
British Standard

**Harmonized system of quality assessment for
electronic components. Electrical relays.
Generic specification: Electromechanical
all-or-nothing relays.**

Part 1. Test and measurement procedures

[IEC title: Electrical relays]

Part 7 : Test and measurement procedures for electromechanical all-or-nothing relays]

Système harmonisé d'assurance de la qualité des composants électroniques.

Relais électriques.

Spécification générique: Relais électromécaniques de tout-ou-rien.

Partie 1. Méthodes d'essai et de mesure

Harmonisiertes Gütebestätigungssystem für Bauelemente der Elektronik.

Elektrische Relais.

Fachgrundspezifikation: Elektromechanische Schaltrelais

Teil 1. Prüf— und Meßverfahren

National foreword

This Part of BS QC 160000 has been prepared under the direction of the Electronic Components Standards Committee. It is identical with IEC Publication 255-7 'Electrical relays Part 7 : Test and measurement procedures for electromechanical all-or-nothing relays' published in 1978 by the International Electrotechnical Commission (IEC).

This standard is a harmonized specification within the IECQ system of quality assessment for electronic components.

This Part and Part 2 'Quality assessment procedures', which is identical with IEC Publication 255-10 : 1979, together constitute the generic specification for these components.

IECQ is governed by its Basic Rules (IEC Publication QC 001001) and its Rules of Procedure (IEC Publication QC 001002). The UK standards harmonized with these publications are BS 9000 'General requirements for a system for electronic components of assessed quality' Part 1 : 1981 'Specification of basic rules and procedures' and Part 3 : 1987 'Specification for national implementation of IECQ basic rules and rules of procedure'.

The test and measurement procedures in this Part may be used for any electrical all-or-nothing relays, such as those that are the subject of BS 5992 : Part 2 'Specification for all-or-nothing electrical relays' (which is identical with IEC 255-1-0 : 1975), but they are mainly intended for use by specification writers, in conjunction with the relevant sectional and blank detail documents, to prepare detail specifications for electromechanical all-or-nothing relays within the IEC quality assessment system for electronic components (IECQ). This Part also gives the relevant terminology. The relevant quality assessment procedures are given in detail in BS QC 160000 : Part 2, and are also dealt with more succinctly in the sectional specification BS QC 160100.

Terminology and conventions. The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

Where page numbers are quoted in the text, they refer to IEC page numbers.

Cross-references

International standards*	Corresponding British Standards
IEC 60	BS 923 Guide on high-voltage testing techniques (Separately published Parts are identical)
	BS 2011 Basic environmental testing procedures
IEC 68-1 : 1982	Part 1.1 : 1983 General and guidance (Identical)
IEC 68-2-1 : 1974	Part 2.1A : 1977 Test A. Cold (Identical)
IEC 68-2-2 : 1974	Part 2.1B : 1977 Tests B. Dry heat (Identical)
IEC 68-2-3 : 1969	Part 2.1Ca : 1977 Test Ca. Damp heat, steady state (Identical)
IEC 68-2-4 : 1960, withdrawn and replaced by IEC 68-2-30 : 1980	Part 2.1Db : 1981 Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle) (Identical)
IEC 68-2-6 : 1982	Part 2.1Fc : 1983 Test Fc. Vibration (sinusoidal) (Identical)
IEC 68-2-7 : 1983	Part 2.Ga : 1984 Test Ga. Acceleration, steady state (Identical)
IEC 68-2-10 : 1984	Part 2.1J : 1985 Test J. Mould growth (Identical)
IEC 68-2-11 : 1981	Part 2.1Ka : 1982 Test Ka. Salt mist (Identical)
IEC 68-2-13 : 1983	Part 2.1M : 1984 Test M. Low air pressure (Identical)
IEC 68-2-14 : 1974	Part 2.1N : 1985 Test N. Change of temperature (Identical)
IEC 68-2-17 : 1978	Part 2.1Q : 1981 Test Q. Sealing (Identical)
IEC 68-2-20 : 1979	Part 2.1T : 1981 Test T. Soldering (Identical)
IEC 68-2-21 : 1983	Part 2.1U : 1984 Test U. Robustness of terminations and integral mounting devices (Identical)

*Undated in the text (except for IEC 255-5 : 1977).

