SRI LANKA STANDARD 1282 : PART 2 : 2006

UDC 621.315.221.8

SPECIFICATION FOR
INSULATING AND SHEATHING MATERIALS FOR ELECTRIC CABLES
PART 2 : PVC INSULATING AND SHEATHING COMPOUNDS

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PART 2 : PVC INSULATING AND SHEATHING COMPOUNDS

SLS 1282: PART 2 : 2006

Gr. 7

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This standard does not purport to include all the necessary provisions of a contract.

FOREWORD

This standard was approved by the Sectoral Committee on Electric Cables and Conductors and was authorized for adoption as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2006-02-21

This is the Part **2** of **SLS 1282 : 2006** which specifies requirements for PVC insulating and sheathing compounds used for electric cables. This standard newly introduces PVC insulation types TI 3 and TI 5, and sheath types TM 3, TM 4 , TM 5 and Type 10. Part **1** and Part **2** of this Sri Lanka Standard supersede **SLS 988 : 1993:** Specification for PVC insulation and sheath of electric cables.

This standard consist of two sections namely, Section 1: PVC Insulating compounds and Section 2: PVC Sheathing compounds .and this is to be read in conjunction with, **SLS 1282** : Part **1**: General Requirements.

All values given in this specification are in SI units.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the results of a test or an analysis shall be rounded off in accordance with **CS 102.** The number of figures to be retained in the rounded off value shall be the same as that of the specified value in the standard.

In the preparation of this standard, the assistance derived from **BS 7655**: Specification for insulating and sheathing materials for cables : Part **3** : PVC insulating compounds and Part **4** : PVC sheathing compounds, are gratefully acknowledged.

SRI LANKA STANDARD
SPECIFICATION FOR INSULATING AND SHEATHING MATERIALS FOR ELECTRIC CABLES
PART 2 : PVC INSULATING AND SHEATHING COMPOUNDS

1 SCOPE

This standard specifies the requirements for the PVC insulating and sheathing compounds.

2 REFERENCES

IEC 60096 Specification for radio-frequency cables

SLS 1199 Common Test Methods for Insulation and sheathing materials of electric cables (adoption of IEC 60811-upto Part 3.2)

- Part 1 : General application
- Part 1.1 : Measurement of thickness and overall dimensions–Tests for determining the mechanical properties (IEC 60811-1-1)
- Part 1.2 : Thermal ageing methods (IEC 60811-1-2)
- Part 1.4 : Tests at low temperature (IEC 60811-1-4)
- Part 2.1 : Methods specific to elastomeric compounds Ozone resistance, hot set and mineral oil immersion test (IEC 60811-2-1)
- Part 3. : Methods specific to PVC compounds
- Part 3.1 : Pressure test at high temperature - Tests for resistance to cracking (IEC 60811-3-1)
- Part 3.2 : Loss of mass test - Thermal stability test (IEC 60811-3-2)
- Part 7.1 : Specific test methods – Non electrical tests
- Part 7.2 : Specific test methods – Electrical tests

3 DEFINITIONS

a) For the purpose of this standard definitions given in Part **1** of **SLS 1282** shall apply with the following.

3.1 PVC

Combination of materials, of which polyvinyl chloride is the characteristic constituent, suitably selected, proportioned and treated, which meet the requirements given in the specification.

SECTION 1

SPECIFICATION FOR PVC INSULATING COMPOUNDS

1.1 Classification of insulating compounds

PVC insulating compounds can be classified as Harmonized types and Hard grade type.

1.2 Harmonized types

Harmonized types are listed in Table **1.**

TABLE 1 - Types of harmonized PVC insulation

Type	Maximum material operating temperature ^{o}C	General Application
TI 1	70	General purpose
TI 2	70	Flexible (including transparent)
TI 3	90	Heat resistant
TI 4	70	For installation at low temperatures
TI 5	70	General purpose flexible for lower temperature use

1.2.1 *Requirements*

The requirements specified for each compound listed in Table **2** shall be met when the compound is tested using the test methods listed against each particular requirement.

