

PAKISTAN STANDARD

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

Part-5: Flexible cables (cords)



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

Part-5: Flexible cables (cords)

0. FOREWORD

- 0.1 This Pakistan Standard was adopted by the authority of the Board of Directors of Pakistan Standard and Quality Control Authority after the draft prepared by the Technical Committee for “**Electric Cables**” (TC-7)” had been approved and endorsed by the National Standards Committee on 27 June 2007.
- 0.2 This Pakistan Standard was adopted on the basis of IEC: 60227-5 since IEC Standard have been established in 2011, hence it is deemed necessary to adopt the International standard to keep abreast with the latest technology and as par with IEC standard.
- 0.3 This Pakistan Standard is an adoption of IEC: 60227-5-2007 Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V Part-5 Flexible cables (cords),” and its use hereby acknowledged with thanks.
- 0.4 This standard is subject to periodical review in order to keep pace with the development in industry. Any suggestions for improvement shall be recorded and placed before the revising committee in due course.
- 0.5 This standard is intended chiefly to cover the technical provisions relating to this standard and it does not include all the necessary provisions of a Contract.

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

Part 5: Flexible cables (cords)

1 General

1.1 Scope

This part of IEC 60227 details the particular specifications for polyvinyl chloride insulated flexible cables (cords), of rated voltages up to and including 300/500 V.

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

1.2 Normative references

The following referenced documents are indispensable for the application 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.

NOTE The IEC 60811 series is currently undergoing a revision, which will lead to a restructuring of its parts. A description of this, as well as a cross-reference table between the current and planned parts will be given in IEC 60811-100.

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60227-2:1997, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*
Amendment 1 (2003)

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 60811-1-1:1993, *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*
Amendment 1 (2001)

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)
Amendment 2 (2000)

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*
Amendment 1 (1993)
Amendment 2 (2001)

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*

Amendment 1 (1994)

Amendment 2 (2001)

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 test*

Amendment 1 (1993)

Amendment 2 (2003)

2 Flat tinsel cord

2.1 Code designation

60227 IEC 41.

2.2 Rated voltage

300/300 V.

2.3 Construction

2.3.1 Conductor

Number of conductors: 2.

Each conductor shall comprise a number of strands or groups of strands, twisted together, each strand being composed of one or more flattened wires of copper or copper alloy, helically wound on a thread of cotton, polyamide or similar material.

The conductor resistance shall not exceed the value given in Table 1, column 5.

2.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in Table 1, column 1.

The insulation resistance shall be not less than the value given in Table 1, column 4.

2.3.3 Assembly of cores

The conductors shall be laid parallel and covered with the insulation.

The insulation shall be provided with a groove on both sides, between the conductors, to facilitate separation of the cores.

2.3.4 Overall dimensions

The mean overall dimensions shall be within the limits given in Table 1, columns 2 and 3.

2.4 Tests

Compliance with the requirements of 2.3 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 1 – General data for type 60227 IEC 41

1	2	3	4	5
Insulation thickness	Mean overall dimensions^a		Minimum insulation resistance at 70 °C	Maximum conductor resistance at 20 °C
Specified value mm	Lower limits mm	Upper limits mm	MΩ × km	Ω/km
0,8	2,2 × 4,4	3,5 × 7,0	0,019	270

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

Table 2 – Tests for type 60227 IEC 41

1	2	3	4	
Ref. No.	Test	Category of test	Test method described in:	
			IEC Standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test on completed cable at 2 000 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 60227-2	
2.1	Checking of compliance with constructional provisions	T, S	60227-1	Inspection and manual test
2.2	Measurement of insulation thickness	T, S	60227-2	1.9
2.3	Measurement of overall dimensions	T, S	60227-2	1.11
3	<i>Mechanical properties of insulation</i>			
3.1	Tensile test before and after ageing	T	60811-1-1 60811-1-2	9.1 8.1
3.2	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 at low temperature</i>			
5.1	Bending test for insulation at low temperature	T	60811-1-4	8.1
6	<i>Heat shock test</i>	T	60811-3-1	9.1
7	<i>Mechanical strength of completed cable</i>			
7.1	Bending test	T	60227-2	3.2
7.2	Snatch test	T	60227-2	3.3
8	<i>Test of flame retardance</i>	T	60332-1	

^a All documents cited in this table refer to the dated editions that are listed in the normative references clause.