International standards*	Corresponding British Standards
IEC 68-2-27 : 1972	Part 2.1Ea : 1977 Test Ea. Shock (Identical)
IEC 68-2-29 : 1968	Part 2.1Eb : 1977 Test Eb. Bump (Identical)
IEC 144 : 1963	BS 5420 : 1977 Specification for degrees of protection of enclosures of switchgear and controlgear for voltages up to and including 1000 V a.c. and 1200 V d.c. (Identical)
IEC 147-5 : 1977, withdrawn and replaced by IEC 749 : 1984†	BS 6493 Semiconductor devices Part 3 : 1985 Mechanical and climatic test methods (Identical)
	BS 5992 Electrical relays
IEC 255-0-20 : 1974	Part 1 : 1980 Specification for contact performance of electrical relays (Identical)
IEC 255-5 : 1977	Part 3 : 1980 Specification for the insulation testing of electrical relays (Identical)
IEC 443 : 1974	BS 5148 : 1975 Method for specifying the performance of stabilized power supply apparatus (Technically equivalent)

The Technical Committee has reviewed the provisions of IEC Publication 50 : Chapter 446 and ISO 3, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related British Standard to IEC Publication 50 : Chapter 446 is BS 4727 'Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms' Part 1 'Terms common to power, telecommunications and electronics' Group 03 : 1971 'Relay terminology'. A related British Standard to ISO 3 is BS 2045 : 1962 'Specification for preferred numbers'.

Additional information. In respect of the earthing of the neutral conductor, if the power supply referred to in **16.4.2** and **16.4.3** is taken directly from the public supply, care should be taken to ensure that the local supply regulations allow the neutral to be earthed. If this is not the case an isolating transformer will be required.

NOTE. *Typographical error.* In the note to figure 6, 'following values' should be read as 'following ratios'.

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

*Undated in the text (except for IEC 255-5 : 1977).

†Clause reference unchanged.

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British Standard

Harmonized system of quality assessment for electronic components. Electrical relays. Generic specification: Electromechanical all-or-nothing relays

Part 1. Test and measurement procedures

1. Scope

This standard states the test and measurement procedures for electromechanical all-or-nothing relays within the scope of the IEC. It covers basic considerations which are, in general, common to all types of relays covered by IEC Publication 255, Electrical Relays, and is of particular interest for all-or-nothing relays of assessed quality. Supplementary requirements may be necessitated by specific designs or application.

This standard will be extended by other tests intended more specifically for electromechanical all-or-nothing relays, with specified time.

2. Object

The object of this standard is to state, for electromechanical all-or-nothing relays:

- special terms and definitions used (Section One) and
- test and measurement procedures (Section Two).

SECTION ONE — TERMINOLOGY

For the purpose of this standard, the following terms and definitions apply:

Note. — For the definitions of general terms used in this standard, reference should be made to Chapter 446: Electrical relays, of the International Electrotechnical Vocabulary. (See IEC Publication 50(446).)

However, in order to cover both monostable and bistable relays, amendments have been added to those definitions.

3. Types of relays

3.1 Electromechanical relay (I.E.V. 446-01-08)

An electrical relay, in which the designed response is developed by the relative movement of mechanical elements under the action of a current in the input circuit(s).

3.2 All-or-nothing relay (I.E.V. 446-01-02 modified)

An electrical relay which is intended to be energized by a quantity whose value is either:

- higher than that at which it operates,
- or lower than that at which it releases.

Note. — The adjective “all-or-nothing” can be deleted when no ambiguity may occur.

