SRI LANKA STANDARD 1282 : PART 3 : 2008
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SPECIFICATION FOR
INSULATING AND SHEATHING MATERIALS FOR ELECTRIC CABLES
PART 3 : CROSS-LINKED ELASTOMERIC INSULATING AND SHEATHING COMPOUNDS

SRI LANKA STANDARDS INSTITUTION

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Gr. 13

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

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 2008-02-27.

This is the Part **3** of **SLS 1282** which specifies requirements for cross-linked elastomeric insulating and sheathing compounds used for electric cables.

This standard consists of two sections namely, Section 1: Cross-linked elastomeric insulating compounds and Section 2: Cross-linked elastomeric 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 7655:1997:** Specification for insulating and sheathing materials for cables, Part **1**: 2000 : Cross-linked elastomeric insulating compounds and Part **2** : 2000 : Cross-linked elastomeric sheathing compounds and **BS EN 50363 : 2005 :** Insulating sheathing and covering materials for low voltage energy cables. is greatly acknowledged.

SRI LANKA STANDARD
SPECIFICATION FOR INSULATING AND SHEATHING MATERIALS FOR ELECTRIC CABLES
PART 3 : CROSS-LINKED ELASTOMERIC INSULATING AND SHEATHING COMPOUNDS

1 SCOPE

This standard specifies the requirements for the cross-linked elastomeric insulating and sheathing compounds.

2 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 amendments) applies.

ISO 48 : Rubber, vulcanized or thermoplastic
Determination of hardness (hardness between 10 IRHD and 100 IRHD)

IEC 60245 **:** Rubber insulated cables - Rated voltages upto and including 450/750 V
Part 6 : Arc welding electrode cables.
IEC 60754 **:** Tests on gases evolved during combustion of materials from cables
Part 1- Determination of amount of halogen acid gases

BS 1755 **:** Glossary of terms used in the plastics industry
Part 1 : Polymer and Plastics technology
Part 2 : Manufacturing processes
BS 3558 **:** Glossary of rubber terms
BS 6195 **:** Rubber or silicon rubber insulated flexible cables and cords for coil reels
BS 6883 **:** Elastomer insulated cables for fixed wiring in ships and on mobile and fixed offshore units
Requirements and test methods
BS 7917 **:** Elastomer insulated fire resistant (limited circuit integrity) cables for fixed wiring in ships and on mobile and fixed offshore units.
Requirements and test methods.
(The standard compliments BS 6883)

CS 102 **:** Presentation of numerical values
SLS 982 **:** Electrotechnical vocabulary
Part 24 : Electric Cables

SLS 1199 : Common test methods for insulating and sheathing materials of electric cables

Part 1.1 : General application – 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 1.3 : Methods for determining the density
Water absorption test – Shrinkage test (IEC 60811-1-3)

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 3.1 : Methods specific to PVC compounds.
Pressure test at high temperature -Tests for resistance to cracking (IEC 60811–3 -1)

Part 4.1 : Methods specific to polyethylene and polypropylene compounds. Resistance to environmental stress cracking - Measurement of melt flow index - Carbon black and/or mineral filler content measurement in polyethylene by direct combustion - Measurement of carbon black content by thermogravimetric analysis (TGA) - Assessment of carbon black dispersion in polyethylene using a microscope. (IEC 60811-4-1)

Part 7.1 : Specific test methods – Non electrical tests

Part 7.2 : Specific test methods- Electrical tests

3 DEFINITIONS

For the purpose of this standard definitions given in **BS 1755**, **BS 3558** and Part **1** of **SLS 1282** shall apply.

SECTION 1

SPECIFICATION FOR CROSS-LINKED ELASTOMERIC INSULATING COMPOUNDS

1.1 Classification of insulating compounds

Cross-linked elastomeric compounds can be classified as harmonized types, general 90 ^{0}C application, XLPE, oil resisting types, flame retardant composites and coil end lead types.

1.2 Harmonized types

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

TABLE 1 - Types of harmonized cross-linked elastomeric insulation

Type	Maximum material operating temperature ^{0}C	General application
(1)	(2)	(3)
EI 2	180	Ordinary duty silicone rubber
EI 3	110	Ordinary duty Ethylene Vinyl Acetate (EVA) rubber or equivalent
EI 4	60	Ordinary duty ethylene propylene rubber
EI 6	90	Ordinary duty ethylene propylene rubber or equivalent synthetic elastomer for cables requiring handling down to - 40 ^{0}C
EI 7	90	Ordinary duty ethylene propylene rubber or equivalent synthetic elastomer

1.2.1 *Requirements*

The requirement specified for the compounds 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 methods of test.*

