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Relais électriques –

Partie 23:
Caractéristiques fonctionnelles des contacts

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Part 23: IEC 60255-23:1995

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Contact performance

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYS –

Part 23: Contact performance

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

International Standard IEC 255-23 has been prepared by IEC technical committee 94: All-or-nothing electrical relays.

This standard cancels and replaces IEC 255-0-20 published in 1974 and constitutes a technical revision.

The text of this standard is based on IEC 255-0-20 and on the following documents:

DIS	Report on voting
41A(CO)32*	94(CO)1

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

Annexes A to E form an integral part of this standard.

* Sub-committee 41A has been transformed into technical committee 94.

ELECTRICAL RELAYS –

Part 23: Contact performance

1 General

1.1 *Scope and object*

This International Standard is applicable to contact assemblies of relays within the scope of the IEC. It covers basic considerations which are, in general, common to all types of relays covered by IEC 255, but supplementary requirements may be necessitated by specific designs or application.

It applies only to relays in a new condition.

The object of this standard is to state, for relay contact assemblies:

- definitions of terms used;
- preferred rated values;
- preferred test conditions;
- basic criteria of contact failure;
- assessment of performance data;
- presentation of performance data.

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1.2 *Normative references*

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(191): 1990, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

IEC 50(446): 1983, *International Electrotechnical Vocabulary (IEV) – Chapter 446: Electrical relays*

IEC 50(531): 1974, *International Electrotechnical Vocabulary (IEV) – Chapter 531: Electronic tubes*

IEC 85: 1984, *Thermal evaluation and classification of electrical insulation*

IEC 255-1-00: 1975, *Electrical relays – All-or-nothing electrical relays*

IEC 255-3: 1989, *Electrical relays – Part 3: Single input energizing quantity measuring relays with dependent or independent time*

IEC 255-5: 1977, *Electrical relays – Part 5: Insulation tests for electrical relays*

IEC 255-7: 1991, *Electrical relays – Part 7: Test and measurement procedures for electro-mechanical all-or-nothing relays*

IEC 255-14: 1981, *Electrical relays – Part 14: Endurance tests for electrical relay contacts – Preferred values for contact loads*

IEC 255-15: 1981, *Electrical relays – Part 15: Endurance tests for electrical relay contacts – Specification for the characteristics of test equipment*

IEC 255-19: 1983, *Electrical relays – Part 19: Electromechanical all-or-nothing relays of assessed quality*

IEC 255-19-1: 1983, *Electrical relays – Part 19: Blank detail specification: Electro-mechanical all-or-nothing relays of assessed quality – Test schedules 1, 2 and 3*

IEC 410: 1973, *Sampling plans and procedures for inspection by attributes*

IEC 605-6: 1986, *Equipment reliability testing – Part 6: Tests for the validity of a constant failure rate assumption*

IEC 664-1: 1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

CCITT, Vol. IX: 1989, *Protection against interference – Series K Recommendations – Recommendation K.17: Tests on power-fed repeaters using solid-state devices in order to check the arrangements for protection from external interference*

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2 Definitions

For the purpose of this International Standard, the following definitions shall apply.

NOTE – For definitions of general terms not defined in this standard, reference should be made to the other parts of IEC 255 and to IEC 50.

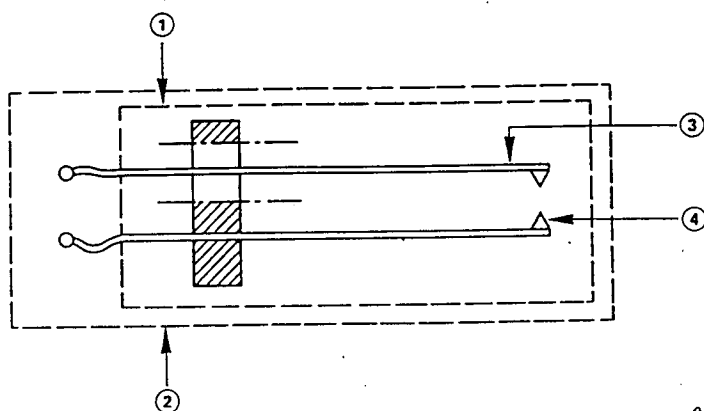
2.1 contact circuit (see 2, figure 1): The whole of the electrically conductive parts of a relay which are intended to be connected to a given external circuit which is to be closed or opened by the relay. [IEV 446-16-02 modified]

NOTE – A change-over contact involves two contact circuits.

