



IEC 60228

Edition 4.0 2023-12
COMMENTED VERSION

INTERNATIONAL STANDARD



Conductors of insulated cables

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.060.20

ISBN 978-2-8322-8003-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION	7
1 Scope	8
2 Normative references	8
3 Terms and definitions	8
4 Classification	9
5 Materials.....	9
5.1 Introduction General	9
5.2 Circular and shaped solid aluminium conductors.....	9
5.3 Circular and shaped stranded aluminium conductors	10
6 Solid conductors and stranded conductors	10
6.1 Solid conductors (class 1).....	10
6.1.1 Construction.....	10
6.1.2 Resistance	10
6.2 Stranded circular non-compacted conductors (class 2).....	10
6.2.1 Construction.....	10
6.2.2 Resistance	11
6.3 Stranded compacted circular conductors and stranded shaped conductors (class 2).....	11
6.3.1 Construction.....	11
6.3.2 Resistance	11
6.4 Milliken conductors (class 2).....	11
6.4.1 Construction.....	11
6.4.2 Resistance	11
7 Flexible conductors (classes 5 and 6).....	11
7.1 Construction.....	11
7.2 Resistance	12
8 Check of compliance with Clause 6 and Clause 7.....	12
Annex A (normative) Measurement of resistance.....	17
Annex B (informative) Exact formulae for the temperature correction factors	19
Annex C (informative) Guidance on the dimensional limits of circular conductors	20
C.1 Object Purpose.....	20
C.2 Dimensional limits for circular copper conductors.....	20
C.3 Dimensional limits for stranded compacted circular copper, aluminium and aluminium alloy conductors	20
C.4 Dimensional limits for circular solid aluminium conductors	20
Bibliography.....	24
List of comments.....	25
Table 1 – Tensile strength limits for circular and shaped solid aluminium conductors.....	9
Table 2 – Tensile strength limits for circular and shaped stranded aluminium conductors.....	10
Table 3 – Class 1 solid conductors for single-core and multi-core cables	13
Table 4 – Class 2 stranded conductors for single-core and multi-core cables	14
Table 5 – Class 5 flexible copper conductors for single-core and multi-core cables	15

Table 6 – Class 6 flexible copper conductors for single-core and multi-core cables	16
Table A.1 – Temperature correction factors k_t for conductor resistance to correct the measured resistance at t °C to 20 °C	18
Table C.1 – Maximum diameters of solid, non-compacted stranded and flexible circular copper conductors.....	21
Table C.2 – Minimum and maximum diameters of stranded compacted circular copper, aluminium and aluminium alloy conductors.....	22
Table C.3 – Minimum and maximum diameters of solid circular aluminium conductors.....	23

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONDUCTORS OF INSULATED CABLES**FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This commented version (CMV) of the official standard IEC 60228:2023 edition 4.0 allows the user to identify the changes made to the previous IEC 60228:2004 edition 3.0. 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 60228 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

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

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

- a) a description of Milliken conductors has been added;
- b) nominal cross-sectional areas above 2 500 mm² have been added;
- c) the old 2 500 mm² aluminium resistance value has been corrected and a new value introduced.

For legacy systems where the 2 500 mm² aluminium conductor was designed taking into account the value presented in previous editions and no longer tabulated, then the original design can be maintained and still utilized.

The suppliers can furthermore utilize such superseded design of 2 500 mm² aluminium conductors either in systems already designed and qualified but not delivered or for example to produce repair and additional spare lengths for delivered systems.

The choice of utilizing the original superseded design of 2 500 mm² aluminium conductors or a new one based on the new resistance tabulated value is a matter of agreement between the supplier and final users.

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

Draft	Report on voting
20/2125/FDIS	20/2131/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.

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, or
- revised.

