.16.1	Procedure	37
6.16.2	Requirements	37
6.16.3	Information to be stated in the detail specification	37
6.17	Salt mist	37
6.17.1	Procedure	37
6.17.2	Requirements	38
6.17.3	Information to be stated in the detail specification	38
6.18	Vibration	38
6.18.1	Vibration 1 – Functional	38
6.18.2	Vibration 2 – Survival	39
6.19	Shock	39
6.19.1	Procedure	39
6.19.2	Requirements	40
6.19.3	Information to be stated in the detail specification	40
6.20	Acceleration test – Functional test only	40
6.20.1	Procedure	40
6.20.2	Requirements	41
6.20.3	Information to be stated in the detail specification	41

6.21	Sealing	41
6.21.1	Procedure	41
6.21.2	Requirements	41
6.21.3	Information to be stated in the detail specification	41
6.22	Electrical endurance	41
6.22.1	Types of electrical endurance test	41
6.22.2	Standard electrical endurance tests	42
6.22.3	General test arrangements	42
6.22.4	Procedure	43
6.22.5	Standard load conditions	44
6.22.6	Maximum load conditions	47
6.22.7	Overload test conditions	47
6.22.8	Requirements	47
6.22.9	Information to be stated in the detail specification	48
6.23	Mechanical endurance	49
6.23.1	General test arrangements	49
6.23.2	Procedure	49
6.23.3	Requirements	50
6.23.4	Information to be stated in the detail specification	50
6.24	Maximum cycling frequency	50
6.24.1	Procedure	50
6.24.2	Requirements	51
6.24.3	Information to be stated in the detail specification	51
6.25	Surge withstand test	51
6.25.1	Procedure	51
6.25.2	Requirements	52
6.25.3	Information to be stated in the detail specification	52
6.26	Making and breaking capacities	52
6.26.1	General test arrangements	52
6.26.2	Procedure	52
6.26.3	Requirements	52
6.26.4	Information to be stated in the detail specification	52
6.27	Conditional short-circuit current test	54
6.27.1	General test arrangements	54
6.27.2	Procedure	55
6.27.3	Requirements	55
6.27.4	Information to be stated in the detail specification	55
6.28	Contact reliability test	55
6.28.1	General	55
6.28.2	Procedure	55
6.28.3	Requirements	56
6.28.4	Information to be stated in the detail specification	56
6.29	Temperature rise	57
6.29.1	Procedure	57
6.29.2	Requirements	58
6.29.3	Information to be stated in the detail specification	58
6.30	Making current capacity test	58
6.30.1	General	58
6.30.2	Procedure	58

6.30.3	Requirements	58
6.30.4	Information to be stated in the detail specification	59
6.31	Breaking current capacity test	59
6.31.1	General	59
6.31.2	Procedure	59
6.31.3	Requirements	60
6.31.4	Information to be stated in the detail specification	60
Annex A (normative)	Standard test coils for reed switches	62
Annex B (normative)	Test systems	64
Annex C (informative)	Electrical endurance test circuit	66
Annex D (informative)	Inrush current loads	68
D.1	Filament lamp loads	68
D.2	Capacitive loads	68
Annex E (informative)	Conditional short-circuit current test circuit	70
Annex F (informative)	Electrical ratings based on classification (see Table F.1)	71
Annex G (informative)	Example of horsepower ratings	72
Annex H (informative)	Example of test arrangement for contact reliability test (see Figure H.1)	73
Annex I (informative)	Example of test arrangement for making current capacity test	75
Annex J (informative)	Example of test arrangement for breaking current capacity test	77
Bibliography		79
Figure 1	– Example of reed switch structure	12
Figure 2	– Example of heavy-duty reed switch structure	12
Figure 3	– Functional characteristics	13
Figure 4	– Time definitions	15
Figure 5	– Contact diagram of make contact	17
Figure 6	– Contact diagram of break contact	17
Figure 7	– Contact diagram of change-over contact	18
Figure 8	– Remanence test sequence	27
Figure 9	– Sequence of contact circuit resistance measurement	28
Figure 10	– Test circuit for the measurement of release and bounce time of a make contact	31
Figure 11	– Test circuit for the measurement of time parameters of a change-over contact	32
Figure A.1	– Configuration of test coils	62
Figure B.1	– Test system 1	64
Figure B.2	– Test system 2	64
Figure C.1	– Generalized endurance test circuit	66
Figure C.2	– Functional block diagram	67
Figure D.1	– Circuit for filament lamp load	68
Figure D.2	– Example for capacitive load test	69
Figure E.1	– Conditional short-circuit current test circuit	70
Figure H.1	– Contact reliability test circuit	73
Figure I.1	– Making current capacity test circuit	75