2.2 contact assembly (see 1, figure 1): An assembly of contact members, with their insulation, which close or open their contact circuit by their relative movement. [IEV 446-16-03]

2.3 contact member (see 3, figure 1): A conductive part of a contact assembly which is electrically isolated from other such parts when the contact circuit is open. [IEV 446-16-04]

2.4 contact tip, contact point (see 4, figure 1): A conductive part of a contact member designed to co-act with another to close the contact circuit. [IEV 446-16-05 modified]



039/77

- ① Contact assembly
- ② Contact circuit
- ③ Contact member
- ④ Contact tip (contact point)

Figure 1 – Example explaining the terms 2.1 to 2.4

2.5 **make contact**: A contact which is open when the relay is in its unenergized condition and which is closed when the relay is in an energized condition.

2.6 **break contact**: A contact which is closed when the relay is in its unenergized condition and which is open when the relay is in an energized condition.

2.7 **contact gap**: The gap between the contact tips, under specified conditions, when the contact circuit is open.

2.8 **contact force**: The force which two contact tips exert against each other in the closed position under specified conditions.

2.9 **limiting continuous current of a contact circuit***: The highest value of current (r.m.s. if a.c.) which a previously closed contact circuit is capable of carrying continuously under specified conditions.

2.10 **limiting short-time current of a contact circuit***: The highest value of current which a previously closed contact circuit is capable of carrying for a specified short period under specified conditions.

2.11 **limiting making capacity***: The highest value of current which a contact assembly is capable of making under specified conditions.

2.12 **limiting breaking capacity***: The highest value of current which a contact assembly is capable of breaking under specified conditions.

2.13 **limiting cycling capacity***: The highest value of current which an output circuit is capable of making and breaking successively under specified conditions (voltage, number of cycles, power factor, time constant, etc.). [IEV 446-16-21]

* The limiting values (see 2.9, 2.10, 2.11, 2.12 and 2.13) may be greater than the corresponding rated values.

2.14 bounce: A phenomenon which may occur while a contact circuit is making or breaking and which is characterized by the contact tips successively touching and separating before reaching their final condition. [IEV 446-16-22]

2.15 bounce time: 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). [IEV 446-17-13]

2.16 contact follow; contact over-travel: The further specified movement of the contact tips when making and after they have just touched and while they are travelling in the same direction as the moving contact member. [IEV 446-16-08]

2.17 contact wipe: When a contact is making, the relative rubbing movement of contact tips after they have just touched. [IEV 446-16-09]

The following definitions apply to all-or-nothing relays.

2.18 relay reliability: The probability that a relay can perform a required function under given conditions for a given time interval or number of operations.

NOTE - It is generally assumed that the all-or-nothing relay is able to perform this required function in its initial condition.

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2.19 mean operating time between failures MTBF (abbreviation): The expectation of the operating time between failures. [IEV 191-12-09]

2.20 cycle-related mean operating time between failures (MTBF_c)*: MTBF_c equals the cycle-related mean value μ of the failure distribution.

NOTE - MTBF_c is often used in place of MTBF to define the number of cycles between failures in place of the operating time between failures.

2.21 relay failure rate* λ (symbol): The number of failures relative to the time of service of the relay.

NOTE - λ is the reciprocal of MTBF.

2.22 cycle-related failure rate* λ_c (symbol): λ_c is the reciprocal of MTBF_c: $\lambda_c = \frac{1}{\text{MTBF}_c}$

2.23 electrical endurance: The number of cycles until failure, under specified electrical loading and other operating conditions.

NOTE - Electrical endurance is preferably stated at confidence level of 60 % or 90 %.