3 (Vacant)

4 Cord for indoor decorative lighting chains

4.1 Code designation

60227 IEC 43.

4.2 Rated voltage

300/300 V.

4.3 Construction

4.3.1 Conductor

Number of conductors: 1.

The conductor shall comply with the requirements given in IEC 60228 for Class 6 conductors.

4.3.2 Insulation

The insulation shall be polyvinyl chloride of the type PVC/D, it shall consist of two layers and applied by dual extrusion around the conductor.

The outer layer of insulation shall be of a colour contrasting with that of the inner layer but shall adhere to the inner layer.

The combined thickness of the inner and outer layer of insulation shall comply with the overall thickness specified in Table 5, columns 3 and 4, but at no point the thickness of either layer shall be less than the value specified in column 2.

The insulation resistance at 70 °C shall be not less than the values given in Table 5, column 7.

4.3.3 Cord identification

Preferred colour of outer layer: green.

4.3.4 Overall diameter

The mean overall diameter shall be within the limits given in Table 5, columns 5 and 6.

4.4 Tests

4.4.1 General

Compliance with the requirements of 4.3 shall be checked by inspection and by the tests given in Table 6, and additionally by the test for long term resistance of insulation to d.c., as given in 4.4.2.

4.4.2 Long term resistance of insulation to d.c.

a) Test sample

Carry out the test on a sample of cable of 5 m length from which all coverings have been removed. The cores of flat unsheathed cords shall not be separated.

For cables having up to five cores, each core shall be tested. For multicore cables having more than five cores, one core of each colour in the cable shall be tested, and where the number of colours is less than 5, duplicate coloured cores shall be tested as necessary to bring the number of cores tested up to a minimum of 5.

Take care to avoid damage to the core(s) during removal of the coverings.

b) Procedure

Immerse the sample in an aqueous solution of sodium chloride having a concentration of 10 g/l and a temperature of $(60 \pm 5) ^\circ\text{C}$, with a length of about 250 mm at each end of the sample projecting above the solution. Connect the negative pole of a 220 V d.c. supply to the conductor(s) of the sample and the positive pole to a copper electrode immersed in the solution, for a period of 240 h.

c) Requirement

No breakdown of the insulation shall occur during the test and, after the test, the exterior of the insulation shall show no sign of damage.

Discoloration of the insulation should be ignored.

4.4.3 (Vacant)

4.5 Guide to use

Maximum conductor temperature in normal use: $70 ^\circ\text{C}$.

Table 3 – General data for type 60227 IEC 43

1	2	3	4	5	6	7
Nominal cross-sectional area of conductor	Thickness of each layer of insulation	Overall insulation thickness	Overall insulation thickness	Mean overall diameter^a		Minimum insulation resistance at $70 ^\circ\text{C}$
mm ²	Minimum value mm	Minimum value mm	Mean value mm	Lower limit mm	Upper limit mm	M Ω × km
0,5	0,2	0,6	0,7	2,3	2,7	0,014
0,75	0,2	0,6	0,7	2,4	2,9	0,012

