
Electrical relays - Part 8: Thermal electrical relays

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Relais électriques - Huitième partie: Relais électriques thermiques

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYS
Part 8: Thermal electrical relays

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.

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 PREFACE
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This standard has been prepared by Sub-Committee 41B: Measuring relays and protection equipment, of IEC Technical Committee 41: Electrical relays. [SIST IEC 60255-8:1995](https://standards.iteh.ai/catalog/standards/sist/6e90c7dc-9161-4674-a7b7-4b58dadcd11/sist-iec-60255-8-1995)

This standard constitutes the second edition of IEC Publication 255-8 and replaces the first edition (1978). It also replaces the first edition (1982) and the second impression (1987) of IEC Publication 255-17.

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

Six Months' Rule	Report on Voting
41B(CO)47	41B(CO)51

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

This standard is a third-level specification.

The following IEC publications are quoted in this standard:

Publications Nos. 50: International electrotechnical vocabulary (IEV).
 255: Electrical Relays.
 255-6 (1988): Part 6: Measuring relays and protection equipment.

ELECTRICAL RELAYS

Part 8: Thermal electrical relays

SECTION ONE – GENERAL

1 Scope and object

This standard is applicable to dependent specified time electrical measuring relays which protect equipment from electrical thermal damage by the measurement of current flowing in the protected equipment.

1.1 This standard covers the following two types of relays:

- a) thermal electrical relays having a total memory function of the load-current conditions before the conditions which caused the switching of the relay;
- b) thermal electrical relays having a partial memory function, i.e. of the overload current conditions only.

1.2 This standard also covers the particular requirements for thermal electrical relays used for motor protection.

The object of this standard is to state the particular requirements for thermal electrical relays. It is to be read in conjunction with higher level documents in the IEC Publication 255 series.

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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 higher level documents.

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

2.1 **hot curve:** For a thermal electrical relay with a total memory function, the characteristic curve representing the relationship between specified operating time and current, taking account of the thermal effect of a specified steady-state load current before the overload occurs.

2.2 **cold curve:** For a thermal electrical relay, the characteristic curve representing the relationship between specified operating time and current, with the relay at reference and steady-state conditions with no-load current flowing before the overload occurs.

2.3 **correcting quantity (compensating quantity):** A quantity modifying the specified characteristics of the relay in a specified manner. Such quantities can be oil temperature, etc.

2.4 **basic current:** The specified limiting value of the current for which the relay is required not to operate.

NOTE – The basic current serves as a reference for the definition of the characteristics of thermal electrical relays. Settings of a thermal electrical relay are made in terms of this current.

2.5 **constant k :** The constant by which the basic current is multiplied to obtain the current value to which the accuracy of the minimum operating current referred.

2.6 **previous load ratio:** The ratio of the load current preceding the overload to basic current under specified conditions.

SECTION TWO – REQUIREMENTS

3 Standard values**3.1 Characteristic curves**

The characteristics of time with respect to current can be stated either by equations or by graphical methods. The equations for a simple thermal model are given below under Sub-clauses 3.1.1 and 3.1.2. Other characteristic curves are permitted and should be declared by the manufacturer. As an example, see Appendix A.

NOTES

1 – For practical purpose, e.g. testing, it is convenient to give the characteristic curve as a combination of current and time values.

2 – The time constant used in an equation should be as specified in National Standards or as declared by the manufacturer.

3.1.1 Cold curve

A general curve for thermal electrical relays, based on the heating effect and on the time constant, is given by the following formula:

$$t = \tau \cdot \ln \frac{I^2}{I^2 - (k \cdot I_B)^2}$$

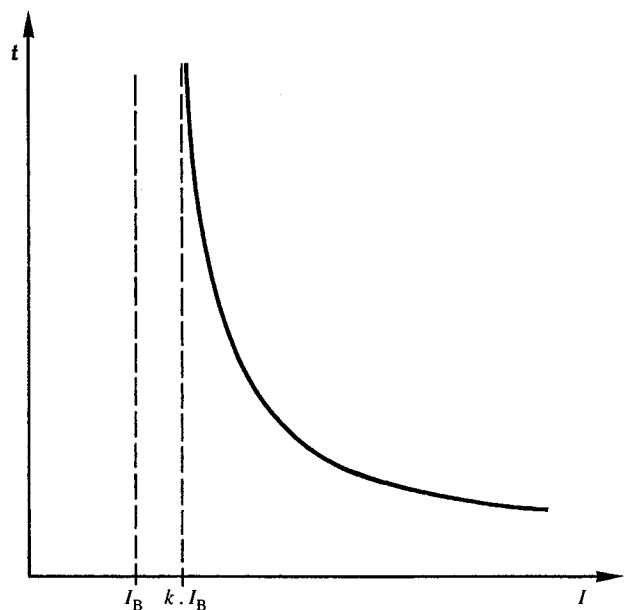
where

- t = operating time;
- τ = time constant;
- I_B = basic current;
- k = constant;
- I = relay current.

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Cold curve

3.1.2 Hot curve

With regard to preheating on a relay with a total memory function, the hot curve is relevant. For example, the equation obtained by modification of the general cold curve is given by the following formula which is derived in Appendix B:

$$t = \tau \cdot \ln \frac{I^2 - I_p^2}{I^2 - (k \cdot I_B)^2}$$

where I_p is the specified load current before the overload occurs.

3.2 Nominal ranges of auxiliary energizing quantities

For other nominal ranges than the preferred 80% to 110% the limits of the nominal range shall be as specified in National Standards or as declared by the manufacturer.

3.3 Standard reference values of influencing quantities and factors

The standard reference values and test tolerances of influencing quantities and factors, previous current values and correcting quantities are given in Tables I, II and III, respectively.

Table I – Reference conditions and test tolerances of influencing quantities and factors

	Influencing quantity and factor	Reference condition (see note)	Test tolerances
General	Position	As specified in National Standards or as declared by the manufacturer	2° in any direction or, for static relays, as specified in National Standards or as declared by the manufacturer
Characteristic quantities and input energizing quantity	Setting of basic current	Rated current or as specified in National Standards or as declared by the manufacturer	As specified in National Standards or as declared by the manufacturer
	Magnitude (reference for determination of variations)	As specified in National Standards or as declared by the manufacturer. For motor protection, two times and six times basic current	As specified in National Standards or as declared by the manufacturer. For motor protection: ±1%
	D.C. transient component in a.c.	Zero	2% of peak value
Time	Setting	As specified in National Standards or as declared by the manufacturer	As specified in National Standards or as declared by the manufacturer
	Setting parameter(s) of the curve	As specified in National Standards or as declared by the manufacturer	As specified in National Standards or as declared by the manufacturer
Auxiliary energizing quantities	Voltage	Rated value(s)	As specified in National Standards or as declared by the manufacturer
	D.C. component in a.c.	Zero	2% of peak value

NOTE – National Standards: special conditions of application or the character of the relay may necessitate the use of non-standard values. In such cases, the manufacturer shall declare the reference values and tolerances. For example, special applications may necessitate the use of 40 °C as the reference value of ambient temperature instead of 20 °C.

Table II – Previous current values when measuring the effect of influencing quantities

Quantity	Reference condition	Test tolerances
Specified load current before overload occurs	For cold curve: zero	Not applicable
	For hot curve: as specified in National Standards or as declared by the manufacturer	As specified in National Standards or as declared by the manufacturer
Previous load ratio for motor protection	For hot curves: 1.0 or 0.9 as chosen by the manufacturer	±1%

Table III – Standard reference conditions and test tolerances of correcting quantities when measuring the effect of influencing quantities

Correcting quantity	Reference condition	Test tolerances
Unbalance current in a sinusoidal poly-phase system	Balanced	See Note 8 of Table II of IEC 255-6
Speed of protected rotating machine	As specified in National Standards or as declared by the manufacturer. (For motor protection: rated speed of motor)	As specified in National Standards or as declared by the manufacturer
Temperatures of different parts of the protected equipment (see Note 1)		
Temperature of cooling medium of the protected equipment	20 °C or as declared by manufacturer (see Note 2)	±2 °C

NOTES

- 1 – These values of correcting quantities represent steady-state thermal conditions of the protected equipment before overload occurs. Their application depends on the principle of the relay used.
- 2 – To be declared by the manufacturer mainly when a cooling medium other than air is used.

3.4 Standard values of the limits of the nominal range of influencing quantities and factors

The standard values of the limits of the nominal range of influencing quantities and factors, previous current values and correcting quantities are given in tables IV, V and VI respectively.