TABLE 2 -Test requirements for harmonized cross-linked elastomeric insulating compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type				
	Part / Section	Clause	EI 2	EI 3	EI 4	EI 6	EI 7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Properties in the state as manufactured	1.1	**9.1**					
Minimum tensile strength (N/mm^2)			5	6.5	5	5	5
Minimum elongation at break (%)			150	200	200	200	200
Properties after ageing in air oven	1.2	**8.1**[1)]					
Temperature (^0C)			200 ± 3	150 ± 2	100 ± 2	135 ± 2	135 ± 2
Duration (h)			10 x 24	10 x 24	7 x 24	7 x 24	7 x24
Minimum tensile strength (N/ mm^2)			4	--	4.2	5	5
Maximum variation (%)			--	30	25	30	30
Minimum elongation at break (%)			120	--	200	--	--
Maximum variation (%)			--	30	25	30	30
Properties after ageing in air bomb	1.2	**8.2**					
Temperature (^0C)			--	150±2	127 ± 2	127 ± 2	127 ± 2
Duration (h)			--	7 X24	40	40	40
Minimum tensile strength (N/ mm^2)			--	6	--	--	--
Maximum variation (%)			--	--	30	30	30
Maximum variation for elongation at break(%)			--	30[2)]	30	30	30
Bending test at low temperature	1.4	**8.1**					
Temperature (^0C)			--	--	--	-50±3	-35±2
Requirement			--	--	--	no cracks	
Elongation test at low temperature	1.4	**8.3**					
Temperature(^0C)			--	--	--	-50±3	-35±2
Minimum elongation without break (%)			--	--	--	30	30
Ozone resistance test	2.1	**8**					
Temperature (^0C)			--	--	25±2	25±2	25±2
Duration (h)			--	--	24	24	24
Ozone concentration (ppm)			--	--	250 to 300	250 to 300	250 to 300
Requirement			--	--	--	no cracks	
Alternative ozone resistance test (low concentration)	7.1	**11**					
Temperature (^0C)			--	--	40±2	40±2	40±2
Duration (h)			--	--	72	72	72
Ozone concentration (pphm)			--	--	200±50	200±50	200±50
Requirement			--	--	no cracks		

TABLE 2 (Concluded)

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type				
	Part/ Section	Clause	EI 2	EI 3	EI 4	EI 6	EI 7
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hot set test	2.1	**9**					
Temperature (^{0}C)			250±3	200±3	200±3	250±3	250±3
Duration (min)			15	15	15	15	15
Mechanical stress (N/mm^2)			0.2	0.2	0.2	0.2	0.2
Requirements							
Maximum elongation under load (%)			100	100	100	100	100
Maximum elongation after unloading (%)			25	25	25	25	25
Pressure test at high temperature	3.1	**8.1**					
Temperature (^{0}C)			--	150±2	--	--	--
Duration (h)			--	0.5	--	--	--
k value			--	1.0	--	--	--
Requirement							
Maximum penetration (%)			--	50	--	--	--

[1)] Unless specified otherwise in the particular product standard EI 2 and EI 3 shall be tested in accordance with 8.1.3.1 and E1 4, E1 6 and E1 7 in accordance with **8.1.3.2** a). Where it is not possible to complete the test to 8.1.3.2 a) i.e due to adhesion of the insulation to the conductor, the ageing shall be carried out with not more than 30% of the conductor wires removed.

[2)]Only a reduction in value is subject to verification.

1.3 General 90 ^{0}C application.

Types of general 90 ^{0}C application are listed in Table **3** as follows:

TABLE 3 – Types of General application cross-linked elastomeric insulation

Type	Maximum material operating temperature ^{0}C	General application
(1)	(2)	(3)
GP 4	90	Ordinary duty
GP 5	90	Ordinary duty
GP 6	90	Ordinary duty HEPR
GP 7	90	Ordinary duty

1.3.1 *Requirements*

The requirement specified for the compounds listed in Table **4** 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 methods of test.*

TABLE 4 – Test requirements for general 90^{0}C application cross-linked elastomeric insulating compounds

Test	Test method in accordance with SLS 1199 unless otherwise tested		Requirements for compound type			
	Part/ Section	Clause	GP 4	GP 5	GP 6	GP 7
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Properties in the state as manufactured	1.1	**9.1**				
Minimum tensile strength (N/mm^2)			6.5	6.5	8.5	4.2
Minimum elongation at break (%)			200	200	200	200
Properties after ageing in air oven	1.2	**8.1**				
Temperature (^{0}C)			135±2	135±2	135±2	135±2
Duration (h)			7 x 24	7 x 24	7 x 24	7 x 24
Maximum variation for tensile strength (%)			30	30	30	30
Maximum variation for elongation at break (%)			30	30	30	30
Properties after ageing in air bomb	1.2	**8.2**				
Temperature (^{0}C)			127±2	127±2	127±2	127±2
Duration (h)			40	40	40	40
Maximum variation for tensile strength (%)			30	30	30	30
Maximum variation for elongation at break (%)			30	30	30	30
***Water absorption (gravimetric*)**	1.3	**9**				
Temperature (^{0}C)			--	--	85±2	85±2
Duration (h)			--	--	14x24	14x24
Maximum variation in mass (mg/cm^2)			--	--	5	5
Ozone resistance test	2.1	**8**				
Temperature (^{0}C)			--	25±2	25±2	25±2
Duration (h)			--	3	30	30
Ozone concentration (ppm)			--	250 to 300	250 to 300	250 to 300
Requirement				no cracks		
Alternative ozone resistance test (low concentration)						
Temperature (^{0}C)	7.1	**11**	--	40±2	40±2	40±2
Duration (h)			--	8	72	72
Ozone concentration (pphm)			--	200±50	200±50	200±50
Requirement				no cracks		

TABLE 4 (Concluded)