Figure I.2 – Making current capacity test sequence.....	75
Figure J.1 – Breaking current capacity test circuit	77
Figure J.2 – Breaking current capacity test sequence	77
Table 1 – Classification.....	22
Table 2 – Resistive loads	45
Table 3 – Loads	46
Table 4 – Cables.....	46
Table 5 – Making and breaking capacity for electrical endurance tests	46
Table 6 – Maximum load conditions for endurance test	47
Table 7 – Overload test conditions for endurance test.....	47
Table 8 – Verification of making and breaking capacity under normal conditions	53
Table 9 – Verification of making and breaking capacity under abnormal conditions	54
Table A.1 – List of standard test coils	62
Table F.1 – Examples of contact rating designation based on classification	71
Table G.1 – Examples of horsepower ratings	72

INTRODUCTION

Reed switches which are in mass production and which are widely used in practice could be classified by the following characteristics:

a) Size:

- normal or standard reed switches with a tube more than 50 mm in length and more than 5 mm in diameter;
- sub-miniature reed switches with a tube > 25 mm and < 50 mm in length and < 5 mm in diameter;
- miniature reed switches with a tube > 10 mm and < 25 mm in length and > 2 mm and < 5 mm in diameter;
- micro-miniature reed switches with a tube > 4 mm and < 10 mm in length and > 1,5 mm and < 2 mm in diameter.

b) Type of switching of electric circuit:

- closing or normally open – A type;
- opening or normally closed – B type;
- changeover – C type.

c) Withstand voltage level:

- low-voltage (up to 1 000 V);
- high-voltage (more than 1 000 V).

d) Switches power:

- low-power (up to 60 VA);
- power (100 to 1 000 VA);
- high-power (more than 1 000 VA).

e) Types of electric contacts:

- the tube is filled with dry air, gas mixture, vacuumized, or high pressurized.

This standard selects and specifies test procedures for reed switches where enhanced requirements for the verification of generic specification apply.

An international standard IEC 62246-1-1 (a quality assessment specification including information of detail specification (DS)) was published in 2013.

REED SWITCHES –

Part 1: Generic specification

1 Scope

This part of IEC 62246 which is a generic specification applies to all types of reed switches including magnetically biased reed switches of assessed quality for use in general and industrial applications.

NOTE 1 Mercury wetted reed switches are not covered by this standard due to their possible environmental impact.

It lists the tests and measurement procedures which may be selected for use in detail specifications for such reed switches.

This standard applies to reed switches which are operated by an applied magnetic field; it is not restricted to any particular type of contact load.

For elementary relays with reed switches, this standard is recommended to be used together with the standards IEC 61810-1, IEC 61811-1 as applicable.

For applications of reed switches, this standard is recommended to be used together with specific product standards.

NOTE 2 Where any discrepancies occur for any reasons, documents rank in the following order of authority:

- a) the detail specification,
- b) the sectional specification,
- c) the generic specification,
- d) any other international documents (for example, of the IEC) to which reference is made.

The same order of precedence applies to equivalent national documents.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-7:1983, *Basic environmental testing procedures – Part 2-7: Tests – Test Ga and guidance: Acceleration, steady state*

IEC 60068-2-11:1981, *Basic environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-13:1983, *Basic environmental testing procedures – Part 2-13: Tests – Test M: Low air pressure*

IEC 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*

IEC 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-21:2006, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-78, *Basic environmental testing procedures – Part 2: Tests – Test Cab: Damp heat, steady state*

IEC 60096 (all parts), *Radio frequency cables*

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Definitions of terms not stipulated in this standard are given in the IEC 60050 series, in particular in IEC 60050-444.

3.1 Reed switch types

3.1.1

type

products having similar design features and nominal dimensions manufactured by the same techniques and falling within a range of ratings specified by the manufacturer

Note 1 to entry: Mounting accessories are ignored, provided they have no significant effect on the test results.

3.1.2

variant

variation within a type having specific characteristics

3.1.3

reed switch

assembly containing contact blades, partly or completely made of magnetic material, hermetically sealed in an envelope and controlled by means of an externally generated magnetic field

Note 1 to entry: For example, an energizing quantity applied to a coil.

Note 2 to entry: See Figure 1.

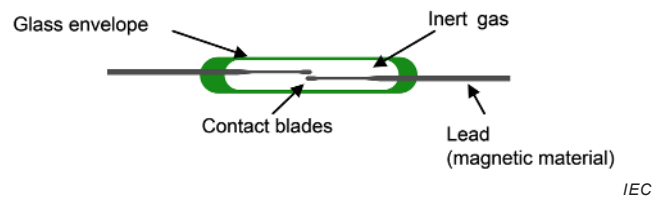


Figure 1 – Example of reed switch structure

3.1.4

high voltage vacuum reed switch

reed switch, in which ability to switch high voltages is achieved by a high vacuum within the hermetically sealed envelope

3.1.5

heavy-duty reed switch

reed switch, in which greater switching capacity is achieved

Note 1 to entry: See Figure 2.

