

Harmonized system of quality
assessment for electronic components

Electromechanical switches for use in electronic equipment— Generic specification

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Policy Committee (ECL/-) to Technical Committee ECL/21, upon which the following bodies were represented:

- British Telecommunications plc
- Electronic Components Industry Federation
- EEA (the Association of Electronics Telecommunications and Business Equipment Industries)
- Ministry of Defence
- National Supervising Inspectorate
- Society of British Aerospace Companies Ltd.

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Association of Control Manufacturers [TACMA (BEAMA Ltd.)]
- Membrane Switch Manufacturers Association (MSMA)

This British Standard, having been prepared under the direction of the Electronic Components Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 October 1992

© BSI 08-1999

The following BSI references relate to the work on this standard:
Committee reference ECL/21
Draft for comment 84/20971 DC

ISBN 0 580 21133 9

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Introduction	1
Section 1. Scope and object	
1.1 Scope	1
1.2 Object	1
Section 2. General	
2.1 Related publications	2
2.2 Units and symbols	3
2.3 Terminology	3
2.4 Preferred values	4
2.5 Marking	4
Section 3. Quality assessment procedures	
3.1 Qualification approval/Quality assessment systems	5
3.2 Primary stage of manufacture	5
3.3 Structurally similar switches	5
3.4 Qualification approval procedures	5
3.5 Quality conformance inspection	6
3.6 Alternative test methods	6
3.7 Unchecked parameters	7
Section 4. Test and measurement procedures	
4.1 General	7
4.2 Standard atmospheric conditions	7
4.3 General examination	8
4.4 Resistance measurements	9
4.5 Voltage stress	11
4.6 Temperature rise	11
4.7 Dynamic stress	11
4.8 Mechanical strength	12
4.9 Mechanical endurance	14
4.10 Electrical endurance	15
4.11 Overload	18
4.12 Environmental	19
4.13 Soldering	21
4.14 Panel seal	22
4.15 Enclosure seal	23
4.16 Fluid resistance	24
4.17 Fire hazard	24
4.18 Capacitance	25
4.19 Illumination	25
Figure 1 — Contact bounce test circuit	9
Figure 2 — Typical trace of contact bounce	10
Figure 3 — Application of forces and torques for test 4.8.1	13
Figure 4 — Submersion seal test enclosure	23
List of references	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is identical with IEC 1020-1:1991 (QC 960000) *Electromechanical switches for use in electronic equipment — Part 1: Generic specification*, published by the International Electrotechnical Commission (IEC), and is a harmonized specification in the IECQ system of quality assessment for electronic components.

IEC 1020-1 was prepared by IEC Subcommittee 48C, Switches, of IEC Technical Committee No. 48, Electromechanical components for electronic equipment, and the United Kingdom participation in the drafting was provided by Subcommittee ECL/21/3, Switches for electronic equipment, of Technical Committee ECL/21, Electromechanical components for electronic equipment.

Cross-references

International Standard	Corresponding British Standard
ISO 129:1985	BS 308 <i>Engineering drawing practice</i> Part 2:1985 <i>Recommendations for dimensioning and tolerancing of size</i> (Technically equivalent)
ISO 286-1:1988	BS 4500 <i>ISO limits and fits</i> Section 1.1:1990 <i>Specification for bases of tolerances, deviations and fits</i> (Identical)
ISO 1000:1981	BS 5555:1981 <i>Specification for SI units and recommendations for the use of their multiples and of certain other units</i> (Identical)
IEC 50(151):1978	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 1:Group 02:1980 <i>Electrical and magnetic devices terminology</i> (Technically equivalent)
IEC 50(441):1984	Part 2:Group 06:1985 <i>Switchgear and controlgear terminology (including fuse terminology)</i> (Technically equivalent)
IEC 50(581):1978	Part 1:Group 13:1991 <i>Electromechanical components for electronic equipment</i> (Identical)
IEC 62:1974	BS 1852:1975 <i>Specification for marking codes for resistors and capacitors</i> (Identical) BS 2011 <i>Environmental testing</i>
IEC 68-1:1983	Part 1.1:1989 <i>General and guidance</i> (Identical)
IEC 68-2-17:1978	Part 2.1Q:1981 <i>Test Q. Sealing</i> (Identical)
IEC 68-2-20:1979	Part 2.1T: <i>Test T. Soldering</i> (Identical)
IEC 68-2-21:1983	Part 2.1U:1984 <i>Test U. Robustness of terminations and integral mounting devices</i> (Identical)
IEC 68-2-38:1974	Part 2.1Z/AD:1977 <i>Tests Z/AD. Composite temperature/humidity cyclic test</i> (Identical)