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type			
	Part/ Section	Clause	GP 4	GP 5	GP 6	GP 7
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hot set test	2.1	**9**				
Temperature (^{0}C)			200±3	200±3	250±3	250±3
Duration (min)			15	15	15	15
Mechanical stress (N/mm ^{2})			0.2	0.2	0.2	0.2
Requirements						
Maximum elongation under load (%)			100	100	100	100
Maximum elongation after unloading(%)			25	25	25	25
Insulation resistance constant	7.2	**6**				
Minimum *K* value at 20 ^{0}C (MΩ.km)			2400	4800	--	--
Minimum *K* value at 90 ^{0}C (MΩ.km)			--	--	3.67	3.67
Power factor and permittivity test	7.2	**7**				
Maximum power factor at 20 ^{0}C			--	0.035	--	--
Maximum permittivity at 20 ^{0}C			--	4.5	--	--
Water absorption determined by the capacitance method	7.2	**8**				
Maximum increase in capacitance						
1 to 14 days (%)			10	6	--	--
7 to 14 days (%)			3	2.5	--	--
Determination of hardness	ISO 48					
Minimum hardness (IHRD)			--	--	80	--

1.4 XLPE

XLPE cross linked elastomeric insulating compound is given in Table **5**.

TABLE 5 - Type of XLPE cross-linked elastomeric insulation

Type	Maximum material operating temperature	General application
(1)	(2)	(3)
GP 8	90 ^{0}C	Ordinary duty XLPE

1.4.1 *Requirements*

The requirement specified for the compounds listed in Table **6** 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 methods of test.*

TABLE 6 - Test requirements for XLPE cross-linked elastomeric insulating compound

Test	**Test method in accordance with SLS 1199 unless otherwise stated**		**Requirements for Compound type GP 8**
	Part/Section	**Clause**	
(1)	**(2)**	**(3)**	**(4)**
Properties in the state as manufactured	1.1	**9.1**	
Minimum tensile strength (N/mm^2)			12.5
Minimum elongation at break (%)			200
Properties after ageing in air oven	1.2	**8.1**	
Temperature (^0C)			135±2
Duration (h)			7 x 24
Maximum variation for tensile strength (%)			25
Maximum variation for elongation at break (%)			25
Water absorption (gravimetric)	1.3	**9.2**	
Temperature (^0C)			85±2
Duration (h)			14 x 24
Maximum variation in mass(mg/cm^2)			1
Hot set test	2.1	**9**	
Temperature (^0C)			200±3
Duration (min)			15
Mechanical stress (N/mm^2)			0.2
Requirements			
Maximum elongation under load (%)			175
Maximum elongation after unloading(%)			15
Insulation resistance constant	7.2	**6**	
Temperature (^0C)			90±2
Minimum K value (MΩ. km)			3.67

1.5 Oil Resisting type

Oil resisting type cross-linked elastomeric insulating compound, is given in Table **7**.

TABLE 7 - Type of oil resisting cross-linked elastomeric insulating compound

Type	Maximum material operating temperature ^{o}C	General application
(1)	**(2)**	**(3)**
OR 1	85	Oil resisting

1.5.1 *Requirements*

The requirement specified for the compounds listed in Table **8** 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 methods of test.*

TABLE 8 - Test requirements for oil resisting cross-linked elastomeric insulating compound

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type OR 1
	Part/Section	Clause	
(1)	**(2)**	**(3)**	**(4)**
Properties in the state as manufactured	1.1	**9.1**	
Minimum tensile strength (N/mm^2)			7
Minimum elongation at break (%)			200
Properties after ageing in air oven	1.2	**8.1**	
Temperature (^{0}C)			120±2
Duration (h)			7 x 24
Maximum variation for tensile strength (%)			30
Maximum variation for elongation at break (%)			40
Properties after ageing in air bomb	1.2	**8.2**	
Temperature (^{0}C)			127±2
Duration (h)			40
Maximum variation for tensile strength (%)			50[1)]
Maximum variation for elongation at break (%)			50[1)]
Mineral oil immersion test	2.1	**10**	
Temperature (^{0}C)			100±2
Duration (h)			24
Maximum variation for tensile strength (%)			40[1)]
Maximum variation for elongation at break (%)			40[1)]
Insulation resistance constant	7.2	**6**	
Temperature			20±2
Minimum K value (MΩ. km)			10

TABLE 8 (Concluded)

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type OR 1
	Part/Section	Clause	
(1)	(2)	(3)	(4)
Water absorption determined by the capacitance method	7.2	**8**	
Maximum increase in capacitance [2)]			
1 to 14 days (%)			15
7 to 14 days (%)			5

[1)] Only a reduction in values is subject to verification.
[2)] This test only applies if the purchaser specifies at the time of ordering that the cable is to be used in a wet location.

1.6 Flame retardant composites

Types of flame retardant composite, cross-linked insulating compounds are classified FR 1 and FR 2 as specified in Table **9.**

These compounds are for use on coil ends leads conforming to BS 6195, but may be used for other suitable applications (as detailed in the cable specifications)

TABLE 9 - Types of flame retardant cross-linked elastomeric insulation

Type	Maximum material operating temperature ^{0}C	General application
(1)	(2)	(3)
FR 1	85	Flame retardant composite for type 4 cable conforming to BS 6195[1)]
FR 2	85	Flame retardant composite for type 4 cable conforming to BS 6195[1)]

[1)] The voltage designation of the cable will have a bearing on the type of compound selected for a particular application.