3.3 Monostable relay (I.E.V. 446-01-12)

An electrical relay which, having responded to an input energizing quantity (or characteristic quantity) and having changed its condition, returns to its previous condition when the quantity is removed.

3.4 *Bistable relay (I.E.V. 446-01-13)*

An electrical relay which, having responded to an input energizing quantity (or characteristic quantity) and having changed its condition, remains in that condition after the quantity has been removed. Another appropriate further energization is required to make it change over.

3.5 *Polarized relay*

A relay the change of condition of which depends upon the direction of its input energizing quantity(ies).

3.6 *Non-polarized relay*

A relay the change of condition of which does not depend upon the direction of its input energizing quantity(ies).

4. **Functions of a relay**

4.1 *Release condition (I.E.V. 446-03-01 modified)*

For a monostable relay, the specified condition of the relay when it is not energized. For a bistable relay, the conventional condition as declared by the manufacturer.

4.2 *Operate condition (I.E.V. 446-03-02 modified)*

For a monostable relay, the specified condition of the relay when it is appropriately energized.

For a bistable relay, the alternate condition to the release condition as declared by the manufacturer.

4.3 *To operate*

A relay operates when it changes from its release condition to its operate condition.

Note. — The term “to operate” is used for both “to pick up” (I.E.V. 446-03-03) and “to operate” (I.E.V. 446-03-17) of Chapter 446.

This term is applicable to both monostable and bistable relays.

4.4 *To release*

A relay releases when it changes from its operate condition to its release condition.

Note. — The term “to release” is used for both “drop out” (I.E.V. 446-03-04) and “return” (446-03-18) of Chapter 446.

This term is applicable to both monostable and bistable relays.

4.5 *To change over (I.E.V. 446-03-05 modified)*

A relay changes over when it operates or releases.

4.6 *To cycle (I.E.V. 446-03-06 modified)*

A relay cycles when it operates and then releases, or vice-versa.

4.7 *To revert*

For a particular polarized or bistable relay being in an operate condition, to change from this condition to the release condition by increasing the value of the energizing quantity.

4.8 *To revert reverse*

For a particular bistable relay being in a release condition by an appropriate energization, to change from this condition to the operate condition by increasing the value of this energizing quantity.

5. **Types of contacts**

5.1 *Make contact (I.E.V. 446-06-15 modified)*

A contact which is closed when the relay is in its operate condition and which is open when the relay is in its release condition.

5.2 *Break contact (I.E.V. 446-06-16 modified)*

A contact which is open when the relay is in its operate condition and which is closed when the relay is in its release condition.

6. **Prefixes for the values applicable to relays**

Values may be defined as rated, actual (“just”), test (“must”) or characteristic value and identified as such by using one of these words as a prefix. The prefixes are also applicable to timing values.

6.1 *Rated value (I.E.V. 151-04-03)*

Value of a quantity assigned, generally by a manufacturer, for a specified operating condition of a relay.

6.2 *Actual (“just”) value*

Value of a quantity measured on a single relay when it just performs a specified function.

6.3 *Test (“must”) value*

Value of a quantity at which, during tests, the relay is required to perform or not to perform a specified function.

6.4 *Characteristic value*

Value of a quantity at which, throughout its lifetime or a specified number of cycles, the relay is required to comply with a specified requirement.

7. **Energization values**

7.1 *Energizing quantity (I.E.V. 446-02-01)*

An electrical quantity (either current or voltage) which alone, or in combination with other such quantities, applied to a relay under specified conditions enables it to fulfil its purpose.

7.2 *Rated value of an energizing quantity*

Value of an energizing quantity to which some of the specified characteristics are referred.

7.3 *Actual ("just") value of an energizing quantity*

Value of an energizing quantity measured on a single relay, when it just performs a specified function.

7.4 *Test ("must") value of an energizing quantity*

Value of an energizing quantity at which, during tests, the relay is required to perform or not to perform a specified function.