Note 2 to entry: Blades having additional contact tips or a contact tip and spring which separate the magnetic path and electric path are typical examples of techniques to increase switching capacity.

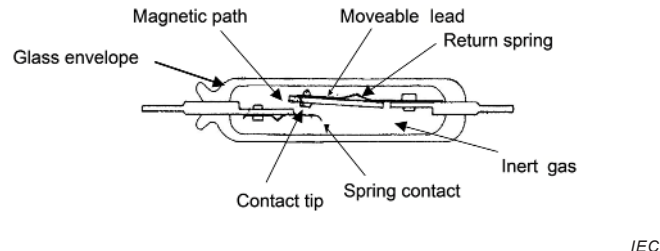


Figure 2 – Example of heavy-duty reed switch structure

3.1.6

magnetically biased reed switch

reed switch to which a biasing magnetic field is applied, determining the functional characteristics and the operate and release position

3.2 Operating values

3.2.1

preferred position

position recommended for use and in which tests are normally performed, unless otherwise specified

3.2.2

rated value

value of a quantity used for specification purpose, established for a specific set of operating conditions

3.2.3

operate position

position in which the make contact is closed and the break contact is open

3.2.4**release position**

position in which the make contact is open and the break contact is closed

3.2.5**just-operate value**

value of the magnetic and electro magnetic fields at which the released reed switch just operates

Note 1 to entry: See Figure 3.

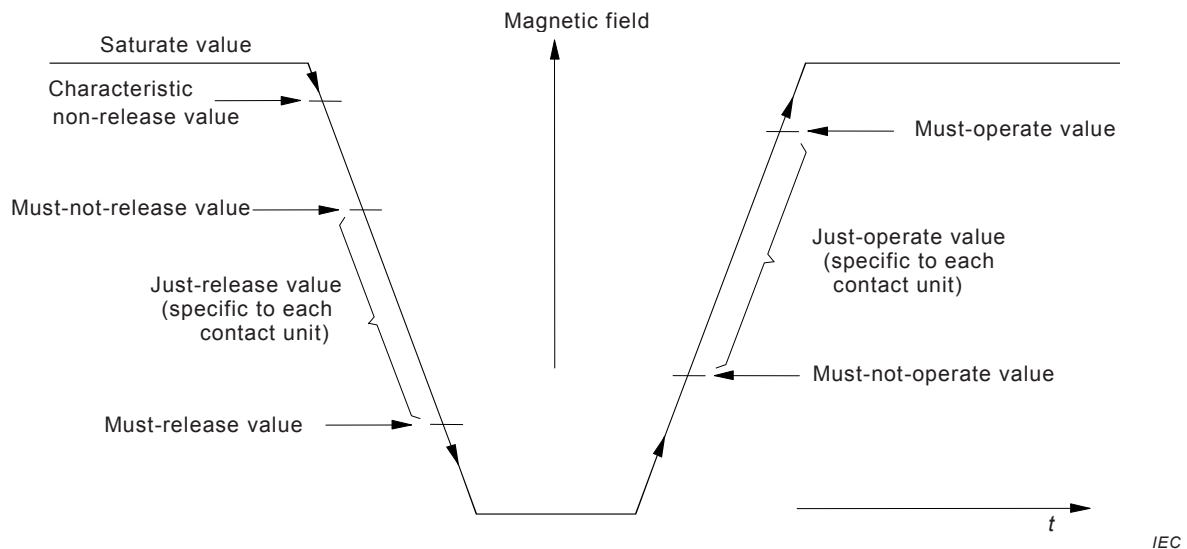


Figure 3 – Functional characteristics

3.2.6**must-operate value**

stated limit of the applied magnetic field at which the reed switch operates

Note 1 to entry: See Figure 3.

3.2.7**just-release value**

value of the applied magnetic field at which the operated reed switch just releases

Note 1 to entry: See Figure 3.

3.2.8**must-release value**

stated limit of the applied magnetic field at which the operated reed switch releases

Note 1 to entry: See Figure 3.

3.2.9**must-not-operate value**

stated limit of the applied magnetic field at which the reed switch does not operate

Note 1 to entry: See Figure 3.

3.2.10**must-not-release value**

stated limit of the applied magnetic field at which the operated reed switch remains operated

Note 1 to entry: See Figure 3.

3.2.11**characteristic non-release value**

stated value of the applied magnetic field above which the operated reed switch fulfils specified qualities, for example contact resistance, noise characteristics, etc.

Note 1 to entry: See Figure 3.

3.2.12**saturate value**

value of the applied magnetic field at which the reed switch is unaffected by further increase of the applied magnetic field

Note 1 to entry: See Figure 3.