1.6.1 *Requirements*

The requirement specified for the compounds listed in Table **10** 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 methods of test.*

TABLE 10 - Test requirements for flame retardant cross-linked elastomeric insulating compounds

Test [1)]	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type	
	Part/ Section	Clause	FR 1	FR 2
(1)	(2)	(3)	(4)	(5)
Properties in the state as manufactured for thicknesses up to and including 2.5 mm	1.1	**9.1**		
Minimum tensile strength (N/mm^2)			5.5	5.5
Minimum elongation at break (%)			200	200
Properties in the state as manufactured for thicknesses over 2.5 mm (inner layer)	1.1	**9.1**		
Minimum tensile strength (N/mm^2)			6.5	6.5
Minimum elongation at break (%)			200	200
Properties in the state as manufactured for thicknesses over 2.5 mm (outer layer)	1.1	**9.1**		
Minimum tensile strength (N/mm^2)			7	7
Minimum elongation at break (%)			200	200
Properties after ageing in air oven for thicknesses up to and including 2.5 mm	1.2	**8 .1**		
Temperature (^0C)			120±2	120±2
Duration (h)			7 x 24	7 x 24
Maximum variation for tensile strength (%)			30	30
Maximum variation for elongation at break (%)			40	40
Properties after ageing in air oven for thicknesses over 2.5 mm (inner layer)	1.2	**8 .1**		
Temperature (^0C)			135±2	135±2
Duration (h)			7 x 24	7 x 24
Maximum variation for tensile strength (%)			30	30
Maximum variation for elongation at break (%)			30	30
Properties after ageing in air oven for thicknesses over 2.5 mm (outer layer)	1.2	**8 .1**		
Temperature (^0C)			120±2	120±2
Duration (h)			7 x 24	7 x 24
Maximum variation for tensile strength (%)			30	30
Maximum variation for elongation at break			40	40
Properties after ageing in air bomb for thicknesses up to and including 2.5 mm	1.2	**8 .2**		
Temperature (^0C)			127±2	127±2
Duration (h)			40	40
Maximum variation for tensile strength (%)			50[2)]	50[2)]
Maximum variation for elongation at break (%)			50[2)]	50[2)]

TABLE 10 (Concluded)

Test[1)]	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type	
	Part/ Section	Clause	FR 1	FR 2
(1)	(2)	(3)	(4)	(5)
Properties after ageing in air bomb for thicknesses over 2.5 mm (inner layer)	1.2	**8.2**		
Temperature (^{0}C)			127±2	127±2
Duration (h)			40	40
Maximum variation for tensile strength (%)			30	30
Maximum variation for elongation at break (%)			30	30
Properties after ageing in air bomb for thicknesses over 2.5 mm (outer layer)	1.2	**8.2**		
Temperature (^{0}C)			127±2	127±2
Duration (h)			40	40
Maximum variation for tensile strength (%)			50[2)]	50[2)]
Maximum variation for elongation at break (%)			50[2)]	50[2)]
Ozone resistance	2.1	**8**		
Temperature (^{0}C)			--	25±2
Duration (h)			--	3
Ozone concentration (ppm)			--	250 to 300
Requirement			--	no cracks
Alternative ozone resistance test (low concentration)	7.1	**11**		
Temperature (^{0}C)			--	40±2
Duration (h)			--	8
Ozone concentration (pphm)			--	200±50
Requirement			--	no cracks
Mineral oil immersion test for thicknesses over 2.5 mm (outer layer)	2.1	**10**		
Temperature (^{0}C)			100±2	100±2
Duration (h)			24	24
Maximum variation for tensile strength (%)[2)]			40	40
Maximum variation for elongation at break (%)[2)]			40	40
Insulation resistance constant	7.2	**6**		
Temperature (^{0}C)			20±2	20±2
Minimum K value (MΩ km)			1 900	3 700
Power factor and permittivity test	7.2	**7**		
Maximum power factor at 20 ^{0}C			--	0.035
Maximum permittivity at 20 ^{0}C			--	5.5
Water absorption determined by the capacitance method	7.2	**8**		
Maximum increase in capacitance				
1 to 14 days (%)			15	10
7 to 14 days (%)			5	3

[1)] Unless otherwise stated, all tests shall be performed on the composite insulation.
[2)] Only a reduction values is subject to verification.

1.7 Coil end lead types

These compounds are specifically use on coil end leads conforming to **BS 6195.**
Coil end lead types can be listed in Table **11.**

TABLE 11- Types of coil end lead cross-linked elastomeric insulation

Type	Maximum material operating temperature ^{0}C	General application
(1)	**(2)**	**(3)**
CL 1	125	For type 9 cable conforming to BS 6195
CL 2	150	For type 10 cable conforming to BS 6195

1.7.1 *Requirements*

The requirement specified for the compounds listed in Table **12** 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 methods of test.*

TABLE 12 - Test requirements for coil end lead cross-linked elastomeric insulation