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

Table 4 – Tests for type 60227 IEC 43

1	2	3	4	
Ref. No.	Tests	Category of test	Test method described in:	
			IEC Standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test on completed cable at 2 000 V	T, S	60227-2	2.3
1.3	Insulation resistance at 70 °C	T	60227-2	2.4
1.4	Long term resistance of insulation to d.c.	T	60227-5	4.4.2
2	<i>Constructional/dimensional characteristics</i>		60227-1 60227-2	
2.1	Compliance with constructional provisions	T, S	60227-1	Inspection and manual tests
			60227-5	4.3
2.2	Measurement of insulation thickness of inner layer (minimum thickness only)	T, S	60227-2	1.9
2.3	Measurement of insulation thickness of outer layer (minimum thickness only)	T, S	60227-2	1.9
2.4	Measurement of overall thickness ^b	T, S	60227-2	1.9
2.5	Measurement of overall diameter	T, S	60227-2	1.11
3	<i>Mechanical properties of insulation</i>			
3.1	Tensile test before ageing ^b	T	60811-1-1	9.1
3.2	Tensile test after ageing ^b	T	60811-1-2	8.1.3.1
3.3	Loss of mass test ^b	T	60811-3-2	8.1
4	<i>Pressure test at high temperature^b</i>	T	60811-3-1	8
5	<i>Elasticity at low temperature</i>			
5.1	Bend test for insulation ^b	T	60811-1-4	8.1
6	<i>Heat shock test^b</i>	T	60811-3-1	9.1
7	<i>Test of flame retardance</i>	T	60332-1	–

^a All documents cited in this table refer to the dated editions that are listed in the normative references clause.

^b Because of the simultaneous extrusion of the same compound for both layers of insulation, the composite layer shall be tested as one layer and evaluated accordingly.

5 Light polyvinyl chloride sheathed cord

5.1 Code designation

60227 IEC 52.

5.2 Rated voltage

300/300 V.

5.3 Construction

5.3.1 Conductor

Number of conductors: 2 and 3.

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

5.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in Table 5, column 2.

The insulation resistance shall be not less than the values given in Table 5, column 6.

5.3.3 Assembly of cores

Circular cord: the cores shall be twisted together.

Flat cord: the cores shall be laid parallel.

5.3.4 Sheath

The sheath shall be polyvinyl chloride compound of type PVC/ST 5 applied around the cores.

The sheath thickness shall comply with the specified value given in Table 5, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores. The assembly of cores may be surrounded by a separator, which shall not adhere to the cores.

The assembly of circular cord shall have a practically circular cross-section.

5.3.5 Overall dimensions

The mean overall diameter of circular cords and the mean overall dimensions of flat cords shall be within the limits given in Table 5, columns 4 and 5.

5.4 Tests

Compliance with the requirements of 5.3 shall be checked by inspection and by the tests given in Table 6.

5.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE Other guidelines are under consideration.

Table 5 – General data for type 60227 IEC 52

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors	Thickness of insulation	Thickness of sheath	Mean overall dimensions ^a		Minimum insulation resistance at 70 °C
mm ²	Specified value mm	Specified value mm	Lower limit mm	Upper limit mm	
2 × 0,5	0,5	0,6	4,6 or 3,0 × 4,9	5,9 or 3,7 × 5,9	0,012
2 × 0,75	0,5	0,6	4,9 or 3,2 × 5,2	6,3 or 3,8 × 6,3	0,010
3 × 0,5	0,5	0,6	4,9	6,3	0,012
3 × 0,75	0,5	0,6	5,2	6,7	0,010

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

Table 6 – Tests for type 60227 IEC 52

1	2	3	4	
Ref. No.	Test	Category of test	Test method described in	
			IEC Standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test on cores at 1 500 V	T, S	60227-2	2.3
1.3	Voltage test on completed cable at 2 000 V	T, S	60227-2	2.2
1.4	Insulation resistance at 70 °C	T	60227-2	2.4
2	<i>Provisions covering constructional and dimensional characteristics</i>		60227-1 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 sheath thickness	T, S	60227-2	1.10
2.4	Measurement of overall dimensions:			
2.4.1	– mean value	T, S	60227-2	1.11
2.4.2	– ovality	T, S	60227-2	1.11
3	<i>Mechanical properties of insulation</i>			
3.1	Tensile test before and after ageing	T	60811-1-2	9.1 8.1
3.2	Loss of mass test	T	60811-3-2	8.1
4	<i>Mechanical properties of sheath</i>			
4.1	Tensile test before and after ageing	T	60811-1-2	9.2 8.1
4.2	Loss of mass test	T	60811-3-2	8.2
5	<i>Pressure test at high temperature</i>			
5.1	Insulation	T	60811-3-1	8.1
5.2	Sheath	T	60811-3-1	8.2
6	<i>Elasticity and impact strength at low temperature</i>			