International Standard Corresponding British Standard

IEC 68-2-45:1980	Part 2.1XA:1981 <i>Test XA and guidance. Immersion in cleaning solvents</i> (Identical)
IEC 410:1973	BS 6001 <i>Sampling procedures for inspection by attributes</i> Part 1:1991 <i>Specification for sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection</i> (Technically equivalent) BS 5772 <i>Basic testing procedures and measuring methods for electromechanical components for electronic equipment</i>
IEC 512-3:1976	Part 3:1979 <i>Current-carrying capacity tests</i> (Identical)
IEC 512-4:1976	Part 4:1979 <i>Dynamic stress tests</i> (Identical)
IEC 512-5:1977	Part 5:1979 <i>Impact tests (free components), static load tests (fixed components), endurance tests and overload tests</i> (Identical)
IEC 512-6:1984	Part 6:1984 <i>Climatic tests and soldering tests</i> (Identical)
IEC 512-8:1985	Part 8:1985 <i>Connector tests (mechanical) and mechanical tests on contacts and terminations</i> (Identical)
IEC 512-9:1977	Part 9:1979 <i>Cable-clamping tests, explosion hazard tests, chemical resistance tests, fire hazard tests, r.f. resistance tests, capacitance tests, shielding and filtering tests and magnetic interference tests</i> (Identical)
IEC 617	BS 3939 <i>Graphical symbols for electrical power, telecommunications and electronics diagrams</i> (Most Parts are identical)
IEC 664:1980 } IEC 664A:1981 }	PD 6499:1981 <i>Guide to insulation co-ordination within low-voltage systems including clearances and creepage distances for equipment</i> (Identical)
IEC 707:1981	BS 6334:1983 <i>Methods of test for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source</i> (Identical)
QC 001002:1986	BS QC 001002:1991 <i>Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ)</i> (Identical)

The British Standard which implements the IECQ Rules of Procedure is BS 9000-3:1991 *General requirements for a system for electronic components of assessed quality — Part 3 Specification for the national implementation of the IECQ System.*

The Technical Committee has reviewed the provisions of ISO 1101, IEC 27, IEC 65, IEC 50(00), IEC 512-2, IEC 512-7, IEC 529 and QC 001001, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

This generic specification covers electromechanical switches of assessed quality. It provides the general requirements, test methods, and quality assessment requirements for use in sectional specifications for push-button switches, rotary switches, sensitive switches, toggle switches, and other electromechanical switches.

The scope of this generic specification has been limited to electromechanical switches for use in electronic equipment to be compatible with the scope assigned to the Technical Committee; however, electromechanical switches are also widely used in electrical equipment as well as in electronic equipment. Electromechanical switches of assessed quality may be used in either electronic equipment or electrical equipment, providing the requirements of the detail specification for the switch ensure compliance with the requirements for the equipment.

As used within this generic specification, the term “electronic equipment” includes any equipment, apparatus, or appliance which incorporates an electronic circuit.

Where it is intended that an electromechanical switch comply with requirements related to safety, the specific safety requirements shall be specified in the detail specification.

Subsequent to the preparation of this publication, it has been noted by both Sub-Committees 23J and 48C that, in a future edition of this generic specification, consideration will be given to the harmonization of safety requirements.

Section 1. Scope and object

1 Scope and object

1.1 Scope

This generic specification is applicable to electromechanical switches of assessed quality in accordance with the IEC Quality Assessment System for Electronic Components (IECQ).