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type	
	Part/Section	Clause	CL 1	CL 2
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Properties in the state as manufactured	1.1	**9.1**		
Minimum tensile strength (N/mm^2)			12.5	12.5
Minimum elongation at break (%)			200	200
Properties after ageing in air oven	1.2	**8.1**		
Temperature (^{0}C)			160±3	180±3
Duration (h)			7 x 24	7 x 24
Minimum tensile strength (N/mm^2)			--	8
Maximum variation for tensile strength (%)			30	--
Minimum elongation at break (%)			--	120
Maximum variation for elongation at break (%)			30	--
Bending test at low temperature	1.4	**8.1**		
Temperature (^{0}C)			-15±2	-15±2
Requirement			no cracks	
Hot set test	2.1	**8**		
Temperature (^{0}C)			200±3	250±3
Duration (minutes)			15	15
Mechanical stress (N/mm^2)			0.2	0.2
Requirements				
Maximum elongation under load (%)			100	100
Maximum elongation after unloading (%)			15	15

SECTION 2

SPECIFICATION FOR CROSS-LINKED ELASTOMETRIC SHEATHING COMPOUNDS

2.1 Classification of sheathing compounds

Cross-linked sheathing compounds can be classified as harmonized types, heat resisting types, general application, welding cable covering, sheathing compounds having low smoke and acid gas emission for general applications and sheathing compounds for ships wiring and off shore applications.

2.2 Harmonized types

Harmonized types are listed in Table **13** as follows :

TABLE 13 - Types of harmonized cross-linked elastomeric sheathing compounds

Type	Maximum material operating temperature ^{0}C	General application
(1)	**(2)**	**(3)**
EM 1	60	Ordinary duty
EM 2	60	Ordinary duty oil-resisting and flame retardant
EM 3	60	Ordinary duty
EM 4	110	Ordinary duty vulcanized Ethylene Vinyl Acetate (EVA) rubber or equivalent synthetic elastomer
EM 6	90	Ordinary duty Ethylene - Propylene rubber (EPR) or equivalent synthetic elastomer
EM 7	90	Ordinary duty Chlorosulphonated Polyethylene (CSP) or equivalent synthetic elastomer
EM 9	180	Heat resisting silicone rubber or equivalent

2.2.1 *Requirements*

The requirement specified for the compounds listed in Table **14** 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 methods of test.*

TABLE 14 -Test requirements for harmonized cross-linked elastomeric sheathing compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type						
	Part/ Section	Clause	EM 1	EM 2	EM 3	EM 4	EM 6	EM 7	EM 9
Properties in the state as manufactured	1.1	**9.2**							
Minimum tensile strength (N/mm^2)			7	10	7	6.5	7	10	5
Minimum elongation at break (%)			300	300	250	200	250	250	150
Properties after ageing in air oven	1.2	**8.1.3.1**							
Temperature (^0C)			70 ± 2	70 ± 2	80 ± 2	150 ± 2	120±2	120± 2	200±3
Duration (h)			10 x 24	10 x 24	10 x 24	10 x 24	3 x 24	7 x 24	10 x 24
Minimum tensile strength (N/mm^2)			--	--	--	--	7	--	4
Maximum variation (%)			20	15 [1)]	30	30	--	30	--
Minimum elongation at break (%)			250	250	--	--	200	--	120
Maximum variation (%)			30	25[1)]	30	30	--	40	--
Continued ageing conditions	1.2	**8.1.3.1**							
Temperature (^0C)			--	--	--	--	120±2	--	--
Total duration of treatment (h)			--	--	--	--	10x24	--	--
Maximum variation for tensile strength (%)			--	--	--	--	20[2)]	--	--
Maximum variation for elongation at break (%)			--	--	--	--	30[2)]	--	--
Properties after ageing in air bomb	1.2	**8.2**							
Temperature (^0C)			--	--	--	150±2	--	--	--
Duration (h)			--	--	--	7x24	--	--	--
Minimum tensile strength (N/mm^2)			--	--	--	6	--	--	--
Maximum variation (%)			--	--	--	--	--	--	--
Maximum variation for elongation at break (%)			--	--	--	30[1)]	--	--	--
Bending test at low temperature	1.4	**8.2**	--						
Temperature (^0C)			--	-35±2	-35±2	-15±2	-35±2	-30±2	--
Requirement				no cracks					
Elongation test at low temperature	1.4	**8.4**							
Temperature (^0C)			--	-35±2	-35±2	-15±2	-35±2	-30±2	--
Minimum elongation without break (%)			--	30	30	30	30	30	--
Ozone resistance test	2.1	**8.1**							
Temperature (^0C)			--	--	25±2	--	25±2	25±2	--
Duration (h)			--	--	24	--	24	24	--
Ozone concentration (ppm)			--	--	250 to300		250 to300	250 to300	
			--			--			--
Requirement			--	--	no cracks	--		no cracks	--

ABLE 14 - (Continued)