1	2	3	4	
Ref. No.	Test	Category of test	Test method described in	
			IEC Standard ^a	Subclause
6.1	Bending test for insulation at low temperature	T	60811-1-4	8.1
6.2	Bending test for sheath at low temperature	T	60811-1-4	8.2
6.3	Impact test on completed cable at low temperature	T	60811-1-4	8.5
7	<i>Heat shock test</i>			
7.1	Insulation	T	60811-3-1	9.1
7.2	Sheath	T	60811-3-1	9.2
8	<i>Mechanical strength of completed cable</i>			
8.1	Flexing test	T	60227-2	3.1
9	<i>Test of flame retardance</i>	T	60332-1	

^a All documents cited in this table refer to the dated editions that are listed in the normative references clause.

6 Ordinary polyvinyl chloride sheathed cord

6.1 Code designation

60227 IEC 53.

6.2 Rated voltage

300/500 V.

6.3 Construction

6.3.1 Conductor

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

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

6.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in Table 7, column 2.

The insulation resistance shall be not less than the value given in Table 7, column 6.

6.3.3 Assembly of cores and fillers, if any

Circular cord: the cores and the fillers, shall be twisted together.

Flat cord: the cores shall be laid parallel.

For circular cord having two cores, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices.

Any filler shall not adhere to the cores.

6.3.4 Sheath

The sheath shall be polyvinyl chloride compound of type PVC/ST 5 applied around the cores.

The sheath thickness shall comply with the specified value given in Table 7, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores. The assembly of cores may be surrounded by a separator, which shall not adhere to the cores.

The assembly of circular cords shall have a practically circular cross-section.

6.3.5 Overall dimensions

The mean overall diameter of circular cords and the mean overall dimensions of flat cords shall be within the limits given in Table 7, columns 4 and 5.

Table 7 – General data for type 60227 IEC 53

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors mm ²	Thickness of insulation Specified value mm	Thickness of sheath Specified value mm	Mean overall dimensions ^a		Minimum insulation resistance at 70 °C MΩ × km
			Lower limit mm	Upper limit mm	
2 × 0,75	0,6	0,8	5,7 or 3,7 × 6,0	7,2 or 4,5 × 7,2	0,011
2 × 1	0,6	0,8	5,9 or 3,9 × 6,2	7,5 or 4,7 × 7,5	0,010
2 × 1,5	0,7	0,8	6,8	8,6	0,010
2 × 2,5	0,8	1,0	8,4	10,6	0,009
2 × 4	0,8	1,1	9,7	12,1	0,007
3 × 0,75	0,6	0,8	6,0	7,6	0,011
3 × 1	0,6	0,8	6,3	8,0	0,010
3 × 1,5	0,7	0,9	7,4	9,4	0,010
3 × 2,5	0,8	1,1	9,2	11,4	0,009
3 × 4	0,8	1,1	10,3	12,8	0,007
4 × 0,75	0,6	0,8	6,6	8,3	0,011
4 × 1	0,6	0,9	7,1	9,0	0,010
4 × 1,5	0,7	1,0	8,4	10,5	0,010
4 × 2,5	0,8	1,1	10,1	12,5	0,009
4 × 4	0,8	1,2	11,5	14,3	0,007
5 × 0,75	0,6	0,9	7,4	9,3	0,011
5 × 1	0,6	0,9	7,8	9,8	0,010
5 × 1,5	0,7	1,1	9,3	11,6	0,010
5 × 2,5	0,8	1,2	11,2	13,9	0,009
5 × 4	0,8	1,3	12,8	15,9	0,007

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

6.4 Tests

Compliance with the requirements of 6.3 shall be checked by inspection and by the tests given in Table 8.

6.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE Other guidelines are under consideration.

