

INTERNATIONAL STANDARD

IEC 60227-3

Edition 2.1
1997-11

Edition 2:1993 consolidated with amendment 1:1997

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

**Part 3:
Non-sheathed cables for fixed wiring**

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IEC 60227-3:1993

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Reference number
IEC 60227-3:1993+A1:1997(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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CONTENTS

| | Page |
|--|------|
| FOREWORD | 5 |
| Clause | |
| 1 General..... | 7 |
| 2 Single-core non-sheathed cable with rigid conductor for general purposes | 9 |
| 3 Single-core non-sheathed cable with flexible conductor for general purposes..... | 13 |
| 4 Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 70 °C..... | 19 |
| 5 Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 70 °C..... | 23 |
| 6 Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 90 °C..... | 27 |
| 7 Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 90 °C..... | 31 |

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**POLYVINYL CHLORIDE INSULATED CABLES
OF RATED VOLTAGES UP TO AND
INCLUDING 450/750 V –****Part 3: Non-sheathed cables for fixed wiring**

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

This consolidated version of IEC 60227-3 consists of the second edition (1993) [documents 20B(CO)115 and 20B(CO)124] and its amendment 1 (1997) [documents 20B/226/FDIS and 20B/250/RVD].

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

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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 7: Flexible cables screened and unscreened with two or more conductors.

This part, in conjunction with parts 1 and 2, forms the complete standard for non-sheathed cables for fixed wiring.

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

Part 3: Non-sheathed cables for fixed wiring

1 General

1.1 Scope

This part of IEC 60227 details the particular specifications for polyvinyl chloride insulated single-core non-sheathed cables for fixed wiring of rated voltages up to and including 450/750 V.

All cables shall comply with the appropriate requirements given in IEC 60227-1 and the individual types of cables shall each comply with the particular requirements of this part.

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 60227-1:1993, *Polyvinyl chloride insulated cables of rated voltage up to and including 450/750 V – Part 1: General requirements**

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

IEC 60228:1978, *Conductors of insulated cables*
First supplement 60228A (1982), amendment 1 (1993)

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

IEC 60811-1-1:1993, *Common test methods for insulating and sheathing materials of electric cables – Part 1: Methods for general application – Section One: Measurement 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*

* Revised edition to be published.

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 Single-core non-sheathed cable with rigid conductor for general purposes

2.1 Code designation

60227 IEC 01.

2.2 Rated voltage

450/750 V.

2.3 Construction

2.3.1 Conductor

Number of conductors: 1.

The conductors shall comply with the requirements of IEC 60228:

- class 1 for solid conductors;
- class 2 for stranded conductors.

2.3.2 Insulation

The insulation shall be polyvinyl chloride compound of Type PVC/C applied around the conductor.

The insulation thickness shall comply with the specified value given in column 3 of table 1.

The insulation resistance shall be not less than the values given in column 5 of table 1.

2.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 4 of table 1.

Table 1 – General data for type 60227 IEC 01

| 1 | 2 | 3 | 4 | 5 | 6 |
|--|---------------------------------|--|-----------------------|-------------------|---|
| Nominal cross-sectional area of conductor mm ² | Class of conductor IEC 60228 | Thickness of insulation Specified value mm | Mean overall diameter | | Minimum insulation resistance at 70 °C MΩ·km |
| | | | Lower limit mm | Upper limit mm | |
| 1,5 | 1 | 0,7 | 2,6 | 3,2 | 0,011 |
| 1,5 | 2 | 0,7 | 2,7 | 3,3 | 0,010 |
| 2,5 | 1 | 0,8 | 3,2 | 3,9 | 0,010 |
| 2,5 | 2 | 0,8 | 3,3 | 4,0 | 0,009 |
| 4 | 1 | 0,8 | 3,6 | 4,4 | 0,0085 |
| 4 | 2 | 0,8 | 3,8 | 4,6 | 0,0077 |
| 6 | 1 | 0,8 | 4,1 | 5,0 | 0,0070 |
| 6 | 2 | 0,8 | 4,3 | 5,2 | 0,0065 |
| 10 | 1 | 1,0 | 5,3 | 6,4 | 0,0070 |
| 10 | 2 | 1,0 | 5,6 | 6,7 | 0,0065 |
| 16 | 2 | 1,0 | 6,4 | 7,8 | 0,0050 |
| 25 | 2 | 1,2 | 8,1 | 9,7 | 0,0050 |
| 35 | 2 | 1,2 | 9,0 | 10,9 | 0,0043 |
| 50 | 2 | 1,4 | 10,6 | 12,8 | 0,0043 |
| 70 | 2 | 1,4 | 12,1 | 14,6 | 0,0035 |
| 95 | 2 | 1,6 | 14,1 | 17,1 | 0,0035 |
| 120 | 2 | 1,6 | 15,6 | 18,8 | 0,0032 |
| 150 | 2 | 1,8 | 17,3 | 20,9 | 0,0032 |
| 185 | 2 | 2,0 | 19,3 | 23,3 | 0,0032 |
| 240 | 2 | 2,2 | 22,0 | 26,6 | 0,0032 |
| 300 | 2 | 2,4 | 24,5 | 29,6 | 0,0030 |
| 400 | 2 | 2,6 | 27,5 | 33,2 | 0,0028 |

2.4 Tests

Compliance with the requirements of 2.3 above shall be checked by inspection and by the tests given in table 2.