Test	Test method in accordance with SLS 199 unless otherwise stated		Requirements for compound type						
	Part/Section	Clause	EM 1	EM 2	EM 3	EM 4	EM 6	EM 7	EM 9
Alternative ozone resistance test (low concentration)	7.1	**11**							
Temperature (^{0}C)			--	--	40±2	--	40±2	40±2	--
Duration (h)			--	--	72	--	72	72	--
Ozone concentration (pphm)			--	--	200±50	--	200±50	200±50	--
Requirement			--	--	no cracks	--	no cracks		--
Hot set test	2.1	**9**							
Temperature			200±3	200±3	200±3	250±3	250±3	200±3	250±3
Duration (min)			15	15	15	15	15	15	15
Mechanical stress (N/mm^2)			0.2	0.2	0.2	0.2	0.2	0.2	0.2
Requirements									
Maximum elongation under load (%)			100	100	100	100	100	100	100
Maximum elongation after unloading (%)			25	25	25	25	25	25	25
Mineral oil immersion test	2.1	**10**							
Temperature (^{0}C)			--	100±2	--	--	--	100±2	--
Duration (h)			--	24	--	--	--	24	--
Maximum variation from unaged sample for the tensile strength (%)			--	40	--	--	--	40	--
Maximum variation from unaged sample for the elongation at break (%)			--	40	--	--	--	40	--
Pressure test at high temperature	3.1	**8.2**							
Temperature (^{0}C)			--	--	--	150±2	--	--	--
Duration (h)			--	--	--	0.5	--	--	--
K value			--	--	--	1.0	--	--	--
Requirement									
Maximum penetration (%)			--	--	--	50	--	--	--
Carbon black content [3] (min.%)	4.1	**11**	--	--	2	--	2	--	--

[1] Only a reduction in values in subject to verification
[2] Variation in this case is the difference between the median value after ageing for 10 days and the median value after ageing for three days expressed as a percentage of the latter
[3] Only applicable when called up in the relevant cable standard.

2.2 Heat resisting type

The type of heat resisting cross-linked elastomeric sheathing compound is given in Table **15.**

TABLE 15 - Type of heat resisting cross-linked elastomeric sheathing compound

Type	Maximum material operating temperature ^{o}C	General application
(1)	**(2)**	**(3)**
EI 2	180	Ordinary duty silicone rubber

2.3.1 Test requirements for physical properties

a) General
The test methods shall be as specified in Table **16** and the method of pre-conditioning shall be as described in **2.3.2.** The temperatures used for the test methods shall conform to the conditions specified in **2.3.3**

TABLE 16 – Test methods (in accordance with SLS 1199 unless otherwise stated)

Test	Method in SLS 1199	
	Part / Section	Clause
(1)	**(2)**	**(3)**
Properties in the state as delivered Tensile strength and elongation at break	1.1	**9.2**
Properties after ageing in air oven Tensile strength and elongation at break	1.2	**8.1**
Hot set test	2.1	**9**

b) When tested by the methods specified in **2.3.1a)** the properties shall be in accordance with the requirements given in Table **17** for the particular type of material.

TABLE 17- Test requirements for heat resisting cross-linked elastomeric sheathing compound

Test	Requirements for compound type EI 2
(1)	**(2)**
Properties in the state as delivered	
Minimum tensile strength (N/mm^2)	5
Minimum elongation at break (%)	150
Properties after ageing in air oven	
Temperature (^0C)	200
Duration (h)	10 x 24
Minimum tensile strength (N/mm^2)	4
Maximum variation	--
Minimum elongation at break (%)	120
Maximum variation	--
Hot set test	
Temperature (^oC)	250
Duration (minutes)	15
Mechanical stress (N/mm^2)	0.2
Requirements	
Maximum elongation under load (%)	100
Maximum elongation after unloading (%)	25

2.3.2 *Pre-conditioning*

The tests shall be carried out not less than 16 h after extrusion and cross-linking.

2.3.3 *Temperatures for test methods*

a) Ambient temperature
Tests shall be made at an ambient temperature within the range 5 ^oC to 35 ^oC unless otherwise specified in the details for the particular test.

b) Tolerances on temperature values
Unless otherwise stated in the particular specification the tolerances on temperature values in the test methods shall be as given in Table **18.**

Table 18- Tolerance on temperature value

Specified temperature, t ^oC	Tolerance ^oC
(1)	**(2)**
$-40 \leq t \leq 0$	± 2
$0 \leq t \leq 50$	According to relevant clause
$50 < t \leq 150$	± 2
$t > 150$	± 3

2.4 General application cross- linked elastomeric sheathing compounds.

General application types are listed as specified in Table **19**

TABLE 19 – Types of cross-linked elastomeric sheathing compounds for general application

Type	Maximum material operating temperature ^{o}C	General application
(1)	**(2)**	**(3)**
RS 2	60	Heavy duty oil-resisting and flame retardant
RS 3	85	Ordinary duty oil-resisting and flame retardant
RS 4	85	Heavy duty oil-resisting and flame retardant
RS 6	60	Heavy duty oil-resisting and flame retardant with increased tear resistance

2.4.1 *Requirements*

The requirement specified for the compounds listed in Table **20** 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 methods of test.*

TABLE 20 - Test requirements for general application cross-linked elastomeric sheathing compounds