7.5 *Characteristic value of an energizing quantity*

Value of an energizing quantity at which, throughout its lifetime or a specified number of cycles, the relay is required to comply with a specified requirement.

7.6 *Operative range of an energizing quantity (I.E.V. 446-02-11)*

The range of values of an energizing quantity for which the relay under specified conditions is able to perform its intended function(s) according to the specified requirements.

7.7 *Magnetic preconditioning value*

For this term and for the following terms refer also to Figures 1 to 5, pages 87 to 89, which show the sequential functions of relays covered by the definitions.

Value of the energizing quantity at which the relay attains a defined magnetic condition.

Notes 1. — For polarized relays, distinction is made between preconditioning in forward (operate) direction, and preconditioning in reverse direction.

2. — For bistable relays, preconditioning may also be used to set the relay to a defined position.

7.8 *Non-operate value*

Value of the energizing quantity at which a relay does not operate.

7.9 *Operate value*

Value of the energizing quantity at which a relay operates.

7.10 *Non-release value*

Value of the energizing quantity at which a relay does not release.

7.11 *Release value*

Value of the energizing quantity at which a relay releases.

7.12 *Non-revert value*

Value of the energizing quantity exceeding the operate value at which a particular polarized or bistable relay does not revert.

7.13 *Reverse non-revert value*

Value of the energizing quantity exceeding the release value at which a particular bistable relay does not revert reverse.

7.14 *Reverse polarity value*

Value of the energizing quantity of reverse polarity at which a polarized monostable relay does not operate.

8. **Electrical properties of contacts**

8.1 *Contact current*

The current which a relay contact carries before opening or after closing.

8.2 *Contact voltage*

The voltage between the contact members before closing or after opening.

8.3 *Limiting continuous current (I.E.V. 446-06-17 modified)*

The highest value of the current (r.m.s. if a.c.), which a previously closed contact circuit is capable of carrying continuously.

8.4 *Contact noise*

The spurious voltage which appears across the terminations of a closed contact.

9. **Application categories of contacts**

9.1 *Category 0 contact*

A contact characterized by a maximum contact voltage of 30 mV, and a maximum contact current of 10 mA.

9.2 *Category 1 contact*

A contact characterized by a contact voltage between 30 mV and 60 V, and a contact current between 10 mA and 0.1 A.

9.3 *Category 2 contact*

A contact characterized by a contact voltage between 5 V and 250 V, and a contact current between 0.1 A and 1 A.

9.4 *Category 3 contact*

A contact characterized by a contact voltage between 5 V and 600 V, and a contact current between 0.1 A and 100 A.

Note. — A contact may have the characteristics of more than one category.

10. Mechanical properties of contacts

10.1 Contact gap (I.E.V. 446-06-06)

The gap between the contact tips (points) under specified conditions when the contact circuit is open.

10.2 Contact force (I.E.V. 446-06-07)

The force which two contact tips (points) exert against each other in the closed position under specified conditions.

11. Terms relating to times

The operate time, release time, transfer time and bridging time, as defined hereunder, do not include bounce times.

The operate time covers the closing time of a make contact and the opening time of a break contact.

The release time covers the opening time of a make contact and the closing time of a break contact.

11.1 Operate time

For a relay which is in the release condition (initial condition) the time interval between the instant a specified value of the input energizing quantity (characteristic quantity) is applied under specified conditions and the instant when the output make circuit closes or the output break circuit opens.

Note. — This term is used only when the relay has only one output circuit or when it has several similar output circuits and no precision is required as to contact time difference.

11.2 Release time

For a relay which is in the operate condition (final condition) the time interval between the instant a specified value of the input energizing quantity (characteristic quantity) is applied under specified conditions and the instant when the output make circuit opens or the output break circuit closes.

Note. — This term is used only when the relay has only one output circuit or when it has several similar output circuits and no precision is required as to contact time difference.

11.3 Transfer time

For a break-before-make change over contact, the time interval during which both contact circuits are open.

