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Saudi Standards, Metrology and Quality Org (SASO)

FINAL DRAFT

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IEC 60227-3:1997

الكابلات المعزولة بعديد كلوريد الفينيل لجهود مقننة حتى ٤٥٠/٧٥٠ فولت – الجزء ٣: الكابلات غير المغلفة للتمديدات الثابتة.

Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 3: Non-sheathed cables for fixed wiring

ICS: 29.060.20

Foreword

Saudi Standards, Metrology and Quality Organization (SASO) has adopted Standard No. (IEC 60227-3:1997) “Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 3: Non-sheathed cables for fixed wiring " issued by (IEC) in English. This standard has been approved as a Saudi Standard with national modifications.

This SASO IEC 60227-3:2020 standard is a modified adoption of International Standard IEC 60227-3:1997, (Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 3: Non-sheathed cables for fixed wiring). Standard has been varied as indicated to take account of Kingdom of Saudi Arabia conditions. The modifications are specified in Annex AA.

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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 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-sheahed 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
Amendement 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

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* 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 colum 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	**Class of conductor**	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 70 °C**
	IEC 60228	**Specified value**	**Lower limit**	**Upper limit**	
mm^2		mm	mm	mm	MΩ·km
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	*Electric test*			
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	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity and impact strength at low temperature*			
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	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	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	2	3	4	5
Nominal cross-sectional area of conductor	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 70 °C**
	Specified value	**Lower limit**	**Upper limit**	
mm^2	mm	mm	mm	MΩ·km
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.

Table 4 – Tests for type 60227 IEC 02

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test method described in IEC**	**Subclause**
1	*Electric test*			
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	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity at low temperature*			
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
6	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	T	60332-1	

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

4 Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 70 °C

4.1 Code designation

60227 IEC 05.

4.2 Rated voltage

300/500 V.

4.3 Construction

4.3.1 Conductor

Number of conductors: 1.

The conductors shall comply with the requirements given in IEC 60228 for class 1 conductors.

4.3.2 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 2 of table 5.

The insulation resistance shall be not less than the value given in column 4 of table 5.

4.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 3 of table 5.

Table 5 – General data for type 60227 IEC 05

1	2	3	4	5
Nominal cross-sectional area of conductor	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 70 °C**
	Specified value	**Lower limit**	**Upper limit**	
mm^2	mm	mm	mm	MΩ·km
0,5 0,75 1	0,6 0,6 0,6	1,9 2,1 2,2	2,3 2,5 2,7	0,015 0,012 0,011

4.4 Tests

Compliance with the requirements of 4.3 shall be checked by inspection and by the tests given in table 6.

4.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE – Other guidelines are under consideration.

Table 6 – Tests for type 60227 IEC 05

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test method described in**	
			IEC	**Subclause**
1	*Electric test*			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test at 2 000 V	T, S	60227-2	2.2
1.3	Insulation resistance at 70 °C	T	60227-2	2.4
2	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity at low temperature*			
5.1	Bending test for insulation	T	60811-1-4	8.1
6	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	T	60332-1	

5 Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 70 °C

5.1 Code designation

60227 IEC 06.

5.2 Rated voltage

300/500 V.

5.3 Construction

5.3.1 Conductor

Number of conductors: 1.

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

5.3.2 Insulation

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

The insulation thickness shall comply with the specified values given in column 2 of table 7.

The insulation resistance shall be not less than the value given in column 4 of table 7.

5.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 3 of table 7.

Table 7 – General data for type 60227 IEC 06

1	2	3	4	5
Nominal cross-sectional area of conductor	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 70 °C**
	Specified value	**Lower limit**	**Upper limit**	
mm^2	mm	mm	mm	MΩ·km
0,5 0,75 1	0,6 0,6 0,6	2,1 2,2 2,4	2,5 2,7 2,8	0,013 0,011 0,010

5.4 Tests

Compliance with the requirements of 5.3 shall be checked by inspection and by the tests given in table 8.

5.5 Guide to use

Maximum conductor temperature in normal use: 70 °C.

NOTE – Other guidelines are under consideration.

Table 8 – Tests for type 60227 IEC 06

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test method described in**	
			IEC	**Subclause**
1	*Electric test*			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test at 2 000 V	T, S	60227-2	2.2
1.3	Insulation resistance at 70 °C	T	60227-2	2.4
2	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity at low temperature*			
5.1	Bending test for insulation	T	60811-1-4	8.1
6	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	T	60332-1	

6 Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 90 °C

6.1 Code designation

60227 IEC 07.

6.2 Rated voltage

300/500 V.