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type			
	Part/ Section	Clause	RS 2	RS 3	RS 4	RS 6
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Properties in the state as manufactured	1.1	**9.2**				
Minimum tensile strength (N/mm^2)			11	8	11	11
Minimum elongation at break (%)			250	250	250	250
Test for tear resistance	7.1	**7**				
Minimum value (N/mm)			--	--	5	7.5
Properties after ageing in air oven	1.2	**8.1.3.1**				
Temperature (^0C)			70±2	120±2	120±2	70±2
Duration (h)			10 x 24	7 x 24	7 x 24	10 x 24
Maximum variation for tensile strength (%)			15[1)]	30	30	15[1)]
Maximum elongation at break (%)			200	--	--	250
Maximum variation for elongation at break (%)			25[1)]	40	40	25[1)]
Properties after ageing in air bomb	1.2	**8.2**				
Temperature (^0C)			--	127±2	127±2	--
Duration (h)			--	40	40	--
Maximum variation for tensile strength (%)			--	50[1)]	50[1)]	--
Maximum variation for elongation at break (%)			--	50[1)]	50[1)]	--
Hot set test	2.1	**9**				
Temperature (^0C)			200±3	200±3	200±3	200±3
Duration (min)			15	15	15	15
Mechanical stress (N/mm^2)			0.2	0.2	0.2	0.2
Requirements						
Maximum elongation under load (%)			100	100	100	100
Maximum elongation after unloading (%)			25	25	25	25
Mineral oil immersion test	2.1	**10**				
Temperature (^0C)			100±2	100±2	100±2	100±2
Duration (h)			24	24	24	24
Maximum variation for tensile strength (%)			40	40	40	40
Maximum variation for elongation at break (%)			40	40	40	40

[1)] Only a reduction in values is subject to verification

2.5 Cross-linked elastomeric sheathing and covering compounds for welding cables

These compounds are for use on welding cables in accordance with **IEC 60245-1,** but RS 5 may be used for other suitable applications. (as detailed in the cable specification)
EM 5 is a harmonized compound.

Types of sheathing of welding cables are listed as specified in Table **21.**

TABLE 21 - Types of cross-linked elastomeric sheathing and covering compounds for welding cables

Type	Maximum material operating temperature ^{0}C	General application
(1)	**(2)**	**(3)**
RS 5	90	for welding cables
EM 5	85	Oil resisting and flame retardant for welding cables

2.5.1 *Requirements*

The requirement specified for the compounds listed in Table **22** 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 methods of test.*

TABLE 22 – Test requirements for cross-linked elastomeric sheathing and covering compounds for welding cables

Test	Test method in accordance with SLS 1199		Requirements for compound type	
	Part/Section	Clause	RS 5	EM 5
(1)	(2)	(3)	(4)	(6)
Properties in the state as manufactured	1.1	**9.2**		
Minimum tensile strength (N/mm^2)			6	10
Minimum elongation at break (%)			200	300
Properties after ageing in air oven	1.2	**8.1.3.1**		
Temperature (^0C)			135±2	100±2
Duration (h)			7 x 24	14 x 24
Maximum variation for tensile strength (%)			30	30[1)]
Maximum variation for elongation at break (%)			30	40[1)]
Properties after ageing in air bomb	2.1	**8.2**		
Temperature (^0C)			127±2	--
Duration (h)			40	--
Maximum variation for tensile strength (%)			30	--
Maximum variation for elongation at break (%)			30	--
Hot set test	2.1	**9**		
Temperature (^0C)			200±3	200±3
Duration (minutes)			15	15
Mechanical stress (N/mm^2)			0.2	0.2
Requirements				
Maximum elongation under load (%)			100	100
Maximum elongation after unloading (%)			25	25
Mineral oil immersion test	2.1	**10**		
Temperature (^0C)			--	100±2
Duration (h)			--	24
Maximum variation for tensile strength (%)			--	40[1)]
Maximum variation for elongation at break (%)			--	40[1)]
Bending test at low temperature	1.4	**8.2**	--	
Temperature (^0C)				-35±2
Requirement				no cracks
Elongation test at low temperature	1.4	**8.4**		
Temperature (^0C)				-35±2
Minimum elongation without break (%)				30

[1)] Only a reduction in values is subject to verification

2.6 Cross-linked elastomeric sheathing compounds having low smoke and acid gas emission for general applications.

This type is given in Table **23**.

TABLE 23 - Type of cross-inked elastomeric sheathing compound having low smoke and acid gas emission for general applications

Type	Maximum material operating temperature ^{0}C	General application
(1)	**(2)**	**(3)**
LRS 1[1)]	85	Ordinary duty oil-resisting with low emission of smoke and corrosive gases when affected by fire
[1)]This compound is equivalent in all respects to compound SW 3 in clause 2.7		

2.6.1 Test requirements for physical properties

a) General
The test method shall be as specified in Table **24** and the method of pre-conditioning shall be as described in **2.6.2.** The temperatures used for the test methods shall conform to the conditions specified in **2.6.3**

TABLE 24 - Test methods (in accordance with SLS 1199 unless otherwise stated)

Test	Method in SLS 1199	
	Section	**Clause**
(1)	**(2)**	**(3)**
Properties in the state as delivered		
Tensile strength and elongation at break	1.1	**9.2**
Properties after ageing in air oven		
Tensile strength and elongation at break	1.2	**8.1**
Properties after ageing in air bomb		
Tensile strength and elongation at break	1.2	**8.2**
Hot set test	2.1	**9**
Mineral oil immersion test	2.1	**10**
Halogen gas emission test	IEC 60754 -1	

b) When tested by the methods specified in **2.6.1a)** the properties shall be in accordance with the requirements given in Table **25** for the particular type of material.