11.4 Bridging time

For a make-before-break change over contact, the time interval during which both contact circuits are closed.

11.5 Bounce time (I.E.V. 446-07-06)

For a contact which is closing (opening) its circuit, the time interval between the instant when the contact circuit first closes (opens) and the instant when the circuit is finally closed (opened).

11.6 Time to stable closed condition

The time interval between the instant when a specified value of the energizing quantity is applied and the instant when a contact circuit fulfils specified requirements.

11.7 Minimum time of operate energization

Minimum duration of application of rated operate value required to ensure that the contact circuit fulfils specified requirements.

11.8 Contact time difference

For a relay having several contacts of the same type, the difference between the maximum value of the operate (release) time of the slowest and the minimum value of the operate (release) time of the fastest.

SECTION TWO — TEST AND MEASUREMENT PROCEDURES

12. General

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

13. Alternative methods

Measurements shall preferably be carried out by using the methods specified. Any other method giving equivalent results may be used except in case of dispute.

Note. — By “equivalent” is meant that the value of the characteristic established by such other method will fall within the specified limits when measured by the specified method.

14. Precision of measurement

The limits quoted in detail specifications are true values. Measurement inaccuracies shall be taken into account when evaluating the results. Usual precautions should be taken to reduce measurement errors to a minimum.

15. Requirements in detail specifications

If the technical requirements of the generic specification relative to inspection are not entirely suitable (either for technical reasons or because of a special application) to the relay described in the detail specification, the latter will set out clearly the various amendments which are to be made to these requirements.

16. Standard conditions for testing

- 16.1 Unless otherwise specified, all tests shall be carried out under the standard atmospheric conditions for testing as specified in Sub-clause 5.3 of IEC Publication 68.1, Basic Environmental Testing Procedure, Part I: General, i.e.:

Temperature	15°C ... 35°C
Relative humidity	45% ... 75%
Air pressure	86 kPa ... 106 kPa (860 mbar ... 1060 mbar)

In case of dispute, the referee conditions are:

Temperature	27°C ± 1°C
Relative humidity	63% ... 67%
Air pressure	86 kPa ... 106 kPa (860 mbar ... 1060 mbar)

(See Sub-clause 5.2 of IEC Publication 68-1.)

The relays shall be under standard atmospheric conditions for testing for a time sufficient to allow them to reach thermal equilibrium.

- 16.2 Unless otherwise specified, the terms a.c. voltage and current indicate r.m.s. values throughout this standard.
- 16.3 Any value to be assigned to quantities as defined in this standard will relate to specified conditions which are within the intended conditions of use of a relay, and different values may apply to steady-state and dynamic operation.
- 16.4 Unless otherwise specified, the following shall apply to power supplies and their connections. (See IEC Publication 443, Stabilized Supply Apparatus for Measurement.)
- 16.4.1 The operating error in voltage or current shall not exceed 5% for a load twice that specified for the test.
- The peak-to-peak periodic and random deviations of a d.c. supply shall not exceed 1%.
- The operating error in frequency of an a.c. supply shall not exceed 1%, and the form factor shall be within 0.95 to 1.25.
- 16.4.2 The following shall be earthed as applicable: the negative side of the d.c. power supply, one side of the single-phase a.c. power supply, or the neutral of the three-phase a.c. power supply.
- 16.4.3 The earthed side of the power supply shall be connected to: one terminal of the coil, or one terminal each of one or more coils of the relay under test, and one terminal of each of the loads connected to the relay under test.
- 16.5 Contacts and/or other parts shall not be cleaned or adjusted prior to submission to a test, unless otherwise prescribed in the detail specification.
- 16.6 Where mounting is required for a particular test, the relay shall be mounted in accordance with the specified fixing instructions.

