IEC 60245-1

Edition 5.0 2026-03

INTERNATIONAL STANDARD

REDLINE VERSION

Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 1: General requirements

ICS 29.060.20; 25.160.20

ISBN 978-2-8327-1153-8

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2026 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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

CONTENTS

FOREWORD 3
~~1 General ..... 5~~
1 Scope 5
2 Normative references 5
3 Terms and definitions 5
~~2.1 Definitions relating to insulating and sheathing materials ..... 5~~
~~2.2 Definitions relating to the tests ..... 5~~
4 Marking 8
4.1 Indication of origin and cable identification 8
4.1.1 General 8
4.1.2 Continuity of marks 8
4.2 Durability 8
4.3 Legibility 8
5 Core identification 9
5.1 General 9
5.2 Core identification by colours 9
5.2.1 General requirements 9
5.2.2 Colour scheme 9
5.2.3 Colour combination green-and-yellow 10
5.3 Core identification by numbers 10
5.3.1 General requirements 10
5.3.2 ~~Preferred arrangement of~~ Requirements for marking arrangements 10
5.3.3 Durability 10
6 General requirements for the construction of cables 11
6.1 Conductors 11
6.1.1 Material 11
6.1.2 Construction 11
6.1.3 Separator between conductor and insulation 11
6.1.4 ~~Construction verification~~ Check on construction 11
6.1.5 Electrical resistance 11
6.2 Insulation 11
6.2.1 Material 11
6.2.2 Application to the conductor 12
6.2.3 Thickness 12
6.2.4 Mechanical properties before and after ageing 12
6.3 Filler 15
6.3.1 Material 15
6.3.2 Application 16
6.4 Textile braid 16
6.4.1 Material 16
6.4.2 Application 16
6.5 Sheath 16
6.5.1 Material 16
6.5.2 Application 16
6.5.3 Thickness 20
6.5.4 Mechanical properties before and after ageing 20

6.6 Tests on completed cables 20
6.6.1 Electrical properties 20
6.6.2 Overall dimensions 20
6.6.3 Mechanical strength of flexible cables 21
7 Guidance on use of the cables 25
Annex A (normative) Code designation 26
Annex B (normative) Calculation method for determination of the thickness of sheath of cable types 60245 IEC 53, 60245 IEC 57 and 60245 IEC 66 of IEC 60245-4 28
B.1 General 28
B.2 Formulae for the calculation 28
B.3 Rounding off of numbers for the calculation of the thickness of sheath 29
~~Bibliography~~ .....

Figure 1 – Arrangement of marking by numbers 10

Table 1 – Requirements for non-electrical tests for cross-linked rubber insulation 13
Table 2 – Requirements for non-electrical tests for cross-linked rubber sheath 17
Table 3 – Requirements for electrical tests for cross-linked rubber insulated cables 21
Table 4 – Mass of weight and diameter of pulleys 23
Table 5 – Current loading 24
~~Table 5 – Requirements for the static flexibility test for lift cables .....~~
Table 6 – Requirements for the static flexibility test for arc-welding electrode cables 24
Table B.1 – Fictitious diameter per nominal cross-sectional area 29
Table B.2 – Assembly coefficient k for cables having no more than five cores 29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 1: General requirements

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 redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60245-1:2003+AMD1:2007 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60245-1 has been prepared by IEC technical committee TC 20: Electric cables. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2003, and Amendment 1:2007. This edition constitutes a technical revision.

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

a) reference to IEC 60245-2 for the tests has been deleted and replaced by IEC 63294;

b) reference to lift cable according to IEC 60245-5 has been deleted;

c) normative references have been updated.

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

Draft	Report on voting
20/2271/FDIS	20/2280/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 the parts in the IEC 60245 series, published under the general title *Rubber insulated cables - Rated voltages up to and including 450/750 V*, can be found on the IEC website.

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.

~~1 General~~

1 Scope

This part of IEC 60245 applies to rigid and flexible cables with insulation, and sheath if any, based on vulcanized rubber of rated voltages U_o/U up to and including 450/750 V used in power installations of nominal voltage not exceeding 450/750 V AC.

~~NOTE For some types of flexible cables the term 'cord' is used.~~

Particular types of cables are specified in IEC 60245-3, IEC 60245-4, IEC 60245-6, IEC 60245-7, IEC 60245-8. The code designations of these types of cables are provided in Annex A of this document.

The test methods specified in Part 1 to Part 8 of the IEC 60245 series are given in ~~IEC 60245-2, IEC 60332-1~~ IEC 63294 and in the relevant parts of IEC 60811.

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.

~~IEC 60173:1964, *Colours of the cores of flexible cables and cords*~~

IEC 60228~~:1978~~, *Conductors of insulated cables*

~~IEC 60245-2:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 2: Test methods*~~

IEC 60245-3~~:1994~~, *Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 3: Heat resistant silicone insulated cables*

IEC 60245-4~~:1994~~, *Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 4: Cords and flexible cables*

IEC 60245-6, *Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 6: Arc welding electrode cables*

IEC 60245-7~~:1994~~, *Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 7: Heat resistant ethylene-vinyl-acetate rubber insulated cables*

IEC 60245-8, *Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 8: Cords for applications requiring high flexibility*

~~IEC 60332-1:1993, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*~~

~~IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section 1: Measurement of thickness and overall dimensions – Tests for determining the mechanical properties*~~

~~IEC 60811-1-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Two: Thermal ageing methods*~~

~~IEC 60811-1-4:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section Four: Tests at low temperature*~~

~~IEC 60811-2-1:1998, *Insulating and sheathing materials of electric and optical cables – Common test methods – Part 2-1: Methods specific to elastomeric compounds – Ozone resistance, hot set andmineral oil immersion tests*~~

