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SPECIFICATION FOR

GLASS MIRRORS FOR GENERAL PURPOSES

SRI LANKA STANDARDS INSTITUTION

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SLS 718:1985

Gr. 7

SRI LANKA STANDARDS INSTITUTION
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SRI LANKA STANDARD

SPECIFICATION FOR GLASS MIRRORS FOR GENERAL PURPOSES

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1985-11-20, after the draft, finalized by the Drafting Committee on Glass Mirrors, had been approved by the Chemicals Divisional Committee.

At present, methods for determining all the salient features of glass mirrors are not available. However, test methods for the determination of the amounts of silver and copper per unit area are given as they are the chief parameters which govern the durability.

All standard values in this specification are given in SI units.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with CS 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 obtained from the publications of the Indian Standards Institution is gratefully acknowledged.

1 SCOPE

1.1 This specification prescribes the requirements and methods of sampling and test for silvered plane glass mirrors used for general purposes.

1.2 It does not cover heavy duty mirrors, mirrors used in optical instruments and mirrors used for other specific purposes.

2 REFERENCES

IS 2835 Flat transparent sheet glass

CS 102 Presentation of numerical values

SLS 428 Random sampling methods

SLS 535 Methods of test for paints

Part 6 : Durability tests on paint films.

3 DEFINITIONS

For the purpose of this specification the following definitions shall apply:

3.1 float glass: A form of flat glass produced by reheating the continuous ribbon of glass whilst it floats over a bath of molten metal.

3.2 plate glass: Flat glass formed by a rolling process, ground and polished on both sides, with surfaces essentially plane and parallel.

4 REQUIREMENTS

4.1 General requirements

4.1.1 Mirrors shall consist of glass sheets coated with silver on one surface. The silver coating shall be protected by a metallic copper film which in turn shall be covered by a suitable protective coating.

4.1.2 The glass sheet used for mirrors shall comply with the requirements prescribed for AA and A qualities of IS 2835:1977. Polished plate glass or float glass may be used for the mirrors if agreed to between the purchaser and the supplier.

4.1.3 The glass sheet shall be suitably treated before silvering.

4.2 Other requirements

4.2.1 *Silver coating*

The silver coating shall be free from defects or blemishes in the reflecting surface such as lifting or separation of the silver from the glass, sulfide or other spots, haze or any other visible defects. The amount of silver deposit shall not be less than 1 g/m^2 when tested according to the method prescribed in Appendix B.

4.2.2 *Copper coating*

Copper shall be deposited chemically or electrolytically on the silvered surface. The amount of copper deposit shall not be less than 0.65 g/m^2 when tested according to the method prescribed in Appendix B.

4.2.3 *Protective coating*

A suitable protective coating shall be applied over the copper coating. This coating shall not crack or peel the silver or copper coatings due to change in the atmospheric temperature or age-drying.

4.2.4 *Waviness*

The mirrors shall pass the waviness test when tested according to the method prescribed in 8.1.

4.2.5 *Salt spray*

The mirrors shall pass the salt spray test when tested according to the method prescribed in Appendix C.

4.2.6 *Thickness*

Mirrors shall be of thicknesses as specified in Table 1, when tested according to the method prescribed in Appendix D.

TABLE 1 - Thickness of mirrors

Nominal thickness of glass sheet, mm	Thickness of mirrors with tolerance, mm
2.00	2.20 ± 0.20
2.50	2.70 ± 0.20
3.00	3.20 ± 0.20
4.00	4.20 ± 0.20
5.00	5.25 ± 0.25
6.00	6.30 ± 0.30

5 PACKAGING

The mirrors shall be packed as agreed between the purchaser and the manufacturer/supplier.

6 MARKING

6.1 The following shall be marked legibly and indelibly on a label attached to the glass mirror:

a) Name and address of the manufacturer, (including country of manufacture);

b) Registered trade mark, if any;

c) Batch or code number;

d) Nominal thickness of the glass sheet, in millimetres; and

e) Perimeter of the mirror, in millimetres.

6.2 The mirrors may also be marked with the Certification Mark of the Sri Lanka Standards Institution illustrated below on permission being granted for such marking by the Sri Lanka Standards Institution.

NOTE - The use of the Sri Lanka Standards Institution Certification Mark (SLS Mark) is governed by the provisions of the Sri Lanka Standards Institution Act and the regulations framed thereunder. The SLS Mark on products covered by a Sri Lanka Standard is an assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control, which is devised and supervised by the Institution and operated by the producer. SLS marked products are also continuously checked by the Institution for conformity to that standard as a further safeguard. Details of conditions under which a permit for the use of Certification Mark may be granted to manufacturers or processors may be obtained from the Sri Lanka Standards Institution.