6.3 Construction

6.3.1 Conductor

Number of conductors: 1.

The conductors shall comply with the requirements given in IEC 60228 for class 1 conductors.

6.3.2 Insulation

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

The insulation thickness shall comply with the specified value given in column 2 of table 9.

The insulation resistance shall be not less than the value given in column 4 of table 9.

6.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 3 of table 9.

Table 9 – General data for type 60227 IEC 07

1	2	3	4	5
Nominal cross-sectional area of conductor	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 90 °C**
	Specified value	**Lower limit**	**Upper limit**	
mm^2	mm	mm	mm	MΩ·km
0,5	0,6	1,9	2,3	0,015
0,75	0,6	2,1	2,5	0,013
1	0,6	2,2	2,7	0,012
1,5	0,7	2,6	3,2	0,011
2,5	0,8	3,2	3,9	0,009

6.4 Tests

Compliance with the requirements of 6.3 shall be checked by inspection and by the tests given in table 10.

6.5 Guide to use

Maximum conductor temperature in normal use: 90 °C.

In circumstances in which it is possible to guard against thermoplastic flow, and reduced insulation resistance can be tolerated, PVC compound suitable for continuous use at 90 °C can be operated at temperatures up to 105 °C for a reduced total working duration.

NOTE – Other guidelines are under consideration.

Table 10 – Tests for type 60227 IEC 07

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test method described in**	
			IEC	**Subclause**
1	*Electric test*			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test at 2 000 V	T, S	60227-2	2.2
1.3	Insulation resistance at 90°C	T	60227-2	2.4
2	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity at low temperature*			
5.1	Bending test for insulation	T	60811-1-4	8.1
6	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	T	60332-1	
8	*Thermal stability*	T	60811-3-2	9

7 Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 90 °C

7.1 Code designation

60227 IEC 08.

7.2 Rated voltage

300/500 V.

7.3 Construction

7.3.1 Conductor

Number of conductors: 1.

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 the conductor.

The insulation thickness shall comply with the specified value given in column 2 of table 11.

The insulation resistance shall be not less than the value given in column 4 of table 11.

7.3.3 Overall diameter

The mean overall diameter shall not exceed the upper limit given in column 3 of table 11.

Table 11 – General data for type 60227 IEC 08

1	2	3	4	5
Nominal cross-sectional area of conductor	**Thickness of insulation**	**Mean overall diameter**		**Minimum insulation resistance at 90 °C**
	Specified value	**Lower limit**	**Upper limit**	
mm^2	mm	mm	mm	MΩ·km
0,5	0,6	2,1	2,5	0,013
0,75	0,6	2,2	2,7	0,012
1	0,6	2,4	2,8	0,010
1,5	0,7	2,8	3,4	0,009
2,5	0,8	3,4	4,1	0,009

7.4 Tests

Compliance with the requirements of 7.3 shall be checked by inspection and by the test given in table 12.

7.5 Guide to use

Maximum conductor temperature in normal use: 90 °C.

In circumstances in which it is possible to guard against thermoplastic flow, and reduced insulation resistance can be tolerated, PVC compound suitable for continuous use at 90 °C can be operated at temperatures up to 105 °C for a reduced total working duration.

NOTE – Other guidelines are under consideration.

Table 12 – Tests for type 60227 IEC 08

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test method described in**	
			IEC	**Subclause**
1	*Electric test*			
1.1	Resistance of conductors	T, S	60227-2	2.1
1.2	Voltage test at 2 000 V	T, S	60227-2	2.2
1.3	Insulation resistance at 90 °C	T	60227-2	2.4
2	*Provisions covering constructional and dimensional characteristics*		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	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity at low temperature*			
5.1	Bending test for insulation	T	60811-1-4	8.1
6	*Heat shock test*	T	60811-3-1	9.1
7	*Test of flame retardance*	T	60332-1	
8	*Thermal stability*	T	60811-3-2	9

Annex AA
(normative)

National Modifications

This annex is National modifications which includes specification of additional types of wires: Thermoplastic insulated wires and fixture wires.

These modifications refers to the following references:

UL 83:2017 ed. 16 , Thermoplastic-Insulated Wires and Cables
UL 66:2018 ed. 2 , Fixture Wire
UL 2556:2015 ed. 4 , Wire and Cable Test Methods
IEC/TR 62602:2009 , Conductors of insulated cables - Data for AWG and KCMIL sizes

Add clause 8 as the following:

8 Single-core nylon-jacketed cable with unilay stranded conductor for a conductor temperature of 90 °C of types TFFN, THHN &THWN.

