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COMMENTED VERSION

INTERNATIONAL STANDARD

colour inside

Electric cables – Calculation of the current rating – Part 1-3: Current rating equations (100 % load factor) and calculation of losses – Current sharing between parallel single-core cables and calculation of circulating current losses

INTERNATIONAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRIC CABLES – CALCULATION OF THE CURRENT RATING –

Part 1-3: Current rating equations (100 % load factor) and calculation of losses – Current sharing between parallel single-core cables and calculation of circulating current losses

FOREWORD

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This commented version (CMV) of the official standard IEC 60287-1-3:2023 edition 2.0 allows the user to identify the changes made to the previous IEC 60287-1-3:2002 edition 1.0. Furthermore, comments from IEC TC 20 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60287-1-3 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

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

a) Change and update of list of symbols. **1**

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

Draft	Report on voting
20/2098/FDIS	20/2105/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.

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

When single-core cables are installed in parallel, it is possible that the load current ~~may~~ will not share equally between the parallel cables. The circulating currents in the sheaths of the parallel cables will also differ. This is because a significant proportion of the impedance of large conductors is due to self reactance and mutual reactance. Hence the spacing and relative location of each cable will have an effect on the current sharing and the circulating currents. The currents are also affected by phase rotation. The method described in this document can be used to calculate the current sharing between conductors as well as the circulating current losses.

There is no simple rule by which the circulating current losses of parallel cables can be estimated. Calculation for each cable configuration ~~is necessary~~ should be applied. The principles and impedance formulae involved are straightforward but the difficulty arises in solving the large number of simultaneous equations generated. The number of equations to be solved generally precludes the use of manual calculations and solution by computer is recommended. For n_c cables per phase having metallic sheaths in a three-phase system there are 6~~n~~ $\cdot$ n_c equations containing the same number of complex variables.

For simplicity the equations set out in this document assume that the parallel conductors all have the same cross-sectional area. If this is not the case, the equations ~~may~~ should be adapted to allow for different resistances for each conductor. The effect of neutral and earth conductors can also be calculated by including these conductors in the appropriate loops. The method set out in this document does not take account of any portion of the sheath circulating currents that ~~may~~ can flow through the earth or other extraneous paths. In this respect, the effect of earth return path has been excluded for the purposes of the methodology described in the following, as it is concluded that it can affect the magnitude of the resulting circulating currents only by a small extent on a limited number of cases, where both very low soil electrical resistivity values and low earthing conductor resistance values are simultaneously considered. **2**

The conductor currents and sheath circulating currents in parallel single-core cables are unlikely to be equal. Because of this, the external thermal resistance for buried parallel cables should be calculated using the method set out in IEC 60287-2-1:2023, 4.2.3.2. Because the external thermal resistance and sheath temperatures are functions of the power dissipation from each cable in the group ~~it is necessary to adopt~~ an iterative procedure to determine the circulating current losses and the external thermal resistance should be adopted.

ELECTRIC CABLES – CALCULATION OF THE CURRENT RATING –

Part 1-3: Current rating equations (100 % load factor) and calculation of losses – Current sharing between parallel single-core cables and calculation of circulating current losses

1 Scope

This part of IEC 60287 provides a method for calculating the phase currents and circulating current losses in single-core cables arranged in parallel.

The method described in this document can be used for any number of cables per phase in parallel in any physical layout. The phase currents can be calculated for any arrangement of sheath bonding. For the calculation of sheath losses, it is assumed that the sheaths are bonded at both ends. A method for calculating sheath eddy current losses in two circuits in flat formation is given in IEC 60287-1-2.

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 60287-1-2:1993, *Electric cables – Calculation of the current rating – Part 1: Current rating equations (100 % load factor) and calculation of losses – Section 2: Sheath eddy current loss factors for two circuits in flat formation*~~

~~IEC 60287-2-1:1994, *Electric cables – Calculation of the current rating – Part 2: Thermal resistance – Section 1: Calculation of thermal resistance*~~

There are no normative references in this document.

IEC 60287-1-3

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Electric cables – Calculation of the current rating – Part 1-3: Current rating equations (100 % load factor) and calculation of losses – Current sharing between parallel single-core cables and calculation of circulating current losses

IEC 60287-1-3:2023-05(en)

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