2.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE – Other guidelines are under consideration.

Table 2 – Tests for type 60227 IEC 01

| 1 | 2 | 3 | 4 | |
|----------|---|------------------|------------------------------|-----------------------------|
| Ref. No. | Test | Category of test | Test method described in IEC | Subclause |
| 1 | <i>Electric test</i> | | | |
| 1.1 | Resistance of conductors | T, S | 60227-2 | 2.1 |
| 1.2 | Voltage test at 2 500 V | T, S | 60227-2 | 2.2 |
| 1.3 | Insulation resistance at 70 °C | T | 60227-2 | 2.4 |
| 2 | <i>Provisions covering constructional and dimensional characteristics</i> | | 60227-1 and 60227-2 | |
| 2.1 | Checking of compliance with constructional provisions | T, S | 60227-1 | Inspection and manual tests |
| 2.2 | Measurement of insulation thickness | T, S | 60227-2 | 1.9 |
| 2.3 | Measurement of overall diameter | T, S | 60227-2 | 1.11 |
| 3 | <i>Mechanical properties of insulation</i> | | | |
| 3.1 | Tensile test before ageing | T | 60811-1-1 | 9.1 |
| 3.2 | Tensile test after ageing | T | 60811-1-2 | 8.1.3.1 |
| 3.3 | Loss of mass test | T | 60811-3-2 | 8.1 |
| 4 | <i>Pressure test at high temperature</i> | T | 60811-3-1 | 8.1 |
| 5 | <i>Elasticity and impact strength at low temperature</i> | | | |
| 5.1 | Bending test for insulation | T | 60811-1-4 | 8.1 |
| 5.2 | Elongation test for insulation ¹⁾ | T | 60811-1-4 | 8.3 |
| 5.3 | Impact test for insulation | T | 60811-1-4 | 8.5 |
| 6 | <i>Heat shock test</i> | T | 60811-3-1 | 9.1 |
| 7 | <i>Test of flame retardance</i> | T | 60332-1 | |

¹⁾ Only applicable if the overall diameter of the cable exceeds the limits specified in the test method.

3 Single-core non-sheathed cable with flexible conductor for general purposes

3.1 Code designation

60227 IEC 02.

3.2 Rated voltage

450/750 V.

3.3 Construction

3.3.1 Conductor

Number of conductors: 1.

The conductors shall comply with the requirements given in IEC 60228 for class 5 conductors.

3.3.2 Insulation

The insulation shall be polyvinyl chloride compounds of type PVC/C, applied around the conductor.

The insulation thickness shall comply with the specified value given in column 2 of table 3.

The insulation resistance shall be not less than the value given in column 4 of table 3.

Table 3 – General data for type 60227 IEC 02

| 1 Nominal cross-sectional area of conductor mm ² | 2 Thickness of insulation Specified value mm | 3 Mean overall diameter | | 4 Minimum insulation resistance at 70 °C MΩ·km |
|---|---|----------------------------|-------------------|--|
| | | Lower limit mm | Upper limit mm | |
| 1,5 | 0,7 | 2,8 | 3,4 | 0,010 |
| 2,5 | 0,8 | 3,4 | 4,1 | 0,009 |
| 4 | 0,8 | 3,9 | 4,8 | 0,007 |
| 6 | 0,8 | 4,4 | 5,3 | 0,006 |
| 10 | 1,0 | 5,7 | 6,8 | 0,0056 |
| 16 | 1,0 | 6,7 | 8,1 | 0,0046 |
| 25 | 1,2 | 8,4 | 10,2 | 0,0044 |
| 35 | 1,2 | 9,7 | 11,7 | 0,0038 |
| 50 | 1,4 | 11,5 | 13,9 | 0,0037 |
| 70 | 1,4 | 13,2 | 16,0 | 0,0032 |
| 95 | 1,6 | 15,1 | 18,2 | 0,0032 |
| 120 | 1,6 | 16,7 | 20,2 | 0,0029 |
| 150 | 1,8 | 18,6 | 22,5 | 0,0029 |
| 185 | 2,0 | 20,6 | 24,9 | 0,0029 |
| 240 | 2,2 | 23,5 | 28,4 | 0,0028 |

3.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 3 of table 3.

3.4 Tests

Compliance with the requirements of 3.3 shall be checked by inspection and by the tests given in table 4.

3.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE – Other guidelines are under consideration.