2.24 relay endurance test: A test carried out over a number of operations to investigate how the properties of a relay are affected by the application of stated stresses.

* Terms and definitions are given for restricted use as explained in annex E.

2.25 contact fault due to contact-circuit resistance: The occurrence of a contact fault is assumed when the contact-circuit resistance of a closed contact exceeds the maximum value stated in the relevant specification.

2.26 contact fault due to non-opening of the contact circuit: The occurrence of a contact fault due to the fact that the contact does not open is assumed when the resistance of an open contact assembly falls below the specified minimum value stated in the relevant specification.

2.27 contact failure: The occurrence of a contact failure is assumed when the number of faults due to contact-circuit resistance and/or of faults due to non-opening of the contact circuit exceeds the number of faults stated in the relevant specification, with reference to a single tested contact.

2.28 relay fault: A temporary malfunction occurring in a relay.

NOTE – A relay fault persists for only a limited time after which the relay recovers the ability to perform a required function without being subject to any corrective maintenance.

2.29 relay failure: A failure occurring when the relay is permanently unable to carry out its required function.

2.30 relay defect: Any deviation of a characteristic of a relay from the requirements.

NOTES

- 1 The requirements may or may not be expressed in the form of a specification.
- 2 A defect may or may not affect the ability of a relay to perform a required function.

2.31 defective relay: A relay containing one or more defects.

2.32 contact current: The current a relay contact carries before opening or after closing. [IEC 255-7: 1991, 2.5.1]

2.33 contact voltage: The voltage between the contact members before closing or after opening. [IEC 255-7: 1991, 2.5.2]

3 Standard rated and preferred values

Values indicated as preferred have been chosen so as to minimize test conditions and to provide reference values for comparison of data.

3.1 Standard rated values

Standard rated values for contact circuits given below are selected from other parts of IEC 255.

3.1.1 Rated voltages

Preferred values:

- d.c.: 12 24 48 60 110 125 220 V;
- a.c.: 12 24 48 110 220 V (r.m.s.).

Other voltages are acceptable but have not been preferred in this standard.

3.2.6 *Insulation resistance*

- a) Preferred values: 5, 10, 20, 50, 100, 500 or 1 000 M Ω .
- b) Preferred measuring voltage: 100 V for a rated insulation voltage of a maximum of 30 V, 250 V for a rated insulation voltage between 30 V and 60 V and 500 V for a rated insulation voltage between 60 V and 250 V.

3.2.7 *Number of cycles determining electrical endurance*

Preferred values: 10 000, 20 000, 30 000, 50 000, 100 000, 200 000, 300 000, 500 000, 700 000, 1 000 000, 2 000 000, 3 000 000, 5 000 000, 10 000 000, 20 000 000, 30 000 000, 50 000 000 or 1000 000 000.

3.2.8 *Contact failure rate for test evaluation purposes*

Preferred values: maximum 10^{-5} , 10^{-6} , 10^{-7} or 10^{-8} /contact/cycle.

4 Test conditions

4.1 *General*

- a) At the commencement of each test, the relay, including contacts, shall be in an effectively new and clean condition in so far as the given test is concerned, unless otherwise stated by the manufacturer.
- b) The relay shall be mounted in the manner intended for normal service, in its case and with cover, if any, in position.
- c) Ambient temperature for make, break and cyclic tests shall be stated by the manufacturer and shall be not less than the reference value.
- d) Ambient temperature for continuous tests: at the upper limit of the nominal range of temperature, unless otherwise stated in the relevant specification.
- e) Relative humidity: 45 % to 75 %, unless otherwise stated in the relevant specification.
- f) All other influencing quantities and factors shall be at their reference values as given in the appropriate part of IEC 255.
- g) The atmosphere shall be as free as possible from dust and other contaminations.
- h) When lubricants or other preparations are recommended by the manufacturer, they shall be applied before commencing the test.
- i) During any given sequence of tests, the contacts shall be neither cleaned nor touched.
- j) The rate of testing shall not exceed that stated by the manufacturer. It shall be such that there is no harmful cumulative heating of the contacts or harmful cumulative ionization within the relay case.