NOTE : See *Table **2** of **SLS 1282 : Part 1** for cross-references to the standards for methods of test.*

TABLE 2 – Test requirements for harmonized PVC insulating compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Test requirements for insulation type				
	Part/ Section	Clause	TI 1	TI 2	TI 3	TI 4	TI 5
Properties in the manufactured state	1.1	**9.1**					
Minimum tensile strength (N/mm^2)			12.5	10	15	12.5	10
Minimum elongation at break (%)			125	150	150	125	150
Properties after ageing in air oven	1.2	**8.1**					
Temperature (^oC)			80±2	80±2	135±2	80±2	80±2
Duration (h)			7x24	7x24	14x24	7x24	7x24
Minimum tensile strength (N/mm^2)			12.5	10	15	12.5	10
Maximum variation (%)			20	20	25	20	20
Minimum elongation at break (%)			125	150	150	125	150
Maximum variation (%)			20	20	25	20	20
Bending test at low temperature	1.4	**8.1**					
Temperature (^oC)			-15±2	-15±2	-15±2	-40±2	-30±2
Requirement			no cracks				
Elongation test at low temperature	1.4	**8.3**			1)		
Temperature (^oC)			-15±2	-15±2	-15±2	-40±2	-30±2
Minimum elongation without break (%)			30	30	20	30	30
Impact test at low temperature	1.4	**8.5**					
Temperature (^oC)			-15±2	-15±2	---	-40±2	-30±2
Requirement			no cracks		---	no cracks	
Pressure test at high temperature	3.1	**8.1**					
Test conditions							
Force exerted by the blade			2)	2)	2)	2)	2)
Duration of heating under load			2)	2)	2)	2)	2)
Temperature (^oC)			80±2	70±2	90±2	80±2	70±2
Maximum indentation (%)			50	50	50	50	50
Resistance to cracking	3.1	**9.1**					
Temperature (^oC)			150±2	150±2	150±2	150±2	150±2
Requirement			no cracks				
Loss of mass test	3.2	**8.1**					
Temperature (^oC)			80±2	80±2	115±2	80±2	80±2
Duration (h)			7x24	7x24	14x24	7x24	7x24
Maximum loss of mass (mg/cm^2)			2	2	1.5	2	2
Minimum thermal stability at (200 ±0.5) ^oC (min)	3.2	**9**	---	---	240	---	---
Insulation resistance test	7.2	**6**					
Temperature (^oC)			70±2	70±2	90±2	70±2	70±2
Minimum *K* value (MΩ.km)			0.037	0.037	0.037	0.037	0.037

1) Currently only applicable for use on national types of cable with mean overall diameters exceeding 12.5 mm.
2) See SLS 1199: Part 3.1 Clause **8.2**

1.3 Hard grade type

Hard Grade - Type 2 is used for general applications of PVC insulation and the maximum operating temperature of the material is 70 °C.

1.3.1 *Requirements*

The requirements specified for the Hard Grade Type 2 PVC insulation compound shall be met when the compound is tested using the test methods listed against each particular requirement of Table **3**.

NOTE : See *Table **2** of **SLS 1282 : Part 1** for cross-references to the standards for methods of test.*

TABLE 3 – Test requirements for hard grade PVC insulating compound

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type 2
	Part/Section	Clause	
Properties in the manufactured state	1.1	**9.1**	
Minimum tensile strength (N/mm^2)			18.5
Minimum elongation at break (%)			125
Bending test at low temperature	1.4	**8.1**	
Temperature (°C)			-15 ± 2
Requirements			no cracks
Elongation test at low temperature	1.4	**8.3**	
Temperature (°C)			-15 ± 2
Minimum elongation without break (%)			20
Pressure test at high temperature	3.1	**8.1**	
Temperature (°C)			80 ± 2
Maximum indentation (%)			50
Resistance to cracking	3.1	**9.1**	
Temperature (°C)			150 ± 2
Requirement			no cracks
Loss of mass test	3.2	**8.1**	
Temperature (°C)			80 ± 2
Duration (h)			7 x 24
Maximum loss of mass (mg/cm^2)			2
Hot deformation test*	7.1	**8**	
Maximum deformation (%)			30
Insulation resistance test	7.2	**6**	
Temperature (°C)			20 ± 2
Minimum *K* value (MΩ.km)			350
*Only for specified radial thickness less than 0.4 mm.			

