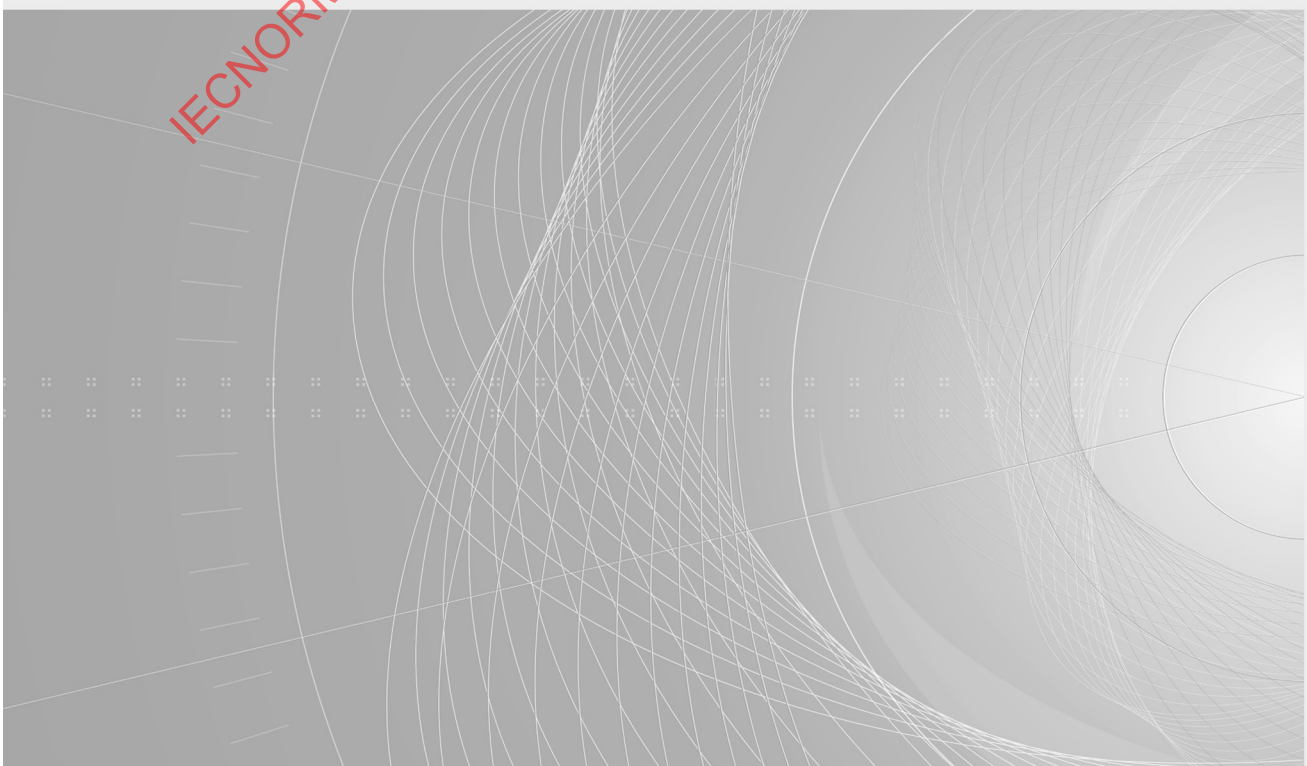
IEC 60227-4

Edition 3.0 2024-02

INTERNATIONAL STANDARD

Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V –
Part 4: Sheathed cables for fixed wiring



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Part 4: Sheathed cables for fixed wiring

FOREWORD

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IEC 60227-4 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

This third edition cancels and replaces the second edition published in 1992 and Amendment 1:1997. This edition constitutes a technical revision.

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

a) the reference to tests according to IEC 60227-2 has been withdrawn and replaced with a reference to IEC 63294;
b) normative references have been updated.

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

Draft	Report on voting
20/2142/FDIS	20/2155/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 parts in the IEC 60227 series, published under the general title *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*, can be found on the IEC website.

This document is to be used in conjunction with IEC 60227-1.

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- withdrawn, or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.

INTRODUCTION

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

IEC 60227-1: General requirements;

IEC 60227-2: Test methods (withdrawn and replaced by IEC 63294);

IEC 60227-3: Non-sheathed cables for fixed wiring;

IEC 60227-4: Sheathed cables for fixed wiring;

IEC 60227-5: Flexible cables (cords);

IEC 60227-6: Lift cables and cables for flexible connections;

IEC 60227-7: Flexible cables screened and unscreened with two or more conductors and of rated voltages up to and including 300/500 V.

This part of IEC 60227, when used in conjunction with IEC 60227-1, forms the complete standard for sheathed cables for fixed wiring.