Conductors described in IEC 60228 are specified in metric sizes. Canada at present uses conductor sizes and characteristics according to the American Wire Gauge (AWG) system and kcmil for larger sizes as shown below. The use of these sizes is currently prescribed uniformly across Canada for installations by sub-national regulations. IEC-TC-20 cable product standards do not prescribe cables with AWG/kcmil conductors. **1**

AWG				kcmil			
Conductor size	Nominal cross-sectional area mm ²	Conductor size	Nominal cross-sectional area mm ²	Conductor size	Nominal cross-sectional area mm ²	Conductor size	Nominal cross-sectional area mm ²
-	-	-	-	250	127	750	380
-	-	-	-	300	152	800	405
20	0,519	4	21,2	350	177	900	456
18	0,823	3	26,7	400	203	1000	507
16	1,31	2	33,6	450	228	1200	608
14	2,08	1	42,4	500	253	1250	633
12	3,31	1/0	53,5	550	279	1500	760
10	5,26	2/0	67,4	600	304	1750	887
8	8,37	3/0	85,0	650	329	2000	1010
6	13,3	4/0	107	700	355	-	-

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

This document is intended as a fundamental reference standard for IEC technical committees and National Committees in drafting standards for electric cables, and to the National Committees in drafting specifications for use in their own countries. These committees ~~should~~ select from the tables of this general standard the conductors appropriate to the particular applications ~~with which they are concerned~~ relevant to them and either include the applicable details in their cable specifications or make appropriate references to this document.

~~In preparing this edition the main objects have been to incorporate IEC 60228A into it and maintain a simplified yet informative standard so far as is compatible with technical and economic considerations.~~

CONDUCTORS OF INSULATED CABLES

1 Scope

This document specifies the nominal cross-sectional areas, in the range 0,5 mm² to ~~2 500~~ 3 500 mm², for conductors in electric power cables and cords of a wide range of types. Requirements for numbers and sizes of wires and resistance values are also included. These conductors include solid, stranded and Milliken, copper, aluminium and aluminium alloy conductors in cables for fixed installations and flexible copper conductors.

This document does not apply to conductors for telecommunication purposes.

The applicability of this document to a particular type of cable is as specified in the standard for the type of cable.

Unless specified otherwise in a particular clause, this document relates to the conductors in the finished cable and not to the conductor as made or supplied for inclusion into a cable.

Conductors described in this document are specified in metric sizes.

Informative annexes provide supplementary information covering temperature correction factors for resistance measurement (Annex B) and guidance on dimensional limits of circular conductors (Annex C).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IECEE OD-5014, *Instrument Accuracy Limits*

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Conductors of insulated cables

Ames des câbles isolés



CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Classification.....	8
5 Materials	8
5.1 General.....	8
5.2 Circular and shaped solid aluminium conductors.....	8
5.3 Circular and shaped stranded aluminium conductors	9
6 Solid conductors and stranded conductors.....	9
6.1 Solid conductors (class 1).....	9
6.1.1 Construction	9
6.1.2 Resistance	9
6.2 Stranded circular non-compacted conductors (class 2)	9
6.2.1 Construction	9
6.2.2 Resistance	10
6.3 Stranded compacted circular conductors and stranded shaped conductors (class 2).....	10
6.3.1 Construction	10
6.3.2 Resistance	10
6.4 Milliken conductors (class 2).....	10
6.4.1 Construction	10
6.4.2 Resistance	10
7 Flexible conductors (classes 5 and 6).....	10
7.1 Construction	10
7.2 Resistance.....	11
8 Check of compliance with Clause 6 and Clause 7	11
Annex A (normative) Measurement of resistance	16
Annex B (informative) Exact formulae for the temperature correction factors	18
Annex C (informative) Guidance on the dimensional limits of circular conductors.....	19
C.1 Purpose	19
C.2 Dimensional limits for circular copper conductors.....	19
C.3 Dimensional limits for stranded compacted circular copper, aluminium and aluminium alloy conductors.....	19
C.4 Dimensional limits for circular solid aluminium conductors	19
Bibliography.....	23
Table 1 – Tensile strength limits for circular and shaped solid aluminium conductors.....	8
Table 2 – Tensile strength limits for circular and shaped stranded aluminium conductors.....	9
Table 3 – Class 1 solid conductors for single-core and multi-core cables.....	12
Table 4 – Class 2 stranded conductors for single-core and multi-core cables.....	13
Table 5 – Class 5 flexible copper conductors for single-core and multi-core cables.....	14
Table 6 – Class 6 flexible copper conductors for single-core and multi-core cables.....	15

Table A.1 – Temperature correction factors k_t for conductor resistance to correct the measured resistance at t °C to 20 °C 17

Table C.1 – Maximum diameters of solid, non-compacted stranded and flexible circular copper conductors 20

Table C.2 – Minimum and maximum diameters of stranded compacted circular copper, aluminium and aluminium alloy conductors 21

Table C.3 – Minimum and maximum diameters of solid circular aluminium conductors 22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONDUCTORS OF INSULATED CABLES

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60228 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

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

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

- a) a description of Milliken conductors has been added;
- b) nominal cross-sectional areas above 2 500 mm² have been added;

- c) the old 2 500 mm² aluminium resistance value has been corrected and a new value introduced.

