SRI LANKA STANDARD 539: 2020

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SPECIFICATION FOR
ENAMEL PAINTS
(Second Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard
SPECIFICATION FOR ENAMEL PAINTS
(Second Revision)

SLS 539: 2020

Gr. 7

SRI LANKA STANDARDS INSTITUTION
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Sri Lanka.

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

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FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Chemical and Polymer Technology and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2020-05-05.

This Specification prescribes the requirements for enamel paints used for protection and decoration of surfaces. Enamel paint is normally applied as a painting system comprising of appropriate primer followed by the undercoating and the finishing enamel. It is desirable that the primer and the finishing enamel are obtained from the same manufacturer for satisfactory results.

This Specification was first published in 1981 and revised in 2010. This is the second revision to SLS 539. In this revision requirements for reducibility with Low aromatic white spirit and recoating properties have been introduced. The methods of determination of drying time, spreading capacity and resistance to water were updated. Limits for metals and the requirement for quantity of material have been reviewed. Considering the adverse impact on human health and safety the permissible limits of lead has been reduced from 600 ppm to 90 ppm.

For the purpose of deciding whether a particular requirement of this Specification is complied with, the value, observed or calculated expressing the result of a test or an analysis, shall be rounded off in accordance with **SLS 102**. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this specification.

In the preparation of this Specification the assistance derived from the following publications is gratefully acknowledged:

IS	133:2013	Enamel, interior: (a) undercoating (b) finishing - Specification
SANS	630:2009	Decorative high gloss enamel paints
SS	7:1998	Specification for Paint-finishing, gloss enamel

1 SCOPE

1.1 This Specification prescribes the requirements and methods of sampling and test for gloss, matt and satin enamel paint finishing used on primed surfaces and uncoated steel, wood, masonry, hard board, compressed fibre board and similar materials used in the construction and finishing of buildings.

1.2 This Specification does not cover automobile paints, water based enamel paint, paints applied for toys and accessories for children and paints used for defense purposes.

2 REFERENCES

ASTM D 5895	Standard test methods for evaluating drying or curing during film formation of organic coatings using mechanical recorders
SLS 102	Rules for rounding off numerical values
SLS 489	Glossary of terms for paints
SLS 523	Methods of sampling of paints
SLS 1256	Methods of test for paints and varnishes
Part 2	Determination of flow time by the use of flow cups
Part 4	Determination of flash point – closed cup method
Part 6	Determination of quantity of material in a container
Part 8	Determination of non-volatile matter
Part 11	Standard panels for testing
Part 13	Determination of hard drying time
Part 17	Visual comparison of the colour of paints
Part 18	Measurement of specular gloss of paint films
Part 19	Determination of contrast ratio (opacity) of light colured paints at a fixed spreading rate (using black and white charts)
Part 20	Scratch test
Part 24	Resistance to water—water immersion method
Part 28	Exposure to laboratory light sources
Section 1	General guidance
Section 3	Fluorescent UV lamps
Part 29	Bend test (Cylindrical mandrel)
Part 30	Determination of surface drying time ballotini method
Part 31	Determination of gloss value at 20^o, 60^o and 85^o
Part 40	Preparation of standard panels for testing (panels other than burnished steel, glass, wood and asbestos)

3 TERMINOLOGY

For the purpose of this Specification, the definitions given in **SLS 489** shall apply:

4 REQUIREMENTS

4.1 Composition

4.1.1 The product shall be in such a composition as to satisfy the requirements of this Specification.

4.1.2 Gypsum and Calcium sulphate shall not be used as raw materials of enamel paints.

4.1.3 Pigments shall be of a pure type, free from foreign matter and have good colour permanence. In the case of white pigment, chalk resisting Titanium dioxide of the rutile type shall be used.

4.1.4 The vehicle shall be an oil modified alkyd resin, appropriate amount of polybasic acid, appropriate amount of polyhydric alcohol and suitable drying oils calculated by weight on the non-volatile portion of the alkyd resin.

4.2 Colour

The colour of the material shall match with the standard colour or any reference colour as agreed to between the purchaser and the manufacturer when tested as prescribed in **SLS 1256: Part 17**.