3.2.13**contact bounce**

phenomenon which can occur while a contact circuit is making or breaking and which is characterized by the contact points successively touching and separating before reaching their final position

3.2.14**magnetic dwell**

difference in the values of applied magnetic field when the break contact just opens and the make contact just closes, or vice versa

3.3 Operating times (see Figure 4)**3.3.1****bounce time**

for a contact which is closing/opening its circuit, time interval between the instant when the contact circuit first closes/opens and the instant when the circuit is finally closed/opened

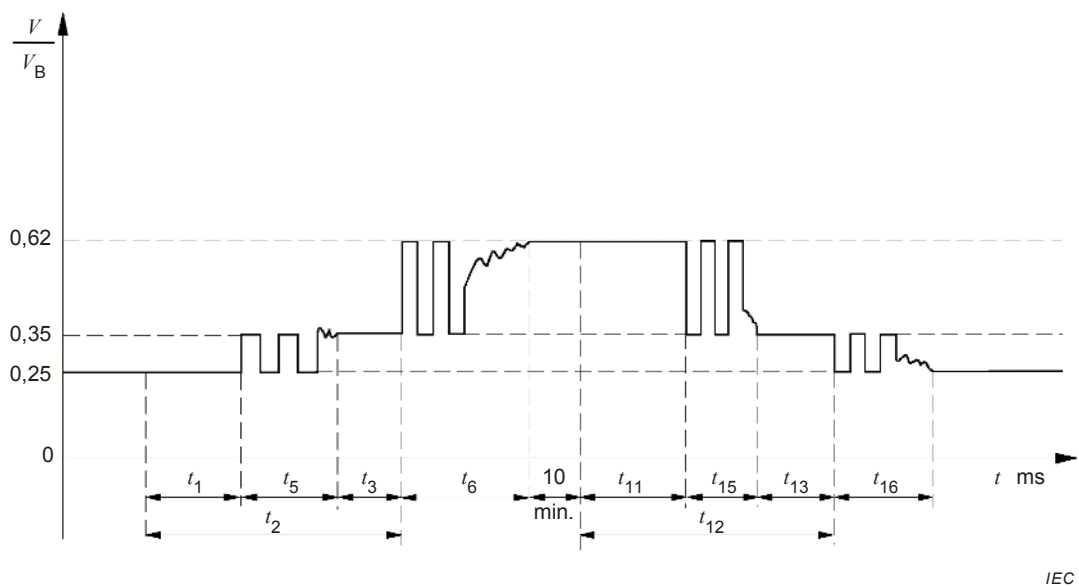
3.3.2**operate time**

time interval between the application of the specified magnetic field to a reed switch in the release condition and the change of state of the last output circuit (not including bounce time)

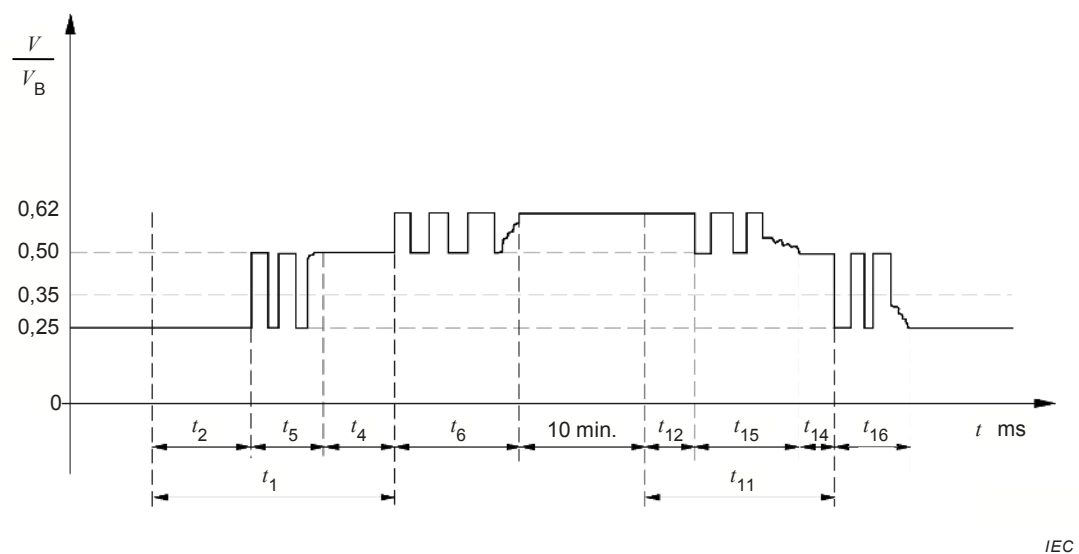
3.3.3**release time**

time interval between the removal of the specified magnetic field to a reed switch in the operate condition, and the change of state of the last output circuit (not including bounce time)

Oscilloscope diagram



a) Break-before-make



b) Make-before-break

Energization of the test coil

 t_1 : operate break time t_2 : operate make time t_3 : operate transfer time t_4 : operate bridging time t_5 and t_6 : bounce times

De-energization of the test coil

 t_{11} : release break time t_{12} : release make time t_{13} : release transfer time t_{14} : release bridging time t_{15} and t_{16} : bounce timesRefer to Figures 10 and 11 for key to V_B .