SECTION 2

SPECIFICATION FOR PVC SHEATHING COMPOUNDS

2.1 Classification of sheathing compounds

PVC sheathing compounds can be classified as Harmonized types, General applications and Special applications - RF cables.

2.2 Harmonized types

Harmonized types are listed in Table **4** as follows :

TABLE 4 – Types of harmonized PVC sheath

Type	Maximum cable operating temperature ^{o}C	General Application
TM 1	70	General purpose for fixed installation cables. May be suitable for over sheathing of cables with a metallic layer operating at a maximum conductor temperature of 80 ^{o}C.
TM 2	70	Flexible general purpose
TM 3	90	Flexible for high temperature use
TM 4	70	Flexible for low temperature use
TM 5	70	Oil-resistant flexible

2.2.1 *Requirements*

The requirements specified for each compound listed in Table **5** shall be met when the compound is tested using the test methods listed against each particular requirement.

NOTE : See *Table* **2** of ***SLS 1282 : Part 1*** *for cross-references to the standards for methods of test.*

TABLE 5 – Test requirements for harmonized PVC sheathing compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Test requirements for sheath type				
	Part/ Section	Clause	TM 1	TM 2	TM 3	TM 4	TM 5
Properties in the manufactured state	1.1	**9.2**					
Minimum tensile strength (N/mm^2)			12.5	10	10	10	10
Minimum elongation at break (%)			125	150	150	150	150
Properties after ageing in air oven	1.2	**8.1**					
Temperature (^oC)			80±2	80±2	135±2	80±2	80±2
Duration (h)			7x24	7x24	14x24	7x24	7x24
Minimum tensile strength (N/mm^2)			12.5	10	10	10	10
Maximum variation (%)			20	20	25	20	20
Minimum elongation at break (%)			125	150	150	150	150
Maximum variation (%)			20	20	25	20	20
Bending test at low temperature	1.4	**8.2**					
Temperature (^oC)			-15±2	-15±2	-15±2	-30±2	-15±2
Requirement			no cracks				
Elongation test at low temperature	1.4	**8.4**					
Temperature (^oC)			-15±2	-15±2	-15±2	-30±2	-15±2
Minimum elongation without break (%)			30	30	30	30	30
Impact test at low temperature	1.4	**8.5**					
Temperature (^oC)			-15±2	-15±2	-15±2	-30±2	-15±2
Requirement			no cracks				
Mineral oil immersion test	2.1	**10**					
Temperature (^oC)			----	----	----	----	90±2
Duration (h)			----	----	----	----	7x24
Maximum variation for tensile strength (%)			----	----	----	----	30
Maximum variation for elongation at break (%)			----	----	----	----	30
Pressure test at high temperature	3.1	**8.2**					
Test conditions							
Force exerted by the blade			1)	1)	1)	1)	1)
Duration of heating under load			1)	1)	1)	1)	1)
Temperature (^oC)			80±2	70±2	90±2	70±2	70±2
Maximum indention (%)			50	50	50	50	50
Resistance to cracking	3.1	**9.2**					
Temperature (^oC)			150±2	150±2	150±2	150±2	150±2
Requirement			no cracks				
Loss of mass test	3.2	**8.2**					
Temperature (^oC)			80±2	80±2	115±2	80±2	80±2
Duration (h)			7x24	7x24	10x24	7x24	7x24
Maximum loss of mass (mg/cm^2)			2	2	1.5	2	2
Minimum thermal stability at (200 ± 0.5) ^oC (min)	3.2	**9**	---	---	240	---	---
1) See SLS 1199 : Part 3.1 Clause **8.2**							

2.3 General application PVC sheathing compound
Types of General applications can be listed in Table **6** as follows :

TABLE 6 – Types of general application PVC sheathing compounds

Type	Maximum material operating temperature ^{o}C	General Application
5	85	Hard
6	70	General purpose
9	---	For use over cable operating at maximum temperature of 90 ^{o}C.
10	70	For outdoor use at low temperatures.

2.3.1 ***Requirements***
The requirements specified for the compounds listed in Table **7** shall be met when the compound is tested using the test methods listed against each particular requirement.