Switches covered by this specification:

- a) are devices which open, close, or change the connection of a circuit by the mechanical motion of conducting parts (contacts);
- b) have a maximum rated voltage of 500 V;
- c) have a maximum rated current of 63 A;
- d) are intended for use in electronic equipment or similar uses.

This generic specification does not include keyboards and keypads which are intended for use in information-handling systems. Electromechanical key switches may be included within the scope of this generic specification.

Switch families shall be described in sectional specifications that make reference to this generic specification. Blank detail specifications, from which detail specifications may be developed by filling in the relevant performance data, make reference to the applicable sectional specifications. In lieu of blank detail specifications, the sectional specification may provide instructions for the preparation of detail specifications.

1.2 Object

The object of this generic specification is to establish a uniform quality assessment system and to provide consistency in sectional specifications for electromechanical switches by specifying the terminology, symbols, test methods and other necessary information.

Section 2. General

2 General

2.1 Related publications

The following publications form a part of this specification to the extent specified herein. When a specific edition is not given, the latest edition of the publication shall be used.

IEC 27:	<i>Letter symbols to be used in electrical technology.</i>
IEC 50(581):	<i>International Electrotechnical Vocabulary, Chapter 581: Electromechanical components for electronic equipment.</i>
IEC 62:	<i>Marking codes for resistors and capacitors.</i>
IEC 65:	<i>Safety requirements for mains operated electronic and related apparatus for household and similar general use.</i>
IEC 68:	<i>Environmental testing.</i>
IEC 68-1 (1983):	<i>Part 1: General and guidance.</i>
IEC 68-2-17 (1978):	<i>Part 2: Test Q: Sealing.</i>
IEC 68-2-20 (1979):	<i>Test T: Soldering.</i>
IEC 68-2-21 (1983):	<i>Test U: Robustness of terminations and integral mounting devices.</i>
IEC 68-2-38 (1974):	<i>Test Z/AD: Composite temperature/humidity cyclic test.</i>
IEC 68-2-45 (1980):	<i>Test XA and guidance: Immersion in cleaning solvents.</i>
IEC 410 (1973):	<i>Sampling plans and procedures for inspection by attributes.</i>
IEC 512:	<i>Electromechanical components for electronic equipment; basic testing procedures and measuring methods.</i>
IEC 512-2 (1985):	<i>Part 2: General examination, electrical continuity and contact resistance tests and voltage stress tests.</i>
IEC 512-3 (1976):	<i>Part 3: Current-carrying capacity tests.</i>
IEC 512-4 (1976):	<i>Part 4: Dynamic stress tests.</i>
IEC 512-5 (1977):	<i>Part 5: Impact tests (free components), static load tests (fixed components), endurance tests and overload tests.</i>
IEC 512-6 (1984):	<i>Part 6: Climatic tests and soldering tests.</i>
IEC 512-7 (1978):	<i>Part 7: Mechanical operating tests and sealing tests.</i>
	<i>Amendment No. 1 (1983).</i>
IEC 512-8 (1984):	<i>Part 8: Connector tests (mechanical) and mechanical tests on contacts and terminations.</i>
	<i>Amendment No. 1 (1985).</i>
IEC 512-9 (1977):	<i>Part 9: Cable-clamping tests, explosion hazard tests, chemical resistance tests, fire hazard tests, r.f. resistance tests, capacitance tests, shielding and filtering tests and magnetic interference tests.</i>
	<i>Amendment No. 1 (1982).</i>
IEC 617:	<i>Graphical symbols for diagrams.</i>
IEC 664:	<i>Insulation co-ordination within low-voltage systems including clearances and creepage distances for equipment.</i>
IEC 664A:	<i>First supplement.</i>
IEC 707 (1981):	<i>Methods of test for the determination of the flammability of solid electrical insulating materials when exposed to an igniting source.</i>
IECQ QC 001001:	<i>Basic rules of the IEC Quality Assessment System for Electronic Components (IECQ).</i>
IECQ QC 001002:	<i>Rules of procedure of the IEC Quality Assessment System for Electronic Components (IECQ).</i>

ISO 129:	<i>Technical drawings — Dimensioning — General principles, definitions, methods of execution and special indications.</i>
ISO 286-1:	<i>ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits.</i>
ISO 1000:	<i>SI units and recommendations for the use of their multiples and of certain other units.</i>
ISO 1101:	<i>Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.</i>

2.2 Units and symbols

Units, graphical symbols and letter symbols shall be, whenever possible, in accordance with ISO 1000, IEC 27 and IEC 617.