TABLE 25- Test requirements for cross-linked elastomeric sheathing compounds having low smoke and acid gas emission for general applications

Test	Requirements for sheath type LRS 1
(1)	**(2)**
Properties in the state as delivered	
Minimum tensile strength (N/mm^2)	8
Minimum elongation at break (%)	150
Properties after ageing in air oven	
Temperature (^0C)	120
Duration (h)	7 x 24
Maximum variation for tensile strength (%)	30
Maximum variation for elongation at break (%)	30
Properties after ageing in air bomb	
Temperature (^0C)	127
Duration (h)	40
Maximum variation for tensile strength (%)	50[1)]
Maximum variation for elongation at break (%)	50[1)]
Hot set test	
Temperature (^0C)	200
Duration (minutes)	15
Mechanical stress (N/mm^2)	0.2
Requirements	
Maximum elongation under load (%)	100
Maximum elongation after unloading (%)	25
Mineral oil immersion test	
Temperature (^0C)	100
Duration (h)	24
Maximum variation for tensile strength (%)	40
Maximum variation for elongation at break (%)	40
Halogen acid gas emission test	
Maximum value (%)	0.5
[1)] Only a reduction in values is subject to verification	

2.6.2 *Pre-conditioning*

The tests shall be carried out not less than 16 h after extrusion and cross-linking.

2.6.3 *Temperatures for test methods*

a) Ambient temperature

Tests shall be made at an ambient temperature within the range 5^0C to $35\ ^0C$ unless otherwise specified in the details for the particular test.

b) Tolerances on temperature values

Unless otherwise stated in the particular specification the tolerances on temperature values quoted in the test methods shall be as given in Table **26**.

TABLE 26 - Tolerances on temperature values

Specified temperature , t ^{0}C	Tolerance ^{0}C
(1)	(2)
$-40 \leq t \leq 0$	±2
$0 < t \leq 50$	According to relevant clause
$50 < t \leq 150$	±2
$t > 150$	±3

2.7 Cross-linked elastomeric sheathing compounds for ships' wiring and off shore applications

These compounds are for use with cables conforming to **BS 6883** and **BS 7917,** but may be used for other suitable applications (as declared in the cable specifications.)

This type is given as specified in Table **27**

TABLE 27- Types of cross-linked elastomeric sheathing compounds for ships' wiring and offshore application

Type	Maximum material operating temperature ^{0}C	General application
(1)	(2)	(3)
SW 1	85	Ordinary duty enhanced oil-resisting and flame retardant
SW 2	85	Ordinary duty enhanced oil-resisting and flame retardant with reduced halogen gas emission
SW 3[1)]	85	Ordinary duty oil resisting with low emission of smoke and corrosive gases when affected by fire
SW 4	85	Ordinary duty enhanced oil-resisting with low emission of smoke and corrosive gases when affected by fire
[1)] This compound is equivalent in all respects to compound LRS 1 in clause 2.6		

2.7.1 *Requirements*

The requirements specified for the compounds listed in Table **28** 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 methods of test.*

TABLE 28 - Test requirements for cross-linked elastomeric sheathing compounds for ships' wiring and off shore applications

Test	Test method in accordance with SLS 1199 unless otherwise stated		Requirements for compound type			
	Part/ Section	Clause	SW 1	SW 2	SW 3	SW 4
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Properties in the state as manufactured	1.1	**9.2**				
Minimum tensile strength (N/mm^2)			8	8	8	8
Minimum elongation at break (%)			250	250	150	150
Test for tear resistance	7.1	**7**				
Minimum value (N/mm)			--	5	--	--
Properties after ageing in air oven	1.2	**8.1.3.1**				
Temperature (^0C)			120±2	120±2	120±2	120±2
Duration (h)			7 x 24	7 x 24	7 x 24	7 x 24
Maximum variation for tensile strength (%)			30	30	30	30
Maximum variation for elongation at break (%)			40	40	30	40
Properties after ageing in air bomb	1.2	**8.2**				
Temperature (^0C)			127±2	127±2	127±2	127±2
Duration (h)			40	40	40	40
Requirements						
Maximum variation for tensile strength (%)			50[1)]	50[1)]	50[1)]	50[1)]
Maximum variation for elongation at break (%)			50[1)]	50[1)]	50[1)]	50[1)]
Hot set test	2.1	**9**				
Temperature (^0C)			200±3	200±3	200±3	200±3
Duration (min)			15	15	15	15
Mechanical stress (N/mm^2)			0.2	0.2	0.2	0.2
Requirements						
Maximum elongation under load (%)			100	100	100	100
Maximum elongation after unloading (%)			25	25	25	25
Mineral oil immersion test	2.1	**10**				
Temperature (^0C)			100±2	100±2	100±2	100±2
Duration (h)			7 x 24	7 x 24	24	7 x 24
Maximum variation for tensile strength (%)			40	40	40	40
Maximum variation for elongation at break (%)			40	40	40	40
Linear swell test	7.1	**10**				
Temperature (^0C)			100±2	100±2	--	100±2
Duration (h)			7 x 24	7 x 24	--	7 x 24
Maximum change in linear dimension (%)			15	15	--	15
Halogen gas emission test	IEC 60754-1					
Maximum value (%)			--	5	0.5	0.5

[1)] Only a reduction in values is subject to verification.

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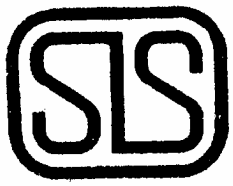

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