16.7 Conditions prescribed in the detail specification :

- 1) Atmospheric conditions, if other than in Sub-clause 16.1.
- 2) Properties of the power supply, and its connections, if other than in Sub-Clause 16.4.
- 3) Cleaning and/or adjustment prior to testing, if required.
- 4) Fixing instructions.
- 5) Tests to which these conditions are to be applied, unless applicable to all tests.
- 6) Steady-state or dynamic operation.

17. Visual inspection and check of dimensions

17.1 The relays shall be checked for conformity to the outline drawings, including creepage distances and clearances, prescribed in the detail specification.

17.2 Unless otherwise prescribed in the detail specification, visual inspection shall be performed under normal factory lighting and visual conditions.

17.3 External inspection and check of key dimensions shall be carried out as non-destructive tests.

17.4 Visual inspection shall include :

- 1) Correctness of marking.
- 2) Correctness of terminal identification.
- 3) Correct housing.
- 4) Absence of physical defects, as prescribed in the detail specification.

17.5 The condition, workmanship and finish shall be satisfactory as determined by visual inspection.

17.6 Shaking of the relay shall be carried out as an audible inspection to detect loose particles, if prescribed in the detail specification.

17.7 Conditions prescribed in the detail specification :

- 1) Dimensions and tolerances, marking and terminals to be checked, if required.
- 2) Creepage distances and clearances to be checked, and their minimum values.
- 3) Particular lighting and/or optical devices, if required.
- 4) Shaking of the relay, if required.
- 5) Physical properties to be checked, and required results.

18. Mechanical tests and weighing

18.1 Mechanical test procedures, if required (e.g. contact force, armature travel) shall be as prescribed in the detail specification.

18.2 Where prescribed in the detail specification, the relay shall be weighed.

18.3 Conditions prescribed in the detail specification:

- 1) Mechanical properties to be tested, methods of tests, and required results.
- 2) Mass of the relay, and tolerances.

19. **Coil resistance, inductance, impedance and burden**

19.1 *Coil resistance*

19.1.1 Purpose: to ensure that the d.c. resistance of the relay coil(s) is within specified limits.

19.1.2 Procedure: the resistance shall be measured between the terminals of the relay. The method shall involve negligible temperature rise. The reference temperature shall be 20°C unless otherwise prescribed in the detail specification.

19.1.3 Conditions prescribed in the detail specification:

- 1) Coil resistance limits.
- 2) Reference temperature, if other than 20°C.
- 3) Temperature coefficient of the wire material, if other than electrolytic copper.
- 4) Any special precautions due to the presence of resistors, diodes, etc. in the coil circuit.

19.2 *Coil inductance*

19.2.1 Purpose: to ensure that the inductance of the relay coil(s) is within the specified limits.

19.2.2 Procedure: the coil inductance shall be measured in the non-energized and in the rated energized condition of the relay. The relay shall be mounted with no adjacent metal parts.

Unless otherwise prescribed in the detail specification, the a.c. voltage applied for measurement shall be sinusoidal at a frequency equal to the nominal frequency of the energizing quantity or for d.c. relays as prescribed in the detail specification.

The measurement of inductance, by determining the time constant, is a permissible alternative.

When d.c. energization is to be superimposed in the winding during measurement, adequate means for isolation of the a.c. and d.c. circuits shall be provided.

19.2.3 Conditions prescribed in the detail specification:

- 1) Coil inductance limits.
- 2) Voltage of the applied a.c. supply.
- 3) Frequency of the applied a.c. supply.
- 4) Rated energization value.
- 5) Any alternative procedure, if the above is not applicable.

19.3 *Coil impedance and burden*

19.3.1 Purpose: to ensure that the impedance of the relay coil(s) is within specified limits.

19.3.2 Procedure: the relay shall be mounted with no adjacent metal parts.

Method 1: the coil impedance shall be measured in the non-energized and the rated energized condition of the relay. Unless otherwise prescribed in the detail specification, the a.c. voltage applied for measurement shall be sinusoidal at a frequency equal to the nominal frequency of the energizing quantity or, for d.c. relays, as prescribed in the detail specification.