Table 8 – Tests for type 60227 IEC 53

1 Ref. No.	2 Test	3 Category of test	4 Test method described in	
			IEC standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test on cores according to specified insulation thickness:	T, S	60227-2	2.3
1.2.1	– at 1 500 V up to and including 0,6 mm	T	60227-2	2.3
1.2.2	– at 2 000 V exceeding 0,6 m	T	60227-2	2.3
1.3	Voltage test on complete cable at 2 000 V	T	60227-2	2.2
1.4	Insulation resistance at 70 °C	T	60227-2	2.4
2	<i>Provisions covering constructional and dimensional characteristics</i>		60227-1 60227-2	
2.1	Checking of compliance with constructional provisions	T, S	60227-1 60227-2	Inspection and manual tests
2.2	Measurement of insulation thickness	T, S	60227-2	1.9
2.3	Measurement of overall dimensions	T, S	60227-2	1.10
2.4	Measurement of overall dimensions:			
2.4.1	– mean value	T, S	60227-2	1.11
2.4.2	– ovality	T, S	60227-2	1.11
3	<i>Mechanical properties of insulation</i>			
3.1	Tensile test before and after ageing	T	60811-1-2	9.1 8.1
3.2	Loss of mass test	T	60811-3-2	8.1
4	<i>Mechanical properties of sheath</i>			
4.1	Tensile test before and after ageing	T	60811-1-2	9.2 8.1
4.2	Loss of mass test	T	60811-3-2	8.2
5	<i>Test of non-contamination</i>	T	60811-1-2	8.1.4
6	<i>Pressure test at high temperature</i>			
6.1	Insulation	T	60811-3-1	8.1
6.2	Sheath	T	60811-3-1	8.2
7	<i>Elasticity and impact strength at low temperature</i>			
7.1	Bending test for insulation at low temperature	T	60811-1-4	8.1
7.2	Bending test for sheath at low temperature	T	60811-1-4	8.2
7.3	Impact test on completed cable at low temperature	T	60811-1-4	8.5
8	<i>Heat shock test</i>			

1	2	3	4	
Ref. No.	Test	Category of test	Test method described in	
			IEC standard ^a	Subclause
8.1	Insulation	T	60811-3-1	9.1
8.2	Sheath	T	60811-3-1	9.2
9	<i>Mechanical strength of completed cable</i>			
9.1	Flexing test	T	60227-2	3.1
10	<i>Test of flame retardance</i>	T	60332-1	

^a All documents cited in this table refer to the dated editions that are listed in the normative references clause.

7 Heat-resistant light PVC-sheathed cord for a maximum conductor temperature of 90 °C

7.1 Code designation

60227 IEC 56.

7.2 Rated voltage

300/300 V.

7.3 Construction

7.3.1 Conductor

Number of conductors: 2 and 3.

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

7.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in Table 9, column 2.

The insulation resistance shall be not less than the values given in Table 9, column 6.

7.3.3 Assembly of cores

Circular cord: the cores shall be twisted together.

Flat cord: the cores shall be laid parallel.

7.3.4 Sheath

The sheath shall be polyvinyl chloride compound of type PVC/ST10, applied around the cores.

The sheath thickness shall comply with the specified value given in Table 9, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores. The assembly of cores may be surrounded by a separator, which shall not adhere to the cores.

The assembly of circular cord shall have a practically circular cross-section.

7.3.5 Overall dimensions

The mean overall diameter of circular cords and the mean overall dimensions of flat cords shall be within the limits given in Table 9, columns 4 and 5.

7.4 Tests

Compliance with the requirements of 7.3 shall be checked by inspection and by the tests given in Table 10.

7.5 Guide to use

Maximum conductor temperature in normal use: 90 °C.

NOTE Other guidelines are under consideration.

Table 9 – General data for type 60227 IEC 56

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors mm ²	Insulation thickness Specified value mm	Sheath thickness Specified value mm	Mean overall dimensions ^a		Minimum insulation resistance at 90 °C MΩ × km
			Lower limits mm	Upper limits mm	
2 × 0,5	0,5	0,6	4,6 or 3,0 × 4,9	5,9 or 3,7 × 5,9	0,012
2 × 0,75	0,5	0,6	4,9 or 3,2 × 5,2	6,3 or 3,8 × 6,3	0,010
3 × 0,5	0,5	0,6	4,9	6,3	0,012
3 × 0,75	0,5	0,6	5,2	6,7	0,010

