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COMMENTED VERSION

Kraftkablar och installationskablar – Ledare

Conductors of insulated cables

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IEC 60228

Edition 4.0 2023-12
COMMENTED VERSION

INTERNATIONAL STANDARD



Conductors of insulated cables

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.060.20

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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.
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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 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*

Note 1 to entry: Each particular size of conductor in this document is required to meet a maximum resistance value.

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Kraftkablar och installationskablar – Ledare

Conductors of insulated cables

Som svensk standard gäller europastandarden EN IEC 60228:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60228:2024.

Nationellt förord

Europastandarden EN IEC 60228:2024

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60228, Fourth edition, 2023 - Conductors of insulated cables**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60228, utg 1:2005 med eventuella tillägg, ändringar och rättelser gäller ej fr o m 2027-06-12.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

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Tel 08-444 14 00
elstandard.se

English Version

Conductors of insulated cables
(IEC 60228:2023)

Ames des câbles isolés
(IEC 60228:2023)

Leiter für Kabel und isolierte Leitungen
(IEC 60228:2023)

This European Standard was approved by CENELEC on 2024-06-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 20/2125/FDIS, future edition 4 of IEC 60228, prepared by IEC/TC 20 "Electric cables" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60228:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2025-03-12 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2027-06-12 document have to be withdrawn

This document supersedes EN 60228:2005 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60228:2023 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IECEE OD-5014	-	IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE System), Committee of Testing Laboratories (CTL), Instrument Accuracy Limits	-	-

Annex ZB
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e. g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard or Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause Special national condition

Table 3 Cyprus, Ireland, United Kingdom

Add:

1,25	0,21	15,6	16,1
------	------	------	------

NOTE This conductor is for cables which are intended for use on appliances fitted with 13 A plugs conforming to BS 1363-1 or I.S. 401

Table C.1 Cyprus, Ireland, United Kingdom

Add:

1,25	–	–	1,7
------	---	---	-----



IEC 60228

Edition 4.0 2023-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Conductors of insulated cables

Ames des câbles isolés

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

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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

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