~~IEC 60811-3-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section One: Pressure test at high temperature – Tests for resistance to cracking*~~

IEC 60811-401, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven*

IEC 60811-403, *Electric and optical fibre cables - Test methods for non-metallic materials - Miscellaneous tests - Ozone resistance test on cross-linked compounds*

IEC 60811-404, *Electric and optical fibre cables - Test methods for non-metallic materials - Miscellaneous tests - Mineral oil immersion tests for sheaths*

IEC 60811-412, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 412: Miscellaneous tests - Thermal ageing methods - Ageing in an air bomb*

IEC 60811-501, *Electric and optical fibre cables - Test methods for non-metallic materials - Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds*

IEC 60811-504, *Electric and optical fibre cables - Test methods for non-metallic materials - Mechanical tests - Bending tests at low temperature for insulation and sheaths*

IEC 60811-505, *Electric and optical fibre cables - Test methods for non-metallic materials - Mechanical tests - Elongation at low temperature for insulations and sheaths*

IEC 60811-507, *Electric and optical fibre cables - Test methods for non-metallic materials - Mechanical tests - Hot set test for cross-linked materials*

IEC 60811-508, *Electric and optical fibre cables - Test methods for non-metallic materials - Mechanical tests - Pressure test at high temperature for insulation and sheaths*

IEC 62440, *Electric cables - Guide to use for cables with a rated voltage not exceeding 450/750V*[~~1~~]

IEC 63294:2021, *Test methods for electric cables with rated voltage up to and including 450/750 V*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/

[~~1~~] ~~In preparation.~~

– ISO Online browsing platform: available at https://www.iso.org/obp

~~**2.1 Definitions relating to insulating and sheathing materials**~~

3.1
type of compound
category in which a compound is placed according to its properties, as determined by specific tests

Note 1 to entry: The type designation is not directly related to the composition of the compound.

3.2
rubber compound
combination of materials suitably selected, proportioned, treated and vulcanized, of which the characteristic constituent is a rubber or synthetic elastomer, or both

Note 1 to entry: Vulcanization is defined as a post-application treatment taking place after the insulation or sheath, or both has been applied in order to induce permanent cross-linking of the elastomer.

3.3
polychloroprene compound
~~**(PCP) or other equivalent synthetic elastomer**~~
~~vulcanized~~ cross-linked compound in which the elastomer is the polychloroprene or other equivalent synthetic elastomer providing a compound with properties similar to PCP

3.4
ethylene-vinyl acetate rubber compound
~~**(EVA) or other equivalent synthetic elastomer**~~
cross-linked compound in which the elastomer is ethylene-vinyl acetate or other equivalent synthetic elastomer providing a compound with properties similar to EVA

3.5
ethylene-propylene rubber compound
~~**(EPR) or equivalent synthetic elastomer**~~
cross-linked compound in which the elastomer is ethylene-propylene or equivalent synthetic elastomer providing a compound with properties similar to EPR

~~**2.1.6**~~
~~**cross-linked polyvinyl chloride (XLPVC)**~~
~~combinations of materials of which polyvinyl chloride is the characteristic constituent, including adequate cross-linking agents, suitably selected, proportioned and treated which, when cross-linked, meet the requirements given in the particular specification~~

~~**2.2 Definitions relating to the tests**~~

~~**2.2.1**~~
~~**type tests**~~
~~***T***~~
~~tests required to be made before supplying a type of cable covered by this standard on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application~~

~~NOTE These tests are of such a nature that, after they have been made, they need not be repeated, unless changes have been made in the cable materials or design which might change the performance characteristics.~~

~~**2.2.2**~~
~~**sample tests**~~
~~***S***~~
~~tests made on samples of completed cable, or components taken from a completed cable, adequate to verify that the finished product meets the design specifications~~

3.6
rated voltage
reference voltage for which the cable is designed, and which serves to define the electrical tests

Note 1 to entry: The rated voltage is expressed by the combination of two values U_o/U expressed in volts:

U_o being the RMS value between any insulated conductor and "earth" (metal covering of the cable or the surrounding medium)

U being the RMS value between any two phase conductors of a multicore cable or of a system of single-core cables

In an alternating-current system, the rated voltage of a cable is at least equal to the nominal voltage of the system for which it is intended.

This condition applies both to the value U_o and to the value U.

In a direct current system, the nominal voltage of the system is not higher than 1,5 times the rated voltage AC value of ~~the cable~~ U_o.

Note 2 to entry: The operating voltage of a system ~~may~~ can permanently exceed the nominal voltage of such a system by 10 %. A cable can be used at a 10 % higher operating voltage than its rated voltage if the latter is at least equal to the nominal voltage of the system.

4 Marking

4.1 Indication of origin and cable identification

4.1.1 General

Cables shall be provided with an indication of the manufacturer, which shall be either an identification thread or a repetitive marking of the manufacturer's name or trademark.

Cables for use at a conductor temperature exceeding 70 °C shall also be marked either with the code designation according to Annex A or with the maximum conductor temperature.

Marking ~~may~~ can be by printing or by reproduction in relief on, or in, the insulation or sheath, or by printing on a proofed tape or a separate marker tape.

4.1.2 Continuity of marks

Each specified mark shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed

– 550 mm if the marking is on the outer sheath of the cable,
– 275 mm if the marking is
  - on the insulation of an unsheathed cable,
  - on the insulation of a sheathed cable,
  - on a tape within a sheathed cable.

4.2 Durability

Printed markings shall be durable. Compliance with this requirement shall be checked by the test given in ~~1.8 of IEC 60245-2~~ IEC 63294:2021, 6.1.

4.3 Legibility

All markings shall be legible.

The colours of the identification threads shall be easy to recognize or easily made recognizable, if necessary, by cleaning with petrol or other suitable solvent.