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

Table 10 – Tests for type 60227 IEC 56

1	2	3	4	5
Reference No.	Test	Category of test	Test methods described in	
			IEC standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T,S	60227-2	2.1
1.2	Voltage test on completed cable at 2 000 V	T,S	60227-2	2.2
1.3	Voltage test on cores at 1 500 V	T	60227-2	2.3
1.4	Insulation resistance at 90 °C	T	60227-2	2.4
2	<i>Provisions covering constructional and dimensional characteristics</i>			
2.1	Checking of compliance with constructional provisions	T,S	60227-1	Inspection and manual tests
2.2	Measurement of thickness of insulation	T,S	60227-2	1.9
2.3	Measurement of thickness of sheath	T,S	60227-2	1.10
2.4	Measurement of overall dimensions			
2.4.1	Mean value	T,S	60227-2	1.11
2.4.2	Ovality	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>Mechanical properties of sheath</i>			
1	Tensile test before ageing	T	60811-1-1	9.2
2	Tensile test after ageing	T	60811-1-2	8.1.3.1
3	Loss of mass test	T	60811-3-2	8.2
5	<i>Pressure test at high temperature</i>			
1	Insulation	T	60811-3-1	8.1
2	Sheath	T	60811-3-1	8.2
6	<i>Tests at low temperature</i>			
6.1	Bending test for insulation	T	60811-1-4	8.1
6.2	Bending test for sheath	T	60811-1-4	8.2
6.3	Impact test	T	60811-1-4	8.5
7	<i>Heat shock test</i>			
7.1	Insulation	T	60811-3-1	9.1
7.2	Sheath	T	60811-3-1	9.2
8	<i>Thermal stability</i>			
8.1	Insulation	T	60811-3-2	9
8.2	Sheath	T	60811-3-2	9
9	<i>Mechanical strength of complete cable</i>			
9.1	Flexing test	T	60227-2	3.1
10	<i>Test of flame retardance</i>	T	60332-1	–

^a All documents cited in this table refer to the dated editions that are listed in the normative references clause.

8 Heat-resistant ordinary PVC-sheathed cord for a maximum conductor temperature of 90 °C

8.1 Code designation

60227 IEC 57.

8.2 Rated voltage

300/500 V.

8.3 Construction

8.3.1 Conductor

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

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

8.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in Table 11, column 2.

The insulation resistance shall be not less than the value given in Table 11, column 6.

8.3.3 Assembly of cores and fillers, if any

Circular cord: the cores and the fillers, if any, shall be twisted together.

Flat cord: the cores shall be laid parallel.

For circular cord having two cores, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices.

Any filler shall not adhere to the cores.

8.3.4 Sheath

The sheath shall be polyvinyl chloride compound of type PVC/ST10 applied around the cores.

The sheath thickness shall comply with the specified value given in Table 11, column 3.

The sheath may fill the spaces between the cores, thus forming a filling, but it shall not adhere to the cores.

The assembly of cores may be surrounded by a separator, which shall not adhere to the cores.

The assembly of circular cords shall have a practically circular cross-section.

8.3.5 Overall dimensions

The mean overall diameter of circular cords and the mean overall dimensions of flat cords shall be within the limits given in Table 11, columns 4 and 5.