For legacy systems where the 2 500 mm² aluminium conductor was designed taking into account the value presented in previous editions and no longer tabulated, then the original design can be maintained and still utilized.

The suppliers can furthermore utilize such superseded design of 2 500 mm² aluminium conductors either in systems already designed and qualified but not delivered or for example to produce repair and additional spare lengths for delivered systems.

The choice of utilizing the original superseded design of 2 500 mm² aluminium conductors or a new one based on the new resistance tabulated value is a matter of agreement between the supplier and final users.

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

Draft	Report on voting
20/2125/FDIS	20/2131/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.

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, or
- revised.

INTRODUCTION

This document is intended as a fundamental reference standard for IEC technical committees and National Committees in drafting standards for electric cables, and to the National Committees in drafting specifications for use in their own countries. These committees select from the tables of this general standard the conductors appropriate to the particular applications relevant to them and either include the applicable details in their cable specifications or make appropriate references to this document.

CONDUCTORS OF INSULATED CABLES

1 Scope

This document specifies the nominal cross-sectional areas, in the range 0,5 mm² to 3 500 mm², for conductors in electric power cables and cords of a wide range of types. Requirements for numbers and sizes of wires and resistance values are also included. These conductors include solid, stranded and Milliken, copper, aluminium and aluminium alloy conductors in cables for fixed installations and flexible copper conductors.

This document does not apply to conductors for telecommunication purposes.

The applicability of this document to a particular type of cable is as specified in the standard for the type of cable.

Unless specified otherwise in a particular clause, this document relates to the conductors in the finished cable and not to the conductor as made or supplied for inclusion into a cable.

Conductors described in this document are specified in metric sizes.

Informative annexes provide supplementary information covering temperature correction factors for resistance measurement (Annex B) and guidance on dimensional limits of circular conductors (Annex C).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IECEE OD-5014, *Instrument Accuracy Limits*

SOMMAIRE

AVANT-PROPOS	26
INTRODUCTION.....	28
1 Domaine d'application	29
2 Références normatives	29
3 Termes et définitions	29
4 Classification	30
5 Matériaux	30
5.1 Généralités	30
5.2 Âmes massives circulaires et sectorales en aluminium	30
5.3 Âmes câblées circulaires et sectorales en aluminium	31
6 Âmes massives et câblées.....	31
6.1 Âmes massives (classe 1).....	31
6.1.1 Construction	31
6.1.2 Résistance	31
6.2 Âmes câblées de section circulaire, non rétreintes (classe 2).....	31
6.2.1 Construction	31
6.2.2 Résistance	32
6.3 Âmes câblées rétreintes de section circulaire et âmes sectorales câblées (classe 2).....	32
6.3.1 Construction	32
6.3.2 Résistance	32
6.4 Âmes segmentées (classe 2)	32
6.4.1 Construction	32
6.4.2 Résistance	32
7 Âmes souples (classes 5 et 6)	32
7.1 Construction	32
7.2 Résistance.....	33
8 Vérification de la conformité aux Articles 6 et 7	33
Annexe A (normative) Mesurage de la résistance	38
Annexe B (informative) Formules exactes pour les facteurs de correction de température	40
Annexe C (informative) Recommandations concernant les limites dimensionnelles des âmes circulaires.....	41
C.1 Objet.....	41
C.2 Limites dimensionnelles pour les âmes circulaires en cuivre	41
C.3 Limites dimensionnelles pour les âmes câblées circulaires rétreintes en cuivre, aluminium et alliage d'aluminium	41
C.4 Limites dimensionnelles pour les âmes massives circulaires en aluminium	41
Bibliographie.....	45
 Tableau 1 – Limites de résistance à la traction des âmes massives circulaires et sectorales en aluminium	 30
Tableau 2 – Limites de résistance à la traction des âmes câblées circulaires et sectorales en aluminium	31
Tableau 3 – Âmes massives de classe 1 pour câbles monoconducteurs et multiconducteurs.....	34