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

Part 4: Sheathed cables for fixed wiring

1 Scope

This part of IEC 60227 details the particular specifications for light polyvinyl chloride sheathed cables of rated voltages of 300/500 V.

This document provides the particular requirements for sheathed cables for fixed wiring which apply in addition to the appropriate requirements specified in IEC 60227-1, which apply to all cables.

The tests for cables specified in the IEC 60227 series are described in IEC 63294.

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

IEC 60228, *Conductors of insulated cables*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

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 60811-409, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 409: Miscellaneous tests – Loss of mass test for thermoplastic insulations and sheaths*.

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: 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 – Part 504: 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 – Part 505: Mechanical tests – Elongation at low temperature for insulations and sheaths*

IEC 60811-506, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 506: Mechanical tests – Impact test at low temperature for insulations and sheaths*

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

IEC 60811-509, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 509: Mechanical tests – Test for resistance of insulations and sheaths to cracking (heat shock test)*

IEC 62440, *Electric cables with a rated voltage not exceeding 450/750 V – Guide to use*

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 terms and definitions given in IEC 60227-1 and the following apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
type test
test made before supplying a type of cable covered by this document on a general commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application

Note 1 to entry: Type tests are of such a nature that, after they have been made, it is not necessary for them to be repeated, unless changes are made in the cable materials or design which can change the performance characteristics.

Note 2 to entry: The symbol T is used to refer to type tests.

3.2
sample test
test made on samples of completed cable or components taken from a completed cable to verify that the finished product meets the design standards

Note 1 to entry: The symbol S is used to refer to sample tests.

4 Light polyvinyl chloride sheathed cable

4.1 Code designation

60227 IEC 10.

4.2 Rated voltage

300/500 V.

4.3 Construction

4.3.1 Conductors

Number of conductors: 2, 3, 4 or 5.

The conductors shall comply with the requirements of IEC 60228:

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

4.3.2 Insulation

The insulation shall be polyvinyl chloride compound of type PVC/C applied around each conductor.

The specified value of the insulation thickness is given in Table 1, column 3.

The insulation resistance shall be not less than the value given in Table 1, column 8.

4.3.3 Assembly of cores

The cores shall be twisted together.

4.3.4 Inner covering

The twisted cores shall be covered by an extruded inner covering consisting of an unvulcanized rubber or plastic compound.

It shall be possible to separate the cores easily.

4.3.5 Sheath

The sheath shall be polyvinyl chloride compound of type PVC/ST4 applied around the inner covering.

The sheath shall fit closely and it shall be possible to remove it without damage to the inner covering.

The specified value of the sheath thickness is given in Table 1, column 5.

4.3.6 Overall diameter

The mean overall diameter shall be within the limits given in Table 1, columns 6 and 7.

4.4 Tests

Compliance with the requirements of 4.3 shall be checked by inspection and by the sample tests and type tests given in Table 2.

4.5 Guidance on use

Maximum conductor temperature in normal use: 70 °C.

The use of the cable type 60227 IEC 10 shall comply with IEC 62440, which provides guidance on the safe use of electric cables with a rated voltage not exceeding 450/750 V.

