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Electrical relays - Part 6: Measuring relays and protection equipment

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Relais électriques - Sixième partie: Relais de mesure et dispositifs de protection

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYS

Part 6: Measuring relays and protection equipment

FOREWORD

1) 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.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 41B: Measuring relays and protection equipment, of IEC Technical Committee No. 41: Electrical relays.

This publication supersedes Publication 255-6 (1978) and its first supplement 255-6A (1980).

The text of this standard is based on the following documents:

Six Months' Rule	Report on Voting
41B(CO)39	41B(CO)42

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

The following IEC publications are quoted in this standard:

Publications Nos. 50: International Electrotechnical Vocabulary (IEV).
50(05) (1956): Chapter 5: Fundamental definitions. (This publication has been superseded by Publications 50(101, 111, 121, 131 and 151.)
85 (1984): Thermal evaluation and classification of electrical insulation.
158: Low-voltage controlgear.
255: Electrical relays.
255-0-20 (1974): Contact performance of electrical relays.
255-5 (1977): Part 5: Insulation tests for electrical relays.
255-11 (1979): Part II: Interruptions to and alternating component (ripple) in d.c. auxiliary energizing quantity of measuring relays.
292: Low-voltage motor starters.
337: Control switches (low-voltage switching devices for control and auxiliary circuits, including contactor relays).

ELECTRICAL RELAYS

Part 6: Measuring relays and protection equipment

SECTION ONE - GENERAL

1. Scope and object

This standard specifies the general performance requirements of all electrical measuring relays and protection equipment used in the electrotechnical fields covered by the IEC.

It excludes relays used in the following electrotechnical fields:

- telephony;
- telegraphy;
- signalling and blocking in railway systems;
- devices covered by IEC Publications 158, 292 and 337.

For special applications (marine, aerospace, explosive atmospheres, computers, etc.), it may be amplified by means of special requirements.

Relays which are designed to meet the requirements prepared by other international standardization organizations (telecommunication, railways, etc.) shall comply with this standard when used in the electrotechnical fields covered by the IEC, other than those excluded above.

The requirements are applicable only to relays in new condition. All tests in this standard are type tests unless otherwise declared.

The object of this standard is to state:

1) definitions of terms used;
2) nominal values relating to energizing and influencing quantities;
3) requirements related to accuracy, thermal and mechanical performance;
4) test methods;
5) markings and data.

2. Definitions

For definitions of general terms not defined in this standard, reference should be made to the International Electrotechnical Vocabulary (IEV) [IEC Publication 50] and first level documents of the IEC Publication 255 series.

For the purpose of this standard the following definitions shall apply.

2.1 *Single input measuring relay*

A relay which is designed to respond to a single input energizing quantity and where the measuring function is determined by a single energizing quantity.

Note. – If single input measuring elements of the same type are packaged as protection equipment, e.g. 3-phase overcurrent relays, they are to be considered as single input measuring relays.

2.2 *Multi input measuring relay*

A relay which is designed to respond to more than one input energizing quantity and where the measuring function is determined by the interaction of the energizing quantities.

2.3 *Dependent time relay with increasing function*

A dependent time relay whose operating time increases in accordance with an increase of the characteristic quantity.

2.4 *Dependent time relay with decreasing function*

A dependent time relay whose operating time decreases in accordance with an increase of the characteristic quantity.

SECTION TWO – REQUIREMENTS

3. Standard values

3.1 *Input energizing quantities*

3.1.1 *General*

No standard values of input energizing quantities are specified. Those given below are preferred values, of which those underlined have found greater acceptance and are expected to become standard values in the future.

3.1.2 *Primary relays*

No preferred rated values for a.c. or d.c.

3.1.3 *Secondary relays*

a) A.C. voltages (r.m.s.)

The preferred rated values of voltages for a.c. are those given below, together with those values multiplied by $\sqrt{3}$, or $1/\sqrt{3}$. For single phase railway systems multiply 100 V and 110 V by 0.5.

100 V; 110 V; 115 V; 120 V; 200 V; 220 V; 240 V; 480 V.

b) A.C. currents (r.m.s.)

The preferred rated values of currents for a.c. are given below:

0.5 A; 1 A; 2 A; 5 A.

3.1.4 *Shunt (energized) relays*

The preferred rated values of d.c. voltages are given below:

30 mV; 45 mV; 50 mV; 60 mV; 75 mV; 100 mV; 150 mV; 200 mV; 300 mV; 600 mV.

3.2 *Auxiliary energizing quantities*

The rated values shall be selected from the following:

3.2.1 *General*

No standard values for auxiliary energizing quantities are specified. Those given below are preferred values, of which those underlined have found greater acceptance and are expected to become standard values in the future.

3.2.2 *A.C. voltages (r.m.s.)*

24 V; 48 V; 100/$\sqrt{3}$ V; 110/$\sqrt{3}$ V; 120/$\sqrt{3}$ V; 100 V; 110 V; 115 V; 120 V; 127 V; 200 V; 220 V; 415/$\sqrt{3}$ V; 380 V; 415 V; 480 V; 500 V; 660 V.

3.2.3 *A.C. current*

There are no preferred rated values for a.c. currents.