Tableau 4 – Âmes câblées de classe 2 pour câbles monoconducteurs et multiconducteurs.....	35
Tableau 5 – Âmes souples en cuivre de classe 5 pour câbles monoconducteurs et multiconducteurs.....	36
Tableau 6 – Âmes souples en cuivre de classe 6 pour câbles monoconducteurs et multiconducteurs.....	37
Tableau A.1 – Facteurs de correction de température k_t pour ramener à 20 °C la résistance de l'âme mesurée à t °C.....	39
Tableau C.1 – Diamètres maximaux des âmes circulaires en cuivre massives, câblées non rétreintes et souples.....	42
Tableau C.2 – Diamètres minimaux et maximaux des âmes câblées circulaires rétreintes en cuivre, aluminium et alliage d'aluminium.....	43
Tableau C.3 – Diamètres minimaux et maximaux des âmes massives circulaires en aluminium	44

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

ÂMES DES CÂBLES ISOLÉS

AVANT-PROPOS

- 1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés « Publication(s) de l'IEC »). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de propriété revendiqué à cet égard. À la date de publication du présent document, l'IEC n'avait pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse <https://patents.iec.ch>. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 60228 a été établie par le comité d'études 20 de l'IEC: Câbles électriques Il s'agit d'une Norme internationale.

Cette quatrième édition annule et remplace la troisième édition parue en 2004. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) une description relative aux âmes segmentées a été ajoutée;
- b) des sections nominales supérieures à 2 500 mm² ont été ajoutées;

- c) l'ancienne valeur de résistance de 2 500 mm² des âmes en aluminium a été corrigée et une nouvelle valeur a été introduite.

Pour les systèmes existants où l'âme en aluminium de 2 500 mm² a été conçue en tenant compte de la valeur présentée dans les éditions précédentes et ne figure plus dans les tableaux, la conception d'origine peut être conservée et encore être utilisée.

Les fournisseurs peuvent également utiliser cette conception remplacée des âmes en aluminium de 2 500 mm² soit dans des systèmes déjà conçus et qualifiés mais non livrés, soit pour produire, par exemple, des longueurs de réparations et des longueurs de réserve supplémentaires pour des systèmes livrés.

Le choix d'utiliser la conception d'origine remplacée des âmes en aluminium de 2 500 mm² ou une nouvelle conception fondée sur la nouvelle valeur de résistance indiquée dans les tableaux doit faire l'objet d'un accord entre le fournisseur et les utilisateurs finaux.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
20/2125/FDIS	20/2131/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La version française de cette norme n'a pas été soumise au vote.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site Web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

INTRODUCTION

Le présent document est destiné à servir de norme de référence fondamentale aux comités d'études et Comités nationaux de l'IEC lors de l'élaboration de normes relatives aux câbles électriques, ainsi qu'aux Comités nationaux lors de l'élaboration de spécifications à utiliser dans leur propre pays. Ces comités choisiront, dans les tableaux de cette norme générale, les âmes qui conviennent aux applications particulières envisagées et incluront les détails applicables dans leurs spécifications de câbles ou feront référence au présent document.

ÂMES DES CÂBLES ISOLÉS

1 Domaine d'application

Le présent document spécifie les sections nominales, dans la plage de 0,5 mm² à 3 500 mm², des âmes d'un large éventail de types de câbles et de cordons électriques. Des exigences relatives au nombre et au diamètre des fils sont également spécifiées, ainsi que des valeurs de résistance. Les âmes concernées sont les âmes massives, câblées et segmentées, en cuivre, aluminium et alliage d'aluminium, destinées aux câbles pour installations fixes, ainsi que les âmes souples en cuivre.

Le présent document ne s'applique pas aux âmes utilisées à des fins de télécommunication.

L'applicabilité du présent document à un type de câble particulier est précisée dans la norme relative à ce type de câble.

Sauf indication contraire dans un article particulier, le présent document porte sur les âmes des câbles terminés, et non sur les âmes seules ou fournies en vue d'une intégration dans un câble.

Les âmes décrites dans le présent document sont spécifiées en tailles métriques.

Des annexes informatives donnent des informations complémentaires sur les facteurs de correction de température à utiliser pour les mesures de résistance (Annexe B) et des recommandations sur les limites dimensionnelles des âmes circulaires (Annexe C).

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IECEE OD-5014, *Instrument Accuracy Limits*