NOTE : See *Table **2** of **SLS 1282 : Part 1** for cross-references to the standards for methods of test.*

TABLE 7– Test requirements for general application PVC sheathing compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Test requirements for compound type			
	Part/Section	Clause	5	6	9	10
Properties in the manufactured state	1.1	**9.2**				
Minimum tensile strength (N/mm^2)			12.5	6	12.5	10
Minimum elongation at break (%)			125	125	150	150
Properties after ageing in air oven	1.2	**8.1.3.1**				
Temperature (^oC)			135±2	---	100±2	80±2
Duration (h)			10x24	---	7x24	7x24
Minimum tensile strength (N/mm^2)			12.5	---	12.5	10
Maximum variation (%)			25	---	25	20
Minimum elongation at break (%)			125	---	150	150
Maximum variation (%)			25	---	25	20
Bending test at low temperature	1.4	**8.2**				
Temperature (^oC)			-15±2	-15±2	-15±2	-40±2
Requirement			no cracks			
Elongation test at low temperature	1.4	**8.4**				
Temperature (^oC)			-15± 2	-15± 2	-15± 2	-40± 2
Minimum elongation without break (%)			20	20	20	20
Impact test at low temperature	1.4	**8.5**				
Temperature (^oC)			---	---	-15±2	-40±2
Requirement			---	---	no cracks	no cracks
Pressure test at high temperature	3.1	**8.2**				
Temperature (^oC)			95±2	80±2	90±2	70±2
Maximum indentation (%)			50	50	50	50
Resistance to cracking	3.1	**9.2**				
Temperature (^oC)			150±2	150±2	150±2	150±2
Requirement			no cracks			
Loss of mass test	3.2	**8.2**				
Temperature (^oC)			115±2	80±2	100±2	80±2
Duration (h)			10x24	7x24	7x24	7x24
Maximum loss of mass (mg/cm^2)			1.5	2	1.5	2
Hot deformation test*	7.1	**8**				
Maximum deformation (%)			30	65	40	---
Insulation resistance test	7.2	**6**				
Temperature (^oC)			20±2	20±2	20±2	--
Minimum *K* value (MΩ.km)			0.0035	0.0035	0.0035	--
*Only for specified radial thickness less than 0.4 mm						

2.4 Special applications – RF Cables
These compounds are for use on cables conforming to **IEC 60096**
Types of General applications can be listed in Table **8** as follows :

TABLE 8– Types of special applications PVC sheathing compounds

Type	Maximum material operating temperature ^{o}C	General Application
7	70	Low temperature non-migratory for radio-frequency cables conforming to **IEC 60096**.
8	70	Low temperature general purpose for radio-frequency cables conforming to **IEC 60096.**

2.4.1 ***Requirements***
The requirements specified for the compounds listed in Table **9** shall be met when the compound is tested using the test methods listed against each particular requirement.

NOTE : See *Table **2** of **SLS 1282 : Part 1** for cross-references to the standards for methods of test*

TABLE 9–Test requirements for special application PVC sheathing compound - RF cables.

Test	Test method in accordance with SLS 1199 unless otherwise stated		Test requirements for compound type	
	Part/ Section	Clause	7	8
Properties in the manufactured state	1.1	**9.2**		
Minimum tensile strength (N/mm^2)			7.5	7.5
Minimum elongation at break (%)			125	150
Bending test at low temperature	1.4	**8.2**		
Temperature (^oC)			-40±2	-40±2
Requirement			no cracks	
Elongation test at low temperature	1.4	**8.4**		
Temperature (^oC)			-40±2	-40±2
Minimum elongation without break (%)			20	20
Pressure test at high temperature	3.1	**8.2**		
Temperature (^oC)			60±2	60±2
Maximum indentation (%)			50	50
Resistance to cracking	3.1	**9.2**		
Temperature (^oC)			100±2	120±2
Requirement			no cracks	
Loss of mass test	3.2	**8.2**		
Temperature (^oC)			80±2	80±2
Duration (h)			7x24	7x24
Maximum loss of mass (mg/cm^2)			2	2
Hot deformation test*	7.1	**8**		
Maximum deformation (%)			65	65
Insulation resistance test	7.2	**6**		
Temperature (^oC)			20±2	20±2
Minimum *K* value (MΩ.km)			0.0035	0.0035
*Only for specified radial thickness less than 0.4 mm				

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SRI LANKA STANDARDS INSTITUTION

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