8.1 Code Designation

THHN/THWN UL 083.

TFFN UL 066.

8.2 Rated voltage:

600 V

8.3 Construction

8.3.1 Conductor

Number of conductors: 1

The conductor shall be stranded and comply with the requirements given in SASO GSO IEC TR 62602 and table 13.

8.3.2 Insulation

The insulation shall be polyvinyl chloride compound meeting the requirements of table 13 for wires types: TFFN and THHN/THWN.

The insulation thickness shall comply with the specified value in table 14

8.3.3 Nylon jacket

The wires of types TFFN and THHN/THWN shall have a nylon jacket extruded tightly over the insulation, nylon jacket thickness shall meet the requirement of table 14.

The minimum thickness at any point of the nylon jacket shall not be less than specified values in table 14.

The insulation resistance for wires shall not be less than the values given in table 14.

Table 13 Conductors for insulated wires

1		2	3	4	5
Conductor Size AWG	mm²	**Maximum Acceptable Length of Lay** (mm)	**Nominal Conductor Diameter** (mm)	**Conductor material**	**Maximum conductor resistance** (ohms/Km)
16	1.31	51	1.29	Bare copper	13.7
14	2.08	44	1.8	Bare copper	8.62
12	3.31	51	2.29	Bare copper	5.43
10	5.26	64	2.87	Bare copper	3.41
8	8.37	70	3.63	Bare copper	2.14
6	13.3	86	4.55	Bare copper	1.35

Table 14 Insulation and Nylon Thickness and insulation resistance

1	**2**	**3**		**4**	**5**
Conductor Size AWG	**Type**	**Insulation Thickness** (mm) **Minimum Average Insulation thickness** (mm)	**Minimum thickness at any point** (mm)	**Minimum Nylon thickness at any point** (mm)	**Minimum insulation resistance** (M ohm.km)
16	TFFN	0.38	0.33	0.1	0.035
14	THHN / THWN	0.38	0.33	0.1	0.035
12	THHN / THWN	0.38	0.33	0.1	0.03
10	THHN / THWN	0.51	0.46	0.1	0.035
8	THHN / THWN	0.76	0.69	0.13	0.035
6	THHN / THWN	0.76	0.69	0.13	0.03

8.4 Tests

Compliance with the requirements of 8.3 shall be checked by inspection and by the test given in table 15.

Table 15 – Tests for Types THHN/THWN and TFFN

1	2	3	4	
Ref. No.	**Test**	**Category of test**	**Test Method described in**	
			IEC	**Subclause**
1	*Electrical test*			
1.1	*Resistance of conductors*	T, S	60227-2	2.1
1.2	*Voltage test at 2 000 V*	T, S	60227-2	2.2
1.3	*Insulation resistance at 90 °C*	T	60227-2	2.4
2	*Provisions covering constructional and dimensional characteristics*		*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 and nylon jacketing thickness*	T, S	60227-2	1.9
2.3	*Measurement of overall diameter*	T, S	60227-2	1.11
3	*Mechanical properties of insulation*			
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	*Pressure test at high temperature*	T	60811-3-1	8.1
5	*Elasticity and impact strength at low temperature*			
5.1	*Cold bend with nylon jacket*	T	60227-2 Annex AA	4.3
6	*Heat shock for nylon jacketed wires*	T	60227-2 Annex AA	4.2
7	*Test of flame retardance*	T	60332-1	
8	*Flexibility at room temperature after aging*	T	60227-2 Annex AA	4.1

8.5 Guide to use

Maximum conductor temperature in normal use: 90 °C

In circumstances in which it is possible to guard against thermoplastic flow, and reduced insulation resistance can be tolerated, PVC compound suitable for continuous use at 90 °C can be operated at temperatures up to 105 °C for a reduced total working duration.

8.5.1 Equivalent wires types current carrying capacities

The following table 16 is practical equivalent size selection guide between wires types IEC 01 and THHN/THWN UL 083 & TFFN UL 066 according to their current carrying capacities in practical conditions:

Table 16 – practical equivalent size selection guide between wires types

Code designation 60227 IEC 01 **Size** (mm²)	**Code designations TFFN UL 066** **THHN/THWN UL 083** **Size** (AWG)
1.5 mm²	16 AWG
2.5 mm²	14 AWG
4 mm²	12 AWG
6 mm²	10 AWG

Above mentioned sizes can be used interchangeably in all applications of Saudi Building Code: SBC 401 – Chapter 52: Wiring systems.