Table 11 – General data for type 60227 IEC 57

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors mm ²	Thickness of insulation Specified value mm	Thickness of sheath Specified value mm	Mean overall dimensions ^a		Minimum insulation resistance at 70 °C MΩ × km
			Lower limit mm	Upper limit mm	
2 × 0,75	0,6	0,8	5,7 or 3,7 × 6,0	7,2 or 4,5 × 7,2	0,011
2 × 1	0,6	0,8	5,9 or 3,9 × 6,2	7,5 or 4,7 × 7,5	0,010
2 × 1,5	0,7	0,8	6,8	8,6	0,010
2 × 2,5	0,8	1,0	8,4	10,6	0,009
2 × 4	0,8	1,1	9,7	12,1	0,007
3 × 0,75	0,6	0,8	6,0	7,6	0,011
3 × 1	0,6	0,8	6,3	8,0	0,010
3 × 1,5	0,7	0,9	7,4	9,4	0,010
3 × 2,5	0,8	1,1	9,2	11,4	0,009
3 × 4	0,8	1,1	10,3	12,8	0,007
4 × 0,75	0,6	0,8	6,6	8,3	0,011
4 × 1	0,6	0,9	7,1	9,0	0,010
4 × 1,5	0,7	1,0	8,4	10,5	0,010
4 × 2,5	0,8	1,1	10,1	12,5	0,009
4 × 4	0,8	1,2	11,5	14,3	0,007
5 × 0,75	0,6	0,9	7,4	9,3	0,011
5 × 1	0,6	0,9	7,8	9,8	0,010
5 × 1,5	0,7	1,1	9,3	11,6	0,010
5 × 2,5	0,8	1,2	11,2	13,9	0,009
5 × 4	0,8	1,3	12,8	15,9	0,007

^a The mean overall dimensions have been calculated in accordance with IEC 60719.

8.4 Tests

Compliance with the requirements of 8.3 shall be checked by inspection and by the tests given in Table 12.

8.5 Guide to use

Maximum conductor temperature in normal use: 90 °C.

NOTE Other guidelines are under consideration.

Table 12 – Tests for type 60227 IEC 57

1	2	3	4	5
Reference No.	Tests	Category of test	Test methods described in	
			IEC standard ^a	Subclause
1	<i>Electrical tests</i>			
1.1	Resistance of conductors	T,S	60227-2	2.1
1.2	Voltage test on completed cable at 2 000 V	T,S	60227-2	2.2
1.3	Voltage test on cores according to specified insulation thickness:			
1.3.1	– at 1 500 V up to and including 0,6 mm	T	60227-2	2.3
1.3.2	– at 2 000 V exceeding 0,6 mm	T	60227-2	2.3
1.4	Insulation resistance at 90 °C	T	60227-2	2.4
2	<i>Provisions covering constructional and dimensional characteristics</i>			
2.1	Checking of compliance with constructional provisions	T,S	60227-1	Inspection and manual tests
2.2	Measurement of thickness of insulation	T,S	60227-2	1.9
2.3	Measurement of thickness of sheath	T,S	60227-2	1.10
2.4	Measurement of overall dimensions			
2.4.1	– mean value	T,S	60227-2	1.11
2.4.2	– ovality	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
3.4	Compatibility test ^b	T	60811-1-2	8.1.4
4	<i>Mechanical properties of sheath</i>			
4.1	Tensile test before ageing	T	60811-1-1	9.2
4.2	Tensile test after ageing	T	60811-1-2	8.1.3.1
4.3	Loss of mass test	T	60811-3-2	8.2
5	<i>Pressure test at high temperature</i>			
5.1	Insulation	T	60811-3-1	8.1
5.2	Sheath	T	60811-3-1	8.2
6	<i>Tests at low temperature</i>			
6.1	Bending test for insulation	T	60811-1-4	8.1
6.2	Bending test for sheath ^c	T	60811-1-4	8.2
6.3	Elongation test for sheath ^d	T	60811-1-4	8.4
6.4	Impact test	T	60811-1-4	8.5
7	<i>Heat shock test</i>			
7.1	Insulation	T	60811-3-1	9.1
7.2	Sheath	T	60811-3-1	9.2
8	<i>Thermal stability</i>			
8.1	Insulation	T	60811-3-2	9
8.2	Sheath	T	60811-3-2	9

Table 12 (continued)

1	2	3	4	5
Reference No.	Tests	Category of test	Test methods described in	
			IEC standard ^a	Subclause
9 9.1	<i>Mechanical strength of complete cable</i> Flexing test	T	60227-2	3.1
10	<i>Test of flame retardance</i>	T	60332-1	–
^a All documents cited in this table refer to the dated editions that are listed in the normative references clause. ^b See 5.3.1 of IEC 60227-1. ^c Only applicable to cables having mean overall diameters up to and including 12,5 mm. ^d Only applicable if the mean overall diameter of the cable exceeds 12,5 mm.				

Bibliography

IEC 60719:1992, *Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V*
