

# INTERNATIONAL STANDARD

# IEC 60227-1

Edition 2.2  
1998-03

Edition 2:1993 consolidated with amendments 1:1995 and 2:1997

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## Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V –

### Part 1: General requirements

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*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.*



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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### POLYVINYL CHLORIDE INSULATED CABLES OF RATED VOLTAGES UP TO AND INCLUDING 450/750 V

#### Part 1: General requirements

#### FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60227-1 has been prepared by subcommittee 20B: Low-voltage cables, of IEC technical committee 20: Electric cables.

This consolidated version of IEC 60227-1 consists of the second edition (1993) [documents 20(CO)115 and 20B(CO)124], its amendment 1 (1995) [documents 20B/184/FDIS and 20B/197/RVD] and amendment 2 (1997) [documents 20B/254/FDIS and 20B/262/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 2.2.

A vertical line shows where the base publication has been modified by amendments 1 and 2.

IEC 60227 consists of the following parts, under the general title: Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V:

Part 1: General requirements

Part 2: Test methods

Part 3: Non-sheathed cables for fixed wiring

Part 4: Sheathed cables for fixed wiring

Part 5: Flexible cables (cords)

Part 6: Lift cables and cables for flexible connections.

Part 3, Part 4, etc. are for particular types of cable and should be read in conjunction with Part 1 and Part 2. Further parts may be added as other types are standardized.

Annex A forms an integral part of this International Standard.

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# POLYVINYL CHLORIDE INSULATED CABLES OF RATED VOLTAGES UP TO AND INCLUDING 450/750 V

## Part 1: General requirements

### 1 General

#### 1.1 Scope

This part of International Standard IEC 60227 applies to rigid and flexible cables with insulation, and sheath if any, based on polyvinyl chloride, of rated voltages  $U_0/U$  up to and including 450/750 V used in power installations of nominal voltage not exceeding 450/750 V a.c.

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

The particular types of cables are specified in IEC 60227-3, IEC 60227-4, etc. The code designations of these types of cables are given in annex A.

The test methods specified in Parts 1, 3, 4, etc. are given in IEC 60227-2, IEC 60332-1 and in the relevant parts of IEC 60811.

#### 1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60227. At the time of publication, the editions indicated were valid. All normative documents are subject to revision and parties to agreements based on this part of IEC 60227 are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

IEC 60227-2:1979, *Polyvinyl chloride insulated cables of rated voltage up to and including 450/750 V – Part 2: Test methods*

IEC 60227-3:1979, *Polyvinyl chloride insulated cables of rated voltage up to and including 450/750 V – Part 3: Non-sheathed cables for fixed wiring*

IEC 60227-4:1979, *Polyvinyl chloride insulated cables of rated voltage up to and including 450/750 V – Part 4: Sheathed cables for fixed wiring*

IEC 60228:1978, *Conductors of insulated cables*

IEC 60332-1:1979, *Tests on electric cables under fire conditions – Part 1: Test on a single vertical insulated wire or cable*

IEC 60811-1-1:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section One: Measuring of thickness and overall dimensions – Tests for determining the mechanical properties*  
Amendment 1 (1988). Amendment 2 (1989)

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*  
Amendment 1 (1989)

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 60811-3-1:1985, *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 60811-3-2:1985, *Common test methods for insulating and sheathing materials of electric cables – Part 3: Methods specific to PVC compounds – Section Two: Loss of mass test – Thermal stability tests*

## 2 Definitions

For the purpose of this standard the following definitions shall apply.

### 2.1 Definitions relating to insulating and sheathing materials

#### 2.1.1 Polyvinyl chloride compound (PVC)

Combination of materials suitably selected, proportioned and treated, of which the characteristic constituent is the elastomer polyvinyl chloride or one of its copolymers. The same term also designates compounds containing both polyvinyl chloride and certain of its polymers.

#### 2.1.2 Type of compound

The category in which a compound is placed according to its properties, as determined by specific tests. The type designation is not directly related to the composition of the compound.

### 2.2 Definitions relating to the tests

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



### 2.2.2 Sample tests (symbol 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.

### 2.3 Rated voltage

The rated voltage of a cable is the reference voltage for which the cable is designed and which serves to define the electrical tests.

The rated voltage is expressed by the combination of two values  $U_0/U$ , expressed in volts:

$U_0$  being the r.m.s. value between any insulated conductor and "earth" (metal covering of the cable or the surrounding medium);

$U$  being the r.m.s. 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 shall be at least equal to the nominal voltage of the system for which it is intended.

This condition applies both to the value  $U_0$  and to the value  $U$ .

In a direct current system, the nominal voltage of the system shall be not higher than 1,5 times the rated voltage of the cable.

NOTE – The operating voltage of a system may 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.

## 3 Marking

### 3.1 Indication of origin and cable identification

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 trade-mark.

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

Marking may be by printing or by reproduction in relief on or in the insulation or sheath.

#### 3.1.1 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
  - a) on the insulation of an unsheathed cable;
  - b) on the insulation of a sheathed cable;
  - c) on a tape within a sheathed cable.

### 3.2 Durability

Printed markings shall be durable. Compliance with this requirement shall be checked by the test given in 1.8 of IEC 60227-2.

### 3.3 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.

## 4 Core identification

Each core shall be identified as follows:

- in cables having up to and including five cores by colour, see 4.1;
- in cables having more than five cores by number, see 4.2.

NOTE – The colour scheme, and in particular the scheme for rigid multicore cables, is under consideration.

### 4.1 Core identification by colours

#### 4.1.1 General requirements

Identification of the cores of a cable shall be achieved by the use of coloured insulation or other suitable method.

Each core of a cable shall have only one colour, except the core identified by a combination of the colours green-and-yellow.

The colours red, grey, white and, when not in combination, green and yellow, shall not be used for any multicore cable.

#### 4.1.2 Colour scheme

The preferred colour scheme for flexible cables and single-core cables is:

- single-core cable: no preferred colour scheme;
- two-core cable: no preferred colour scheme;

NOTE – It is not necessary to identify the cores of non-sheathed flat two-core cords.

- three-core cable: either green-and-yellow, light blue, brown, or light blue, black, brown;
- four-core cable: either green-and-yellow, light blue, black, brown, or light blue, black, brown, black or brown;
- five-core cable: either green-and-yellow, light blue, black, brown, black or brown, or light blue, black, brown, black or brown, black or brown.

The colours shall be clearly identifiable and durable. Durability shall be checked by the test given in 1.8 of IEC 60227-2.