

## **Kaablite sooned**

Conductors of insulated cables

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 60228:2005 sisaldab Euroopa standardi EN 60228:2005 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 27.04.2005 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 60228:2005 consists of the English text of the European standard EN 60228:2005.</p> <p>This document is endorsed on 27.04.2005 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p><b>Käsitlusala:</b> Specifies standardized nominal cross-section areas from 0,5 mm<sup>2</sup> to 2 000 mm<sup>2</sup>, numbers and diameters of wires and resistance values of conductors in electric cables and flexible cords. Classifies conductors for: 1.Cables for fixed installations -Class 1, solid conductors; -Class 2, stranded conductors. 2.Flexible copper conductors -Class 5, -Class 6 (more flexible than Class 5). Includes table of temperature correction factors <math>k_t</math> for conductor resistance to correct the measured resistance at <math>t</math> °C to 20°C. Does not apply to conductors for telecommunication purposes. Applies to conductors of special design only when stated in the specification for the type of cable. Conductors of special design are, for example. conductors for pressure cables, conductors in extra-flexible welding cables or in special types of flexible cables for having the cores twisted together with unusually short lays. This publication supersedes EN 60180 (1965). Note: -In this edition, the number of classes of conductors has been reduced from 6 to 4.</p>	<p><b>Scope:</b> Specifies standardized nominal cross-section areas from 0,5 mm<sup>2</sup> to 2 000 mm<sup>2</sup>, numbers and diameters of wires and resistance values of conductors in electric cables and flexible cords. Classifies conductors for: 1.Cables for fixed installations -Class 1, solid conductors; -Class 2, stranded conductors. 2.Flexible copper conductors -Class 5, -Class 6 (more flexible than Class 5). Includes table of temperature correction factors <math>k_t</math> for conductor resistance to correct the measured resistance at <math>t</math> °C to 20°C. Does not apply to conductors for telecommunication purposes. Applies to conductors of special design only when stated in the specification for the type of cable. Conductors of special design are, for example. conductors for pressure cables, conductors in extra-flexible welding cables or in special types of flexible cables for having the cores twisted together with unusually short lays. This publication supersedes EN 60180 (1965). Note: -In this edition, the number of classes of conductors has been reduced from 6 to 4.</p>
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ICS 29.060.20

**Võtmesõnad:**

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EUROPEAN STANDARD

**EN 60228**

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2005

ICS 29.060.20

Supersedes HD 383 S2:1986 + A1:1989 + A2:1993  
Incorporates Corrigendum May 2005

English version

**Conductors of insulated cables**  
(IEC 60228:2004)

Ames des câbles isolés  
(CEI 60228:2004)

Leiter für Kabel und isolierte Leitungen  
(IEC 60228:2004)

This European Standard was approved by CENELEC on 2004-12-07. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 20/718/FDIS, future edition 3 of IEC 60228, prepared by IEC TC 20, Electric cables, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60228 on 2004-12-07.

A draft amendment, prepared by the Technical Committee CENELEC TC 20, Electric cables, was submitted to the formal vote and was approved by CENELEC for inclusion into EN 60228 on 2004-12-07.

This European Standard supersedes HD 383 S2:1986 + A1:1989 + A2:1993.

The principal changes with respect to HD 383 S2 are

- addition of a definition for nominal cross-sectional area;
- an increase in the range of conductor sizes in Tables 1 and 2;
- addition of a note that solid aluminium alloy conductors, having the same dimensions as aluminium conductors, will have a higher resistance;
- strengthening of the recommendations for dimensional limits of compacted stranded copper conductors.

The following dates were fixed:

- |  |       |            |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2005-09-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2007-12-01 |

Annex ZA, Special national conditions, has been added by CENELEC.

The contents of the corrigendum of May 2005 have been included in this copy.

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### Endorsement notice

The text of the International Standard IEC 60228:2004 was approved by CENELEC as a European Standard without any modification.

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**Annex ZA**  
(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. If it affects harmonization, it forms part of the European Standard.

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
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# INTERNATIONAL STANDARD

**IEC**  
**60228**

Third edition  
2004-11

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## Conductors of insulated cables

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number  
IEC 60228:2004(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

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# INTERNATIONAL STANDARD

# IEC 60228

Third edition  
2004-11

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## Conductors of insulated cables

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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*For price, see current catalogue*

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

This third edition cancels and replaces the IEC 60228 (1978), its Amendment 1 (1993) and its first supplement, IEC 60228A (1982).

The principal changes with respect to the previous edition are as follows:

- a) the consolidation of material from IEC 60228A;
- b) addition of a definition for nominal cross-sectional area;
- c) an increase in the range of conductor sizes in Tables 1 and 2;
- d) addition of a note that solid aluminum alloy conductors, having the same dimensions as aluminum conductors, will have a higher resistance;
- e) strengthening of the recommendations for dimensional limits of compacted stranded copper conductors.

The text of this standard is based on the following documents:

FDIS	Report on voting
20/718/FDIS	20/737/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

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.

AWG				kcmil			
Conductor size	Nominal cross-sectional area mm <sup>2</sup>	Conductor size	Nominal cross-sectional area mm <sup>2</sup>	Conductor size	Nominal cross-sectional area mm <sup>2</sup>	Conductor size	Nominal cross-sectional area mm <sup>2</sup>
-	-	-	-	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	-	-

## INTRODUCTION

IEC 60228 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 and either include the applicable details in their cable specifications or make appropriate references to this standard.

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.

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## CONDUCTORS OF INSULATED CABLES

### 1 Scope

This International Standard specifies the nominal cross-sectional areas, in the range 0,5 mm<sup>2</sup> to 2 500 mm<sup>2</sup>, 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 and stranded copper, aluminium and aluminium alloy conductors in cables for fixed installations and flexible copper conductors.

The standard does not apply to conductors for telecommunication purposes.

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

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

Informative annexes are included giving supplementary information covering temperature correction factors for resistance measurement (Annex B) and dimensional limits of circular conductors (Annex C).

### 2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 2.1

##### **metal-coated**

coated with a thin layer of suitable metal, such as tin or tin alloy

#### 2.2

##### **nominal cross-sectional area**

value that identifies a particular size of conductor but is not subject to direct measurement

NOTE Each particular size of conductor in this standard is required to meet a maximum resistance value.

### 3 Classification

The conductors have been divided into four classes, 1, 2, 5 and 6. Those in classes 1 and 2 are intended for use in cables for fixed installations. Classes 5 and 6 are intended for use in flexible cables and cords but may also be used for fixed installations.

- Class 1: solid conductors.
- Class 2: stranded conductors.
- Class 5: flexible conductors.
- Class 6: flexible conductors which are more flexible than class 5.