Table 1 – General data for type 60227 IEC 10

1	2	3	4	5	6	7	8
Number and nominal cross-sectional area of conductors	Class of conductor according to IEC 60228	Insulation thickness specified value	Inner covering thickness approximate value	Sheath thickness specified value	Mean overall diameter		Minimum insulation resistance at 70 °C
					Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	mm	MΩ · km
2 × 1,5	1 2	0,7 0,7	0,4 0,4	1,2 1,2	7,6 7,8	10,0 10,5	0,011 0,010
2 × 2,5	1 2	0,8 0,8	0,4 0,4	1,2 1,2	8,6 9,0	11,5 12,0	0,010 0,009
2 × 4	1 2	0,8 0,8	0,4 0,4	1,2 1,2	9,6 10,0	12,5 13,0	0,008 05 0,007 07
2 × 6	1 2	0,8 0,8	0,4 0,4	1,2 1,2	10,5 11,0	13,5 14,0	0,007 00 0,006 05
2 × 10	1 2	1,0 1,0	0,6 0,6	1,4 1,4	13,0 13,5	16,5 17,5	0,007 00 0,006 05
2 × 16	2	1,0	0,6	1,4	15,5	20,0	0,005 02
2 × 25	2	1,2	0,8	1,4	18,5	24,0	0,005 00
2 × 35	2	1,2	1,0	1,6	21,0	27,5	0,004 04
3 × 1,5	1 2	0,7 0,7	0,4 0,4	1,2 1,2	8,0 8,2	10,5 11,0	0,011 0,010
3 × 2,5	1 2	0,8 0,8	0,4 0,4	1,2 1,2	9,2 9,4	12,0 12,5	0,010 0,009
3 × 4	1 2	0,8 0,8	0,4 0,4	1,2 1,2	10,0 10,5	13,0 13,5	0,008 05 0,007 07
3 × 6	1 2	0,8 0,8	0,4 0,4	1,4 1,4	11,5 12,0	14,5 15,5	0,007 00 0,006 05
3 × 10	1 2	1,0 1,0	0,6 0,6	1,4 1,4	14,0 14,5	17,5 19,0	0,007 00 0,006 05
3 × 16	2	1,0	0,8	1,4	16,5	21,5	0,005 02
3 × 25	2	1,2	0,8	1,6	20,5	26,0	0,005 00
3 × 35	2	1,2	1,0	1,6	22,0	29;0	0,004 04
4 × 1,5	1 2	0,7 0,7	0,4 0,4	1,2 1,2	8,6 9,0	11,5 12,0	0,011 0,010
4 × 2,5	1 2	0,8 0,8	0,4 0,4	1,2 1,2	10,0 10,0	13,0 13,5	0,010 0,009
4 × 4	1 2	0,8 0,8	0,4 0,4	1,4 1,4	11,5 12,0	14,5 15,0	0,008 05 0,007 07
4 × 6	1 2	0,8 0,8	0,6 0,6	1,4 1,4	12,5 13,0	16,0 17,0	0,007 00 0,006 05
4 × 10	1 2	1,0 1,0	0,6 0,6	1,4 1,4	15,5 16,0	19,0 20,5	0,007 00 0,006 05
4 × 16	2	1,0	0,8	1,4	18,0	23,5	0,005 02
4 × 25	2	1,2	1,0	1,6	22,5	28,5	0,005 00
4 × 35	2	1,2	1,0	1,6	24,5	32,0	0,004 04

1	2	3	4	5	6	7	8
Number and nominal cross-sectional area of conductors	Class of conductor according to IEC 60228	Insulation thickness specified value	Inner covering thickness approximate value	Sheath thickness specified value	Mean overall diameter		Minimum insulation resistance at 70 °C
					Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	mm	MΩ · km
5 × 1,5	1 2	0,7 0,7	0,4 0,4	1,2 1,2	9,4 9,8	12,0 12,5	0,011 0,010
5 × 2,5	1 2	0,8 0,8	0,4 0,4	1,2 1,2	11,0 11,0	14,0 14,5	0,010 0,009
5 × 4	1 2	0,8 0,8	0,6 0,6	1,4 1,4	12,5 13,0	16,0 17,0	0,008 05 0,007 07
5 × 6	1 2	0,8 0,8	0,6 0,6	1,4 1,4	13,5 14,5	17,5 18,5	0,007 00 0,006 05
5 × 10	1 2	1,0 1,0	0,6 0,6	1,4 1,4	17,0 17,5	21,0 22,0	0,007 00 0,006 05
5 × 16	2	1,0	0,8	1,6	20,5	26,0	0,005 02
5 × 25	2	1,2	1,0	1,6	24,5	31,5	0,005 00
5 × 35	2	1,2	1,2	1,6	27,0	35,0	0,004 04

Table 2 – Tests for type 60227 IEC 10

1	2	3	4
Ref. No.	Test	Category of test	Test method described in
1	Electrical tests		
1.1	Resistance of conductors	T, S	IEC 63294:2021, 5.1
1.2	Voltage test on core at 2 000 V	T,	IEC 63294:2021, 5.3
1.3	Voltage test on complete cable at 2 000 V	T, S	IEC 63294:2021, 5.2
1.4	Insulation resistance at 70 °C	T	IEC 63294:2021, 5.4
2	Provision covering constructional and dimensional characteristics		
2.1	Checking of compliance with constructional provisions	T, S	IEC 60227-1 Inspection and manual test
2.2	Measurement of insulation thickness	T, S	IEC 63294:2021, 6.2
2.3	Measurement of sheath thickness	T, S	IEC 63294:2021, 6.3
2.4	Measurement of overall diameter		
2.4.1	Mean value	T, S	IEC 63294:2021, 6.4
3	Mechanical properties of insulation		
3.1	Tensile test before ageing	T	IEC 60811-501
3.2.	Tensile test after ageing	T	IEC 60811-401
3.3	Loss of mass test	T	IEC 60811-409
4	Mechanical properties of sheath		
4.1	Tensile test before ageing	T	IEC 60811-501
4.2	Tensile test after ageing	T	IEC 60811-401
4.3	Loss of mass test	T	IEC 60811-409
5	Test of non-contamination	T	IEC 60811-401