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INTERNATIONAL STANDARD

colour inside

Conductors of insulated cables

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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.
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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 mm^2 have been added;

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

   For legacy systems where the 2 500 mm^2 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 mm^2 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 mm^2 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 mm²	Conductor size	Nominal cross-sectional area mm²	Conductor size	Nominal cross-sectional area mm²	Conductor size	Nominal cross-sectional area mm²
-	-	-	-	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 mm^2 to ~~2 500~~ 3 500 mm^2, 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*

Edition 4.0 2023-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Conductors of insulated cables

Ames des câbles isolés

IEC 60228:2023-12(en-fr)

CONTENTS

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IECEE OD-5014, *Instrument Accuracy Limits*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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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 mm^2 ont été ajoutées;

c) l'ancienne valeur de résistance de 2 500 mm^2 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 mm^2 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 mm^2 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 mm^2 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.

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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 mm^2 à 3 500 mm^2, 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*