Figure 4 – Time definitions

3.3.4**transfer time**

time interval during which both contact circuits are open (not including bounce time)

Note 1 to entry: Form C contact only.

3.3.5**bridging time**

time interval during which both contact circuits are closed (not including bounce time)

Note 1 to entry: Form C contact only.

3.3.6**operate make time**

time interval between the instant of the application of a magnetic field to the reed switch and the instant of the first closing of the make contact

3.3.7**operate break time**

time interval between the instant of the application of a magnetic field to the reed switch and the instant of the first opening of the break contact

3.3.8**release make time**

time interval between the instant of the removal of an applied magnetic field from the reed switch and the instant of the first closing of the break contact

3.3.9**release break time**

time interval between the instant of the removal of an applied magnetic field from the reed switch and the instant of the first opening of the make contact

3.3.10**operate transfer time**

transfer time measured when the break-before-make reed switch moves from the release position to the operate position

Note 1 to entry: Form C contact only.

3.3.11**release transfer time**

transfer time measured when the break-before-make reed switch moves from the operate position to the release position

Note 1 to entry: Form C contact only.

3.3.12**minimum time of operate energization**

minimum time between the instant of the first application of a magnetic field (at a stated value), and the instant of reduction of that field to the characteristic non-release value to ensure that the reed switch is maintained in the operate condition

3.3.13**time to stable closed position**

time between the instant of application of a specified magnetic field to the instant at which the reed switch fulfils specified qualities, for example, contact resistance, noise characteristics

3.4 Contacts

3.4.1

contact blade

metal blade providing the functions of either the electric or magnetic circuit or both functions combined as in the case of dry reed switches

3.4.2

biasing magnetic field

continuous magnetic field intended to determine the operate and the release position of the contact, which can be adjusted to form a monostable or bistable switch

Note 1 to entry: For bistable switches, operate and release conditions have to be defined in the detail specification with reference to applied magnetic field polarity.

3.4.3

applied magnetic field

externally generated field (for example by a test coil) intended to change the position of the contact

3.4.4

switch, mechanically biased

switch where the biasing, to determine the operate and release positions, is achieved mechanically

3.4.5

make contact

contact which is closed when the reed switch is in its operate condition and which is open when the switch is in its release condition, there is no applied magnetic field

Note 1 to entry: Form A contact.

Note 2 to entry: See Figure 5.

Note 3 to entry: The make contact is also known as a normally open (NO) contact.

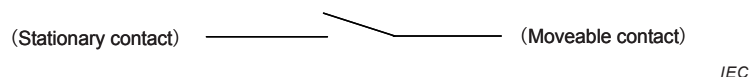


Figure 5 – Contact diagram of make contact

3.4.6

break contact

contact which is open when the reed switch is in its operate condition and which is closed when the switch is in its release condition, there is no applied magnetic field

Note 1 to entry: Form B contact.

Note 2 to entry: See Figure 6.

Note 3 to entry: The break contact is also known as a normally closed (NC) contact.



Figure 6 – Contact diagram of break contact

3.4.7**change-over contact**

contact set which contains a make contact and a break contact within a single envelope, one contact blade being common. Change-over contact in which the break contact circuit opens before the make contact circuit closes or the make contact circuit makes before the break contact circuit breaks

Note 1 to entry: Form C contact.

Note 2 to entry: See Figure 7.

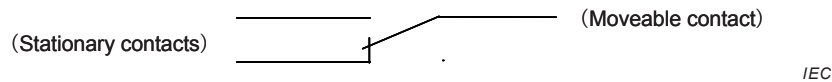


Figure 7 – Contact diagram of change-over contact

3.4.8**maximum cycling frequency**

maximum number of cycles per second, at and below which the reed switch still meets the specifications

3.4.9**failure-to-make**

fault condition of the contacts, indicated by the contact circuit resistance of the unit exceeding a specified value, for a specified applied magnetic field, within a specified period

3.4.10**failure-to-break**

fault condition of the contacts, indicated by the contact circuit resistance of the unit failing to exceed a specified value, for a specified applied magnetic field, within a specified period

3.4.11**contact sticking**

failure-to-break of a reed switch due to residual magnetic, physical or chemical effects

3.4.12**maximum switching current**

maximum allowed switched DC or peak current in correlation to a given number and frequency of operations and load, under specified conditions

3.4.13**limiting continuous current**

greatest value of electric current which a closed contact is capable of carrying continuously under specified conditions

3.4.14**maximum switching voltage**

maximum allowed switched AC/DC or peak voltage, in correlation to a given number of operations and load, under specified conditions

3.4.15**contact noise**

spurious voltage which appears across the terminals of a closed contact

3.4.16**thermal e.m.f.**

e.m.f. generated by the reed switch, when connected to an external circuit in an operate position and subjected to a temperature differential

3.4.17**duty factor**

ratio of the duration of energization to the total period of operation

Note 1 to entry: The duty factor can be expressed as a percentage of the total period.