Graphical symbols and letter symbols peculiar to a particular switch subfamily shall be defined in the applicable sectional specification. Graphical symbols and letter symbols peculiar to a group of structurally similar switches shall be defined in the detail specification. When additional units or symbols are required, they shall be derived in accordance with the principles of the documents listed above whenever possible.

2.3 Terminology

Terminology shall be in accordance with IEC 50(581).

Terminology peculiar to a particular switch subfamily shall be defined in the applicable sectional specification. Terminology peculiar to a group of structurally similar switches shall be defined in the detail specification.

The following terminology is common to all electromechanical switches. Where the definition is compatible with an established definition listed in IEC 50(00), the IEV number for the related definition is given in brackets.

Basic insulation: The insulation necessary for the proper functioning of the switch by providing basic protection against electrical breakdown.

Category temperature range: The range of ambient temperatures for which the switch has been designed to operate continuously.

Clearance: The shortest distance in air between two conductive parts. [IEC 664]

Contact bounce: The intermittent and random opening of closed contacts and closing of open contacts which may occur after contact transfer and which is caused by the switch mechanism.

Contact bounce time: The time period measured from the moment of first closure of two mating contacts or first opening of two closed contacts to the moment when all contact bounce ceases.

Contact disturbance: The intermittent and random closing of open contacts and/or opening of closed contacts caused by external influences such as shock and vibration.

Contact separation (gap): The distance between mating contacts when the contacts are open.

Contact set: A group of contacts which all function in relation to the same pole of a switch.

Creepage distance: The shortest distance along the surface of an insulating material between two conductive parts. [IEC 664]

Cycle (operation): The actuation or actuations necessary to close (or open) a set of contacts and return the contacts to their original mode. [IEV 441-16-02]

Double break switch: A switch that opens a circuit at two points in series with each other.

Double insulation: Insulation which consists of basic insulation and supplemental insulation with the two insulations physically separated.

Double pole: A term applied to a contact arrangement to denote that it includes two separate forms; that is, two single pole contact assemblies.

Double throw: A term applied to a contact arrangement to denote that each contact form included is a break-make.

Duty cycle: The ratio of conducting (ON) time to the total time for one cycle. For example 30 % ON. [IEV 151-04-06]

Electromechanical switch: A switch that opens, closes, or changes the connection of an electrical circuit by the mechanical motion of conducting parts (contacts).

Lower category temperature: The minimum ambient temperature for which a switch has been designed to operate continuously.

Pole (switch): That portion of the switch associated exclusively with one electrically separated conducting path of the main circuit of the device. [IEV 441-15-01]

NOTE 1 Those portions that provide a means for mounting and operating all poles together are excluded from the definition of a pole.

NOTE 2 A switching device is called single pole if it has only one pole. If it has more than one pole, it may be called multipole (two-pole, three-pole, etc.) provided that the poles are coupled in such manner as to operate together.

Opposite polarity: Two parts of a switch which when connected together may result in blowing the line fuses to the power supply.

Single pole: A term applied to a contact arrangement to denote that it includes only one circuit.

Single throw: A term applied to a contact arrangement to denote that each contact form included is a single contact pair.

Snap-action: The type of switching action in which the speed of the moving contact is relatively independent of the speed of the actuating mechanism.

Style: A sub-division of a type generally based on dimensional factors. A style may include several variants, generally of a mechanical order.

Supplementary insulation: An independent insulation provided in addition to basic insulation to provide protection against electric shock in the event of a failure of the basic insulation.

Type: A group of switches having similar design features and the similarity of whose manufacturing techniques enables them to be grouped together either for qualification approval or for quality conformance inspection.