When d.c. energization is to be superimposed in the winding during measurement, adequate means for isolation of the a.c. and d.c. circuits shall be provided.

Method 2: the burden shall be measured in the rated energized condition of the relay or, for a relay the burden of which varies with the position of its moving parts, in the energized conditions as prescribed in the detail specification.

19.3.3 Conditions prescribed in the detail specification:

- 1) Method 1 or 2.
- 2) Coil impedance or burden limits.
- 3) Rated energization value or, with method 2, the energization test values.
- 4) Method 1: voltage of the applied a.c. supply and its frequency.
- 5) An alternative procedure, if the above is not applicable.

20. **Dielectric test**

20.1 Procedure: this test shall be carried out in accordance with the dielectric test in Clause 6 of IEC Publication 255-5 (1977), Part 5: Insulation Tests for Electrical Relays, except that the terminals to which the test voltage is applied shall be those prescribed in the detail specification.

20.2 Conditions prescribed in the detail specification:

- 1) terminals to which the test voltage shall be applied, selected from the following:
 - a) terminals of each contact circuit:
 - break contacts shall be opened for this test;
 - b) all terminals requiring the same test voltage connected together and any exposed conductive part not intended to be electrically connected, the latter being simulated by a foil wrapped around relays having an insulating enclosure (in this case this test is only a type test) (see IEC Publication 255-5, Sub-clause 5.3);
 - c) terminals of separate windings (bifilar or not);
 - d) all coil terminals requiring the same test voltage connected together and all contact circuit terminals connected together;
 - e) terminals of separate contact circuits.
- 2) Test voltage or voltages, or the rated insulation voltage(s) and the series in accordance with Table I of IEC Publication 255-5.

- 3) Duration of the test: 1 s or 1 min.
- 4) Maximum leakage current, if applicable.
- 5) Reductions for repetition tests, e.g. for final measurement after an endurance test. These shall be specified together with such tests.

21. Impulse voltage test

21.1 Procedure: this test shall be carried out in accordance with the impulse voltage test in Clause 8 of IEC Publication 255-5, and shall be applied to the parts of the relay and following the detailed requirements specified in the detail specification. A flashover is a criterion of failure only if it causes permanent damage; after application of the impulses, the relay shall comply with the final measurements prescribed in the detail specification.

21.2 Conditions prescribed in the detail specification:

- 1) Number of impulses, if other than three positive and three negative impulses.
- 2) Terminals to which the test voltage is applied.
- 3) Waveform and generator characteristics, if other than a standard lightning impulse in accordance with IEC Publication 60: High-voltage Test Techniques, and/or deviating from the standard test circuit recommended in IEC Publication 255-5.
- 4) Value of the impulse voltage.
- 5) Required test results and final measurements to verify compliance.

22. Insulation resistance

22.1 Procedure: this test shall be carried out in accordance with the insulation resistance measurement procedure in Clause 7 of IEC Publication 255-5, except that the terminals concerned, and the time to steady-state reading, if required, shall be those prescribed in the detail specification, and that the measurement voltage shall be 500 V unless otherwise prescribed in the detail specification.

22.2 Conditions prescribed in the detail specification:

- 1) Terminals to which the test voltage shall be applied, selected from the following:
 - a) terminals of each contact circuit. Break contacts shall be opened for this test;
 - b) all terminals requiring the same test voltage connected together and any exposed conductive part not intended to be electrically connected, the latter being simulated by a foil wrapped around relays having an insulating enclosure (in this case this test is only a type test) (see IEC Publication 255-5, Sub-clause 5.3);
 - c) terminals of separate windings (bifilar or not);
 - d) all coil terminals requiring the same test voltage connected together and all contact circuit terminals connected together;
 - e) terminals of separate contact circuits.
- 2) Measurement voltage, if other than 500 V.
- 3) Time to steady-state reading, if required.
- 4) Minimum value(s) of insulation resistance(s).