3.4.18**rated conditional short-circuit current**

value of prospective current, stated by the manufacturer, which the switch, protected by a short-circuit protective device specified by the manufacturer, can withstand satisfactorily under specified conditions

3.4.19**cycle-related failure rate**

mean number of failures relative to the number of cycles of service of the switch

Note 1 to entry: λ_c is the reciprocal of MTBF_c.

3.4.20**frequency of operation**

number of cycles per unit of time

3.4.21**mechanical endurance**

number of cycles until contact failure, with unloaded output circuit(s) and under specified operating conditions

3.4.22**electrical endurance**

number of cycles until contact failure, with specified electrical loading of the output circuit(s) and under specified operating conditions

3.4.23**rated making current capacity**

value of electric current which the reed switch is capable of making under specified conditions such as contact voltage, number of makes, power factor, time constant

Note 1 to entry: For AC the r.m.s. value is specified.

3.4.24**rated breaking current capacity**

value of electric current which the reed switch is capable of breaking under specified conditions such as contact voltage, number of breaks, power factor, time constant

Note 1 to entry: For AC the r.m.s. value is specified.

3.4.25**rated insulation voltage**

value of voltage to which dielectric tests and creepage distances are referred

3.4.26**open circuit voltage across contacts**

voltage between the terminals of a make switch in the release position, and between the terminals of a break switch in the operate position

3.4.27**rated operational voltage**

U_e

value of voltage which, combined with a rated operational current, determines the application of the equipment and to which the relevant tests and the classification are referred

3.4.28**rated operational current** I_e

value of current which, combined with a rated operational voltage, determines the application of the equipment and to which the relevant tests and the classification are referred

4 Rated values**4.1 General**

The recommended values listed below do not comprise all technical possibilities; unless otherwise stated in the detail specification other values may be adopted according to conditions of operation and use.

4.2 Frequency of operation

Recommended frequencies: 1; 2; 5; 8; 10; 12,5; 16; 20; 25; 30; 50; 60; 100; 120; 200; 500 operations per second.

4.3 Duty factor

Recommended value: 50 %.

4.4 Open-circuit voltage across contacts

- a) 0,01 V a.c.; 0,1 V a.c.; 5 V a.c.; 12 V a.c.; 24 V a.c.; 30 V a.c.; 40 V a.c.; 50 V a.c.; 100 V a.c.; 110 V a.c.; 120 V a.c.; 127 V a.c.; 150 V a.c.; 170 V a.c.; 175 V a.c.; 200 V a.c.; 220 V a.c.; 240 V a.c.; 250 V a.c.; 265 V a.c.; 300 V a.c.; 380 V a.c.; 400 V a.c.; 500 V a.c.; 1 000 V a.c.; 1 500 V a.c.; 2 000 V a.c. (r.m.s.).
- b) 0,01 V d.c.; 0,03 V d.c.; 0,05 V d.c.; 0,1 V d.c.; 1 V d.c.; 1,5 V d.c.; 4,5 V d.c.; 5 V d.c.; 6 V d.c.; 6,3 V d.c.; 10 V d.c.; 12 V d.c.; 15 V d.c.; 17 V d.c.; 20 V d.c.; 24 V d.c.; 28 V d.c.; 30 V d.c.; 36 V d.c.; 40 V d.c.; 48 V d.c.; 50 V d.c.; 60 V d.c.; 72 V d.c.; 80 V d.c.; 96 V d.c.; 100 V d.c.; 110 V d.c.; 125 V d.c.; 150 V d.c.; 170 V d.c.; 175 V d.c.; 200 V d.c.; 220 V d.c.; 250 V d.c.; 265 V d.c.; 280 V d.c.; 350 V d.c.; 400 V d.c.; 440 V d.c.; 500 V d.c.; 600 V d.c.; 800 V d.c.; 1 000 V d.c.; 1 200 V d.c.; 1 500 V d.c.; 2 000 V d.c.; 3 500 V d.c.; 5 000 V d.c.; 10 000 V d.c.; 15 000 V d.c.