3.2.4 *D.C. voltage*

12 V; 24 V; 48 V; 60 V; 110 V; 125 V; 220 V; 250 V; 440 V.

3.2.5 *D.C. current*

There are no preferred rated values for d.c. current.

3.2.6 *Operative ranges of auxiliary energizing quantities*

The limits of the operative range for each auxiliary energizing quantity shall be as specified in lower level documents.

Rated values of non-preferred ranges shall be distinguished from the values of the limits of the operative range by suitable means, for example by underlining, or by use of a special type face.

The values shall be marked on the relay. Examples are shown in Table I.

3.2.7 *Preferred operative range of auxiliary energizing quantities*

The limits of the preferred operative range are 80%–110% of the rated value. For d.c. these values are mean values. For permitted peak-ripple factor see Table II (Note 6).

For a.c. auxiliary energizing quantities, in special cases, for example frequency measuring relays, the auxiliary energizing quantities may require larger limits.

Note. – In some circumstances, particularly in the case of energization from certain storage batteries, the limits of the operative range may necessarily differ from the preferred value. In these circumstances the manufacturer shall declare the limits of the range and the corresponding rated value.

TABLE I

Examples of marking the operative range of an auxiliary energizing quantity

		Example (V)	Meaning
Normal case based on 80% to 110% range	A single rated value	220	Rated value: 220 V Operative range: 80% to 110% of 220 V
	Two rated values	220 250	Rated values: 220 V and 250 V. Operative ranges 80% to 110% of 220 V and 250 V
	Large range e.g. d.c./d.c. convertor	40 to 128	Operative range 80% of 40 V to 110% of 128 V
Example of non-preferred range	A single rated value	165–220–253	Operative range: 75% to 115% of 220 V

3.3 *Frequency*

The standard rated values of frequency shall be selected from the following:

16⅔ Hz; 50 Hz; 60 Hz.

3.4 *Values of resetting and disengaging ratios*

To be specified in lower level documents.

3.5 *Contact circuits*

The standard values of voltages and currents for contact circuits shall be taken from IEC Publication 255-0-20.

3.6 *Independent specified times*

There are no rated values for independent specified times; however, in the case of relays having a time-setting range, maximum values are proposed in Appendix A.

3.7 *Standard reference values of influencing quantities and factors and standard values of their nominal and extreme ranges*

3.7.1 *Standard reference values of influencing quantities and factors*

The standard reference values of influencing quantities and factors and the associated test tolerances are given in Table II.

The manufacturer shall declare the effects of self heating of relays mounted as in normal service where these are significant, i.e. if they cause changes in accuracy which are of the same order of magnitude, or greater than the assigned error.

3.7.2 *Standard values of the limits of the nominal ranges of influencing quantities and factors*

a) Nominal range of ambient temperature

The standard nominal range shall be selected from the following:

−5 °C to +40 °C; 0 °C to +45 °C; −10 °C to +55 °C; −25 °C to +40 °C; −25 °C to +55 °C.

b) Nominal range of frequency

The standard values of the limits of frequency shall be chosen from one of the following ranges:

−5% to +5%; −5% to +10%; −10% to +10%.

c) Nominal ranges of other influencing quantities and factors

The values of the limits of the nominal ranges of other influencing quantities and factors are given in Table III.

3.7.3 *Limits of extreme range of ambient temperature*

The standard values of the limits of the extreme range of ambient temperature are:

−25 °C and +70 °C.

Relays shall be capable of withstanding temperatures within this range under conditions of transport, storage and installation without suffering irreversible changes. This requirement is only applicable to non-energized relays.

Notes 1. – For relays which cannot withstand this condition, the manufacturer should declare the maximum range.

2. – For certain low temperature areas of the world, a low level temperature of − 40 °C may apply.

TABLE II

Standard reference conditions and test tolerances of influencing quantities and factors

Influencing quantity or factor		Reference condition (see Note 1)	Test tolerances
General	Ambient temperature	20 °C	± 2 °C
	Atmospheric pressure	86 kPa to 106 kPa	-
	Relative humidity	45% to 75%	(See Note 2)
	Position	As specified in lower level documents	2° in any direction or for static relays, as specified in lower level documents
	External magnetic field	Zero	Induction equal to or less than 0.5 mT
Characteristic and input energizing quantities	Input energizing voltage(s)	As specified in lower level documents	
	Input energizing current(s)		
	Phase angle between input energizing quantities		
	Frequency	Rated value	± 0.5% (see Note 3)
	Waveform	Sinusoidal	Distortion factor 2% (see Notes 4 and 5)
	Alternating component in d.c. (ripple) (See Note 6)	Zero	6% (see Note 7)
	D.C. transient component in a.c.	As specified in lower level documents	
	Setting value		
	Balanced polyphase supplies	Fully balanced	(See Note 8)
Time	Parameter(s) of characteristic curve	As specified in lower level documents	
	Setting value		
Auxiliary energizing quantities	Voltage or current	Rated value(s)	As specified in lower level documents
	Frequency	Rated value	± 0.5% (see Note 3)
	Waveform	Sinusoidal	Distortion factor 2% (See Notes 4 and 5)
	Alternating component in d.c. (see Note 6)	Zero	6% (see Note 7)
	D.C. transient components in a.c.	As stated in lower level documents	