4.3 Condition of material in container

The material shall not show excessive settling in a freshly opened can containing the specified quantity and shall be easily redispersed with a spatula to a smooth homogeneous state. The material shall not show coagulation, caking or colour separation and shall be free from lumps, skin pieces and foreign matter.

4.4 Dilution stability

The material when diluted according to the manufacturer's instructions and allowed to stand for 2 hours in a well-stoppered glass container, shall remain stable and uniform, showing no significant settling or separation.

4.5 Application properties

4.5.1 *Brushing properties*

The material, as received, shall easily possess good leveling properties when applied as per manufacturer's instructions to a smooth, mild steel panel as given in Appendix **D.1**. The paint shall dry to a smooth, glossy uniform film, and shall be free from running, sagging, streaking or wrinkling.

4.5.2 *Spraying properties*

The material when sprayed as specified in **SLS 1256: Part 11: Section 2** as per manufacturer's instructions to a smooth, mild steel panel as given in Appendix **D.1**, to obtain an even and uniform coat (It shall not be poured or spilled upon the panel), the air dried film shall not show seeding, floating or other film defects.

4.5.3 *Reducibility with low aromatic white spirit, and spray application*

4.5.3.1 When tested in accordance with Appendix **B**, the paint shall mix readily with the low aromatic white spirit to a smooth homogeneous state and shall not show incompatibility after the standing period or wet film defects on panel with flowed-out paint.

4.5.4 Recoating properties

When the paint is overcoated in accordance with Appendix **C**, there shall be no ciss marks or lifting of the first coat. The hard dry time of the second coat shall not exceed 24 h.

4.6 Quantity of material

The volume of the material shall be tested as prescribed in **SLS 1256: Part 6** at 27 ± 2 ^{0}C. The measured volume shall be within a tolerance of ±5 per cent and ±2 per cent from the declared volume for the containers up to 5 litre and above 5 litre respectively.

4.7 Keeping properties (before open the container)

The paint when stored under normal storage and temperature condition in the original sealed container for the specified period, which is not less than 1 year, the paint shall not show skinning, gelling, hard caking or curdling and shall be free from any extraneous matter.

4.8 Finish

When tested and examined as prescribed in Appendix **D**, the paint shall have a smooth and glossy surface, unless otherwise agreed to between the purchaser and the supplier.

4.9 Resistance to artificial weathering

When the paint film is prepared and tested for 400 h as per the method given in **SLS 1256 : Part 28: Section 1** and **SLS 1256: Part 28: Section 3** there shall be no considerable change in colour, loss of gloss, blistering, and cracking of the paint film.

4.10 Spreading capacity

The declared spreading capacity shall comply with the capacity measured by the method prescribed in Appendix **E**.

4.11 Other requirements

The material shall also comply with the requirements given in Table **1** and Table **2,**
when tested in accordance with the relevant methods given in Column (**4**) of each table.

TABLE 1 – Requirements for enamel paints

Sl. No. (1)	Characteristic (2)	Requirement (3)	Method of test (4)
i)	Drying time, max. a) Surface dry, h. b) Hard dry, h.	 4 18	 Appendix F Appendix F
ii)	Flow time (Ford cup No. 4 viscosity cup) at 27 ± 2 °C, seconds, min.	85	SLS 1256 : Part 2
iii)	Gloss (specular reflection value),units, min. at 60 °.	85	Method 1:SLS 1256 :Part 18 Method 2: SLS 1256 :Part 31
iv)	Flash point °C, min.	30	SLS 1256 : Part 4
v)	Non volatile matter, per cent by mass of paint, min.	50	SLS 1256 : Part 8
vi)	Skinning	Pass the test	Appendix G
vii)	Bending properties	Pass the test	SLS 1256 : Part 29
viii)	Scratch resistance (load of 600 g)	Pass the test	SLS 1256 : Part 20
ix)	Resistance to water	Pass the test	Appendix H

TABLE 2- Limits of metals for enamel paints

Sl. No. (1)	Characteristic (2)	Limit (3)	Method of test (4)
i)	Total Lead content, as Pb, mg/kg, max.	90	Appendix J
ii)	Total Chromium content, as Cr, mg/kg, max.	50	Appendix J
iii)	Total Barium content, as Ba, mg/kg, max.	100	Appendix J
iv)	Total Cadmium content, as Cd, mg/kg, max.	5	Appendix J
v)	Total Mercury content, as Hg, mg/kg, max.	0.5	Appendix J

5 PACKAGING AND MARKING

5.1 Packaging

Enamel paint shall be packed in sound, clean, dry leakage free and corrosion resistant containers. The volume of the paint shall be as agreed between the manufacturer and the purchaser.