4.5 Current rating

Recommended values: 1 A; 1,25 A; 1,5 A; 1,6 A; 2 A; 2,5 A; 3 A; 3,15 A; 3,5 A; 4 A; 5 A; 6,3 A; 7 A; 7,5; 8 A or the decimal multiples or submultiples of these figures in A.

4.6 Load ratings

Recommended values: 0,3 VA; 1 VA; 2 VA; 3 VA; 5 VA; 10 VA; 15 VA; 16 VA; 20 VA; 25 VA; 30 VA; 40 VA; 50 VA; 70 VA; 100 VA; 150 VA; 250 VA; 500 VA; 750 VA; 1 000 VA; 1 800 VA; 3 600 VA; 7 200 VA.

Recommended values: 0,1 W; 0,3 W; 1 W; 2 W; 3 W; 5 W; 10 W; 15 W; 16 W; 20 W; 25 W; 30 W; 40 W; 50 W; 70 W; 100 W; 150 W; 250 W; 500 W.

4.7 Number of operations

Recommended number of cycles: 5 000, 10 000, 20 000, 50 000,

1×10^5 , 2×10^5 , 1×10^6 , 2×10^6 , 5×10^6 , 1×10^7 , 2×10^7 , 5×10^7 , 1×10^8 , 2×10^8 , 5×10^8 , 1×10^9 , 1×10^{10} .

4.8 Climatic category

The climatic category (see Annex A of IEC 60068-1:2013) of a reed switch, both steady state and cyclic, shall be established by a selection from the following preferred standard values of lower and upper ambient temperatures and damp heat values.

- a) The preferred values of lower ambient temperature are:
–65 °C, –55 °C, –50 °C, –40 °C, –25 °C, –10 °C
- b) The preferred values of upper ambient temperature are:
40 °C, 55 °C, 70 °C, 85 °C, 100 °C, 125 °C, 150 °C, 180 °C, 200 °C
- c) The preferred times of exposure to damp heat, steady state are:
4, 10, 21, 42, 56 days
- d) The preferred climatic categories are:
65 / 125 / 56
40 / 100 / 56
40 / 100 / 21
40 / 85 / 56
40 / 70 / 21
25 / 70 / 21
25 / 55 / 04
10 / 40 / 04
10 / 55 / 04

4.9 Environmental severities

- a) Vibration (IEC 60068-2-6, Test Fc)

Frequency	Vibration amplitude or acceleration	No. of sweep cycles
10 Hz to 500 Hz	0,35 mm or 49 m/s ² (5 g_n)	10
10 Hz to 500 Hz	0,75 mm or 98 m/s ² (10 g_n)	10
10 Hz to 2 000 Hz	0,75 mm or 98 m/s ² (10 g_n)	8
10 Hz to 2 000 Hz	1,5 mm or 196 m/s ² (20 g_n)	8
10 Hz to 2 000 Hz	3,5 mm or 490 m/s ² (50 g_n)	12

Duration of the sweep endurance in each of the three axes is given by a specified number of sweep cycles. Sweep rate: 1 octave per minute $\pm$ 10 %.

Cross-over frequency between 57 Hz and 62 Hz.

- b) Shock (IEC 60068-2-27, Test Ea)

6 ms, 980 m/s², 100 g_n
 11 ms, 490 m/s², 50 g_n
 11 ms, 294 m/s², 30 g_n

- c) Acceleration (IEC 60068-2-7, Test Ga)

m/s ²	g_n
98	10
196	20
490	50
19 600	2 000

49 000	5 000
98 000	10 000
196 000	20 000
294 000	30 000

Duration of 1 min in each direction prescribed in the specification.

d) Low air pressure (IEC 60068-2-13, Test M): 80 hPa

4.10 Surge voltage

a) 800 V, 1 500 V, 2 500 V, 3 000 V, 4 000 V, 5 000 V

b) $1,2 \times 50 \mu\text{s}$, $10 \times 700 \mu\text{s}$ or $1\,000 \mu\text{s}$.

4.11 Classification

The classification as given in Table 1 is preferred. Any other types of application shall be based on agreement between manufacturer and user, but information given in the manufacturer's catalogue or tender may constitute such an agreement.

Table 1 – Classification

Kind of current	Classification	Typical application
AC	AC inductive load (contactor coil, solenoid valve)	Control of electromagnetic loads >72 VA
DC	DC inductive load (contactor coil, solenoid valve)	Control of electromagnets

Utilization categories as given in IEC 60947-5-1 may also apply; in such cases all the relevant requirements and tests from IEC 60947-5-1 shall be fulfilled, e.g. the requirements regarding the ability to make and break under normal and abnormal load conditions, conditional short-circuit current, etc.

NOTE Special requirement for capacitive and filament lamp loads can be applied.

4.12 Contact reliability

Recommended values of failure rates: 1; 5; 10 failures per 10^9 cycles.

