

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical insulation – Thermal evaluation and designation

Isolation électrique – Evaluation et designation thermiques

IEC 60085:2007

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**ELECTRICAL INSULATION –
THERMAL EVALUATION AND DESIGNATION**

FOREWORD

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International Standard IEC 60085 has been prepared by technical committee 112: Evaluation and qualification of electrical insulating materials and systems.

This fourth edition cancels and replaces the third edition, published in 2004, and constitutes a technical revision.

The major technical changes with regard to the previous edition concern the fact that this edition is an amalgamation of the third edition of this standard together with IEC 62114:2001.

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

FDIS	Report on voting
112/74/FDIS	112/77/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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ELECTRICAL INSULATION – THERMAL EVALUATION AND DESIGNATION

1 Scope

This International Standard now distinguishes between thermal classes for electrical insulation systems and electrical insulating materials. It establishes the criteria for evaluating the thermal endurance of either electrical insulating materials (EIM) or electrical insulation systems (EIS). It also establishes the procedure for assigning thermal classes.

This standard is applicable where the thermal factor is the dominant ageing factor.

NOTE A thermal class is not assigned to an EIM as related to its use in an EIS

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60216-1: *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60505: *Evaluation and qualification of electrical insulation systems*

IEC 61857 (all parts), *Electrical insulation systems – Procedures for thermal evaluation*

IEC 61858, *Electrical insulation systems – Thermal evaluation of modifications to an established wire-wound EIS*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60505, as well as the following, apply.

3.1 electrical insulating material (EIM)

solid or fluid with negligibly low electric conductivity, or a simple combination of such materials, used to separate conducting parts at different electrical potential in electrotechnical devices

NOTE 1 A “simple combination” may be a combination of EIM delivered in a joint state, for example, a flexible material consisting of a paper laminated on polyethylene terephthalate film.

NOTE 2 For testing purposes, electrodes may be applied on material specimens without this combination formally constituting an EIS to be tested as such.

3.2 electrical insulation system (EIS)

insulating structure containing one or more EIM together with associated conducting parts employed in an electrotechnical device

3.3 candidate EIM

EIM under evaluation to determine its estimated thermal endurance

3.4 reference EIM

material with known thermal endurance, preferably derived from service experience, used for comparative tests with the candidate EIM

3.5 candidate EIS

EIS under evaluation to determine its service capability (thermal)

3.6 reference EIS

established EIS evaluated on the basis of either a known service experience record or a known comparative functional evaluation

3.7 EIM assessed thermal endurance index (EIM ATE)

numerical value of the temperature in degrees Celsius, up to which the reference EIM possesses known, satisfactory service experience in the specified application

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3.8 EIM relative thermal endurance index (EIM RTE)

numerical value of the temperature in degrees Celsius at which the estimated time to endpoint of the candidate EIM is the same as the estimated time to endpoint of the reference EIM at a temperature equal to its EIM ATE

3.9 EIS assessed thermal endurance index (EIS ATE)

numerical value of the temperature in degrees Celsius for the reference EIS as derived from known service experience or a known comparative functional evaluation

3.10 EIS relative thermal endurance index (EIS RTE)

numerical value of the temperature in degrees Celsius for the candidate EIS which is relative to the known EIS ATE of a reference EIS, when both EIS are subjected to the same ageing and diagnostic procedures in a comparative test

3.11 thermal class

designation that is equal to the numerical value of the recommended maximum continuous use temperature in degrees Celsius

NOTE 1 EIS subjected to operating temperatures exceeding its assigned thermal class can result in shorter expected life.

NOTE 2 EIM with different thermal endurance indices (ATE/RTE according to IEC 60216-5) may be combined to form an EIS which has a thermal class that may be higher or lower than the recommended maximum continuous use temperature of any of the individual components according to IEC 60505.

4 General considerations – Relation of EIM to EIS

The description of an electrotechnical device as being of a particular thermal class does not mean, and must not be taken to imply, that each EIM used in its construction is of the same thermal endurance.

The thermal class for an EIS may not be directly related to the thermal endurance of the individual EIM included in it. In the EIS, the protective character of other EIM used in the system may improve the performance of an individual EIM allowing its use in an EIS with a thermal class greater than the thermal endurance of the individual EIM. On the other hand, problems of incompatibility between EIM may decrease the appropriate thermal class of the system below the thermal endurance of the EIM. Therefore, the thermal capabilities of an EIM shall not be deduced from the thermal class of an EIS of which it is a component

4.1 Maximum use temperature

The thermal classes in this standard are numerically equal to the maximum temperature recommended for the EIS under normal operating conditions as defined by the product technical committee.

Product TCs shall determine the operating conditions under which the maximum temperature of the device may differ from the thermal class of the EIS. Such situations may occur because either a shorter or longer life than normal is envisaged, or exceptional conditions of service exist.

4.2 Other factors of influence

Apart from thermal factors, the ability of the EIS to fulfil its function is affected by many factors, such as electrical and mechanical stresses, vibration, deleterious atmospheres and chemicals, moisture, dirt and radiation. All such factors should be taken into account when designing particular electrotechnical devices and further guidance on the evaluation of these aspects may be found in IEC 60505.

4.3 Thermal evaluation of EIM

Insulating materials and simple combinations of insulating materials shall follow the precepts set forth in IEC 60216-1 and be evaluated in accordance with IEC 60216-5 and refer to expected service conditions.

4.4 Thermal evaluation of EIS

Experience has demonstrated that, under normal operating conditions, satisfactory economic life is obtained for many electrotechnical devices such as rotating machines, transformers, etc., that are designed and built in accordance with standards based on thermal evaluations of EIS.

Test procedures for the thermal evaluation of EIS shall follow the precepts set forth in IEC 60505. Specific test procedures for EIS intended for use in low-voltage devices are listed in IEC 61857 and IEC 61858.

5 Thermal class

Since the temperature in electrotechnical devices is very often the dominant ageing factor affecting the EIM in the EIS, certain basic thermal classes are useful and have been recognized as such internationally. Where a thermal class is specified for an EIS, this means

the recommended maximum continuous use temperature in degrees Celsius for which that combination of EIM is appropriate.

Thermal classes shall be assigned to an EIS based on service experience or on the results of functional tests based upon test procedures in accordance with 4.4. Thermal classes are assigned to an EIS based on the EIS ATE or EIS RTE.

While a thermal class may be applied to an EIM based on service experience or on the results of testing in accordance with 4.3, this does not automatically imply that it is suitable for use in an EIS of that thermal class, or that the thermal class of an EIS in which it is a part is the same as for that EIM.

Designations for the thermal classes of are as follows:

Table 1 – Thermal class assignment

ATE or RTE °C		Thermal class °C	Letter designation ^a
≥90	<105	90	Y
≥105	<120	105	A
≥120	<130	120	E
≥130	<155	130	B
≥155	<180	155	F
≥180	<200	180	H
≥200	<220	200	N
≥220	<250	220	R
≥250 ^b	<275	250	-

^a If desired, the letter designation may be added in parentheses, e.g. Class 180 (H). Where space is a factor, such as on a nameplate, the product TC may elect to use only the letter designation.

^b Designations of thermal classes over 250 shall increase by increments of 25 and be designated accordingly.

Bibliography

IEC 60216-6, *Electrical insulating materials – Thermal endurance properties – Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method*

IEC 62101/TS, *Electrical insulation systems – Short-time evaluation of combined thermal and electrical stresses*

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