5.2 Marking

Each container shall be marked or labeled legibly and indelibly with the following information:

a) Name of the product;
b) Name and address of the manufacturer including the country of origin (**NOTE** *Name and address of the manufacturer and the distributor need to be marked on imported products*.);
c) Colour;
d) Brand name, if any;
e) Net volume of the material, in mili1itre or 1itre;
f) Date of manufacture;
g) Shelf life / best before;
h) Batch number or code number or lot identification number;
(**NOTE:** *if one batch is manufactured during the day, date of manufacture may be used as the batch no. /lot identification no. / code no.*)
j) Lead content;
k) Spreading capacity, in m^2/litre;
l) Registered trade mark, if any;
m) Instruction for use including the solvent use for dilution and the dilution ratio;
n) Special precautions to be obtained in use, if required; and
o) Specific warning statement(s), where necessary.

6 METHODS OF TEST

6.1 Tests shall be carried out as specified in **4.7** to **4.11**, Appendix **B** to Appendix **J** and the relevant sections of **SLS 1256**.

6.2 During the analysis, unless otherwise stated, use only reagents of analytical grade and only distilled water.

6.3 For testing purposes, the primer and the finishing enamels shall be from the same source.

7 SAMPLING

Representative samples of the product for ascertaining conformity to the requirements of their specification shall be drawn as prescribed in Appendix **A**.

APPENDIX A
COMPLIANCE OF A LOT

The sampling scheme given in this Appendix shall apply where compliance of a lot to the requirements of this Specification has to be assessed based on sampling and inspection.

Where compliance with this Specification is to be assured, appropriate schemes of sampling and inspection shall be adopted based on manufacturer's control systems coupled with type tests and testing procedures.

A.1 LOT

In any consignment, all the containers of the same size containing paint material of one batch of manufacture shall constitute a lot.

A.2 SAMPLING

The method of drawing representative samples of the material shall be as specified in the relevant clauses of **SLS 523**.

A.3 NUMBER OF TESTS

A.3.1 Each container selected shall be examined for the packaging and marking requirements.

A.3.2 From each of the sample container prepared as specified in **SLS 523** a small but equal quantity of material shall be taken and mixed thoroughly to form a composite sample. The composite sample shall be transferred to another sample container.

A.3.3 The remaining portion of material from each sample container shall constitute an individual sample representing a particular container in the lot.

A.3.4 Tests for requirements given in **4.2** to **4.6** shall be carried out on each individual sample.

A.3.5 Tests for requirements given in **4.7** and **4.11** shall be carried out on the composite sample.

A.4 CRITERIA FOR CONFORMITY

A lot shall be declared as conforming to the requirements of this Specification if the following conditions are satisfied:

A.4.1 Each container examined as in **A.3.1** satisfies the packaging and marking requirements.

A.4.2 Each individual sample satisfied the relevant requirements tested as in **A.3.4.**

A.4.3 The composite sample satisfied the relevant requirements tested as in **A.3.5.**

APPENDIX B
DETERMINATION OF REDUCIBILITY WITH LOW AROMATIC WHITE SPIRIT

B.1. REDUCIBILITY WITH LOW AROMATIC WHITE SPIRIT

B.1.1 Use low aromatic white spirit that contains between 12 per cent and 28 per cent (by volume) of aromatic solvent and that has a boiling range of 140 ^{o}C to 230 ^{o}C

B.1.2 Dilute four volumes of enamel (at a temperature in the range (21 ^{o}C to 32 ^{o}C) with one volume of low aromatic white spirit, at the same temperature. Observe whether the paint mixes readily and easily with the low aromatic white spirit. Almost fill a glass container with the diluted paint, stopper it well. Leave the reduced paint to stand for 4 h at 23 ^{o}C ± 2 ^{o}C.