5 Marking

The sectional or detail specifications shall indicate the identification criteria and other information to be shown on the unit and/or package. The letter or colour code shall be described in full or reference made to the appropriate specifications. The order of priority for marking small units shall be specified.

Information given in the manufacturer's literature may take the place of marking of contact ratings (examples of contact ratings are shown in Annex F and Annex G).

The marking shall, as a minimum, consist of:

- the trade mark or the manufacturer's name;
- the unit, type and variants' code;
- the coded date of manufacture, quantified by months or less.

Each package of reed switches shall be marked with the following information:

- date code;

- number of the detail specification;
- manufacturer's factory identification code;
- additional marking as required by the detail specification.

6 Test and measurement procedures

6.1 General

The blank detail specifications shall contain tables showing the tests to be made, which measurements are to be made before and after each test or subgroup of tests, and the sequence in which they shall be carried out.

6.2 Alternative procedures

The test and measurement methods given in the relevant specification are not necessarily the only methods which can be used. However, the manufacturer shall satisfy the National Supervising Inspectorate that any alternative methods which he uses will give results equivalent to those obtained by the methods specified.

Alternative methods shall not be used where methods are specifically designated as referee or reference methods.

6.3 Standard conditions for testing

Unless otherwise prescribed, all tests shall be carried out under standard atmospheric conditions for testing, as specified in IEC 60068-1. The stages of each test shall be carried out in the order written.

For those measurements that require the switch to be energized, the switch shall be positioned in its test coil as prescribed in the detail specification.

Test coils and test systems shall, wherever possible, be selected from the list of standard test coils in Annex A.

The test shall be carried out in an environment such that no external field or body can influence the test results by an amount equivalent to $0,5 \text{ A} \times \text{turns}$ or 2 %, whichever is the greater.

The voltage of the test supply as measured at the test specimen shall remain within 0,5 % of the nominal value at all test conditions other than the voltage test, unless otherwise prescribed.

6.4 Visual inspection and check of dimensions

6.4.1 Visual inspection

Unless otherwise prescribed in the detail specification, inspection shall be performed under normal visual conditions. The workmanship, seals, finish, and marking shall be as prescribed in the detail specification.

If prescribed in the detail specification, more detailed visual inspection under specified magnification shall be made for failures such as:

- glass defects: cracks, bubbles, crystallisation, devitrification, chips, cold-seals, short-seals, un-wetted parts, etc;
- geometrical defects: contact alignment, overlapping failures, burrs, parallelism, etc;

- mechanical defects: blistering, un-plated areas, staining, rusting, magnetic and non-magnetic dirt, whisker growth, etc.

6.4.2 Outline dimensions

The outline dimensions shall be checked and shall comply with those prescribed in the detail specification.

6.4.3 Mass

The nominal mass shall be prescribed in the detail specification whenever required.

6.4.4 Information to be stated in the detail specification

The detail specification shall include the following:

- For visual inspection, typically: conditions of light and magnification, inspection limits.
- Outline dimensions.
- Nominal mass.

6.5 Functional tests

6.5.1 Procedures

6.5.1.1 Procedures for reed switches

Functional tests shall be applied, in the order given, to the switch mounted in a test coil. Unless otherwise prescribed, the increase and decrease of the energization of the coil shall be performed at a rate not greater than:

- 5 A × turns/ms for saturate value and zero energization;
- 1 A × turns/ms for must-not-release, must-release, must-not-operate, must-operate, just-release and just-operate values.

Either of the following monitoring procedures may be used:

Procedure 1: Contact circuits shall be monitored, throughout the tests, for failure-to-make and failure-to-break at the appropriate values of test coil energization.

Procedure 2a: Physical opening and closing of the contact shall be monitored throughout the tests by magnetic induction or other equivalent methods.

- Saturate: The test coil shall be energized for a specified period to the saturate value. The contact is then in the operate position.
- Must-not-release: When prescribed, the energization of the coil shall be reduced to the must-not-release value (see Notes 1 and 2).
- Must-release: The energization of the coil shall be reduced from the must-not-release value (or in its absence, the saturate value) to the must-release value. Unless otherwise prescribed, the release energization attained shall then be reduced to zero for a minimum period of 20 ms.
- Must-not-operate: When prescribed, the energization of the coil shall be increased from zero to the must-not-operate value (see Note 1).
- Must-operate: The energization of the coil shall be increased from zero (or from the must-not-operate value, when specified) to the must-operate value.

Procedure 2b: Physical opening and closing of the contact shall be monitored throughout the tests by magnetic induction or other equivalent methods.

- Saturate: The test coil shall be energized for a specified period to the saturate value. The contact is then in the operate condition.
- Zero energization: The energization shall be reduced to zero for a period of 20 ms.