

INTERNATIONAL STANDARD

**Electric cables – Calculation of the current rating –
Part 2-1: Thermal resistance – Calculation of thermal resistance**





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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC CABLES – CALCULATION OF THE CURRENT RATING –

Part 2-1: Thermal resistance – Calculation of thermal resistance

FOREWORD

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IEC 60287-2-1 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) thorough redefinition of symbols used across the IEC 60287 and IEC 60853 series to realign and unify definitions, eliminate inconsistencies and to improve cross-use of the different parts of both IEC 60287 and IEC 60853 series;
- b) improvement in the identification of tabulated materials and introduction of new materials in the tables;

- c) introduction of generic annular layers to improve thermal modelling of existing and future cables designs;
- d) improved calculation of T_4 in the case of directly buried cables;
- e) introduction of corrective factors, on relevant calculated physical characteristics to take into account the effect of multicore lay-lengths; a dedicated annex to highlight correction factors for different number of cores has been introduced (Annex A);
- f) improved description and formulation for the case of cables in pipe and backfill;
- g) redefinition of the calculation method of T_4 for duct banks where $y/x > 3$, the new table based method eliminates errors, extends the usability of the new formulation while keeping a suitable conservative margin in the calculation.

The text of this International Standard is based on the following documents:

Draft	Report on voting
20/2099/FDIS	20/2106/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60287 series, published under the general title *Electric cables – Calculation of the current rating*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The IEC 60287 series has been divided into three parts so that revisions of, and additions to the document can be carried out more conveniently.

Each part is subdivided into subparts which are published as separate standards.

Part 1: Formulae of ratings and power losses;

Part 2: Formulae for thermal resistance;

Part 3: Operating conditions.

This part of IEC 60287-2 contains methods for calculating the internal thermal resistance of cables and the external thermal resistance for cables laid in free air, ducts and buried.

The formulae in this document contain quantities which vary with cable design and materials used. The values given in the tables are either internationally agreed, for example, electrical resistivities and resistance temperature coefficients, or are those which are generally accepted in practice, for example, thermal resistivities and permittivities of materials. In this latter category, some of the values given are not characteristic of the quality of new cables but are considered to apply to cables after a long period of use. In order that uniform and comparable results can be obtained, the current ratings should be calculated with the values given in this document. However, where it is known with certainty that other values are more appropriate to the materials and design, then these may be used, and the corresponding current rating declared in addition, provided that the different values are quoted.

Quantities related to the operating conditions of cables are liable to vary considerably from one country to another. For instance, with respect to the ambient temperature and soil thermal resistivity, the values are governed in various countries by different considerations. Superficial comparisons between the values used in the various countries can lead to erroneous conclusions if they are not based on common criteria: for example, there can be different expectations for the life of the cables, and in some countries design is based on maximum values of soil thermal resistivity, whereas in others average values are used. Particularly, in the case of soil thermal resistivity, it is well known that this quantity is very sensitive to soil moisture content and can vary significantly with time, depending on the soil type, the topographical and meteorological conditions, and the cable loading.

The following procedure for choosing the values for the various parameters should, therefore, be adopted:

Numerical values should preferably be based on results of suitable measurements. Often such results are already included in national specifications as recommended values, so that the calculation may be based on these values generally used in the country in question; a survey of such values is given in IEC 60287-3-1.

A suggested list of the information required to select the appropriate type of cable is given in IEC 60287-3-1.