B.1.3 Examine the condition of the paint in the container. Pour the paint on to a glass panel, and inspect for defects in the film.

APPENDIX C
DETERMINATION OF RECOATING PROPERTIES

Apply two coats of the enamel paints by brushing at a wet film thickness of 60 µm to 65 µm per coat, (unless otherwise specified) on a 70 mm x 150 mm (unless otherwise specified) clean, glass panel prepared in accordance with **SLS 1256: Part 40** allowing 18 h between coats. Examine the panel for film defects, immediately and after drying.

Determine the hard dry time of the second coat as per the method given in the Appendix **F**.

APPENDIX D
TEST FOR FINISH

D.1 TEST PANELS

A mild steel panel of 150 mm x 150 mm in size conforming to **SLS 1256: Part 11: Section 1**.

D.2 PROCEDURE

D.2.1 The material is applied by brushing or spraying as specified in **SLS 1256: Part 11: Section 2** on a clean mild steel panel as given in **D.1** so as to obtain an even and uniform coat and allowed to hard dry for 18 hours.

D.2.2 The film so produced shall be firmly adherent, flexible, smooth and free from wrinkling or sagging with a semi-glossy or glossy surface or as agreed to between the purchaser and supplier.

APPENDIX E
DETERMINATION OF SPREADING CAPACITY

Two methods have been prescribed for the determination of spreading capacity. The method prescribed in **E.1** shall be the reference method and shall be carried out in case of any dispute.

E.1 METHOD 1

This test shall be carried out as specified in **SLS 1256: Part 19** and determine the spreading capacity.

E.2 METHOD 2

E.2.1 PROCEDURE

Weigh an appropriate quantity of the material with a flat bristle brush, of width approximately 40 mm and free from loose bristle. The material shall then be applied by brushing to a flat, smooth and non-absorbent surface one square metre in area in a uniform normal coat commensurate with satisfactory coverage and appearance. The balance of the material with the brush shall be weighed.

The volume of the material shall be tested as prescribed in **SLS 1256: Part 6** at $27 \pm 2\ ^{0}C$.

The spreading rate shall be calculated as the number of square metres that can be covered by one litre of the paint.

The spreading capacity is given as the average spreading rate.

APPENDIX F
DETERMINATION OF DRYING TIME

Two methods have been prescribed for each of the determination for surface drying and hard drying times. The method prescribed in **F.1** shall be the reference method and shall be carried out in case of any dispute.

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F.1 METHOD 1

F.1.1 Determination of surface drying time (Ballotini method)

This test shall be carried out as specified in **SLS 1256: Part 30.**

F.1.2 Determination of hard drying time

This test shall be carried out as prescribed in **SLS 1256: Part 13.**

F.2 METHOD 2

F.2.1 Surface drying time and hard drying time shall be determined as prescribed in **ASTM D 5895**.

APPENDIX G
TEST FOR SKINNING

G.1 PROCEDURE

Fill a clean 500-ml container to three quarter of its capacity with the material, cover it tightly and invert it momentarily. Restore the container to an upright position and leave it in that position for 48 hours at 27 ± 2 ^{0} C. Do not agitate or disturb the sample during this period. Inspect the contents of the tin after 48 hours for skinning.

APPENDIX H
DETERMINATION OF RESISTANCE TO WATER

H.1 PROCEDURE

Apply one coat of enamel paint at a wet film thickness of 60 µm to 65 µm, with an adjustable film applicator to a polished steel panel complying with **SLS 1256: Part 40** and prepare each test panel accordingly. Dry the panel horizontally and age the panels for 7 days in a standard atmosphere, before testing. Carryout the test as described in **SLS 1256: Part 24**, immersing the panel for 16 h. Inspect the panel immediately after removal from the water and again 24 h after removal, for compliance with **SLS 1256: Part 24**.

APPENDIX J
DETERMINATION OF METALS

Atomic Absorption Spectroscopy (AAS) methodology or Inductively Coupled Plasma Mass Spectrometry (ICP-MS) shall be used for the determination of metals.

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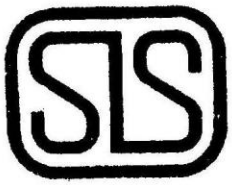
The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*



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SRI LANKA STANDARDS INSTITUTION

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