They are generally covered by a single detail specification; however, switches described in several detail specifications may, in some cases, be considered as belonging to the same type and may be grouped together for approval and quality conformance inspection.

Upper category temperature: The maximum ambient temperature for which a switch has been designed to operate continuously.

Wiping action (contact): The sliding or tangential motion between two contact surfaces when they are touching.

2.4 Preferred values

The sectional or blank detail specification may prescribe any preferred values for rated and limiting values, characteristics, tolerances, requirements and dimensions applicable to the whole subfamily.

2.4.1 Clearance and creepage distances

The sectional or detail specification shall specify either the minimum clearance and creepage distances or the minimum dielectric test voltage under specified air pressure for either basic or double insulation, as applicable. When minimum clearance and creepage distances are specified, the applicable material group of IEC 664 shall also be specified for the insulating materials of the switch.

2.5 Marking

Where space permits after national or contractual marking requirements (for example, safety requirements) have been satisfied, each switch shall be marked with the following information:

- a) terminal identification when specified by the relevant specification;
- b) date code: the date code shall be in accordance with IEC 62;
- c) manufacturer's name or trade mark;
- d) IEC part number identification (number of detail specification plus the number for the style of the switch).

Other markings may be applied to the switches provided they do not obscure or confuse the required markings. When conditions do not permit full marking on the switch, the markings shall be applied in the order of preference shown above. Any required marking that cannot be applied to the switch shall be marked on the package containing the switch.

Section 3. Quality assessment procedures

3 Quality assessment procedures

When this specification is used within the IEC Quality Assessment System for Electronic Components (IECQ System), the basic rules and rules of procedure for the quality assessment system shall be in accordance with IEC QC 001001 and QC 001002, respectively.

3.1 Qualification approval/Quality assessment systems

3.1.1 When these documents are being used for the purpose of a full quality assessment system such as the IEC Quality Assessment System for Electronic Components (IECQ), with qualification approval and quality conformance inspection, the procedures of **3.4** and **3.5** shall be complied with.

3.1.2 When these documents are used outside such quality assessment systems as the IECQ system for purposes such as design proving or type testing, the procedures and requirements of **3.4.1** and **3.4.2** may be used, but the tests and parts of tests shall be applied in the order given in the test schedules.

3.2 Primary stage of manufacture

The primary stage of manufacture is defined as the process which produces a piece part which can be identified with the switch.

3.3 Structurally similar switches

Switches may be considered to be structurally similar and may be grouped for the purpose of forming inspection lots provided the following conditions are met:

- the switches shall be produced by the manufacturer using essentially the same design, materials, processes and methods;
- the switches shall be such that the results of a given test carried out on one switch design are valid for other switch designs in the group;
- each design variant defined in the detail specification shall be assigned a unique part number by the manufacturer;
- the manufacturer shall submit to the National Supervising Inspectorate a statement of the structural similarities between the switch designs for which qualification approval is sought;
- the National Supervising Inspectorate shall approve the grouping of structurally similar switches;
- additional conditions which may be specified by the relevant sectional specification are met.

When switches are grouped for inspection purposes, the test limits applicable to each individual switch design shall still apply, and a failure of the test samples to meet the specified requirements shall be cause for the rejection of all the production lots from which the sampling was made.

3.4 Qualification approval procedures

3.4.1 The manufacturer shall comply with:

- the general requirements of the rules of procedure governing qualification approval;
- the requirements for the primary stage of manufacture contained in **3.2**.

3.4.2 The tests required for qualification approval inspection shall be specified in the sectional specification.

The test samples for qualification approval inspection shall be randomly selected from a current production lot or as agreed with the National Supervising Inspectorate.

In the event that qualification is sought on a variant of a previously qualified switch, qualification inspection shall be limited to those tests for which the test results on the previously qualified switch are not valid.

3.4.2.1 The minimum number of test specimens for each test shall be specified in the sectional specification. The test specimens shall be representative of the type(s) for which qualification is sought (see **3.3**). Test specimens shall not be included in lots released for delivery.

3.4.2.2 Qualification approval may be granted for all switches which are structurally similar (see **3.3**) to the qualification test specimens.