7 SAMPLING

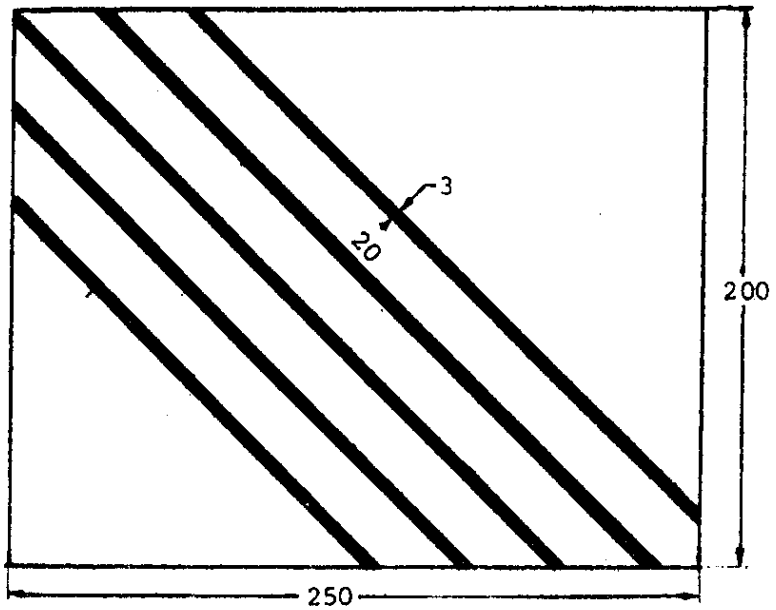
Representative samples of glass mirrors shall be drawn as prescribed in Appendix A.

8 METHODS OF TEST

Tests shall be carried out as specified in 8.1 and Appendices B, C and D.

8.1 Test for waviness

8.1.1 Place a mirror vertically on a suitable fixture. Move in front of the mirror a sketch shown in Figure 1. The sketch comprises of broad straight bands drawn at an angle of 45° to the horizontal within a rectangle.



(All dimensions in millimetres)

FIGURE 1 - Sketch for testing waviness in mirrors

8.1.2 The mirrors shall be deemed to be free from waviness if the image of the bands appears to be free from distortion.

9 CONFORMITY TO STANDARD

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

9.1 Each mirror inspected as in A.3.1 satisfies the marking requirements.

9.2 The number of mirrors not conforming to requirements specified in 4.2.3, 4.2.4, and 4.2.6 is less than or equal to the corresponding acceptance number given in Column 3 of Table 2.

9.3 Each mirror tested as in A.3.2 satisfies the relevant requirements.

APPENDIX A

SAMPLING

A.1 LOT

In any consignment, all the glass mirrors of the same thickness, perimeter, design and manufactured under the same conditions shall be grouped together to constitute a lot.

A.2 SCALE OF SAMPLING

A.2.1 Samples shall be tested from each lot for ascertaining the conformity of the mirrors to the requirements of this specification.

A.2.2 The number of samples to be drawn from a lot shall be in accordance with Column 1 and Column 2 of Table 2.

TABLE 2 - Scale of sampling

Number of mirrors in the lot (1)	Number of mirrors to be selected (2)	Acceptance number (3)
Up to 25	3	0
26 to 50	5	0
51 to 90	8	1
91 to 150	10	1
151 and above	13	2

A.2.3 The mirrors shall be selected at random. In order to ensure randomness of selection, random number tables as given in **SLS 428** shall be used.

A.3 NUMBER OF TESTS

A.3.1 Each mirror selected as in A.2.2 shall be inspected for marking requirements and tested for requirements specified in 4.2.3, 4.2.4 and 4.2.6.

A.3.2 One mirror, if the lot contains 50 or less mirrors, two mirrors otherwise, shall be selected from the mirrors selected as in A.2.2 and subjected to tests for determining requirements specified in 4.2.1, 4.2.2 and 4.2.5.

APPENDIX B

TEST FOR SILVER AND COPPER COATINGS

B.1 PRINCIPLE

The silver and copper deposits are dissolved in nitric acid. Silver is estimated by titrating with ammonium thiocyanate solution. Copper is estimated by comparing the intensity of cupro-ammonium complex of the test solution with that of a standard copper sulfate solution.

B.2 REAGENTS

B.2.1 *Nitric acid,* concentrated rel. den. = 1.42.

B.2.2 *Ammonium thiocyanate solution,* $c(NH_4CNS) = 0.01$ mol/l, *standard volumetric solution,* Dissolve about 1 g of ammonium thiocyanate in 1 litre of water. Standardize against silver nitrate solution, $c(AgNO_3) = 0.01$ mol/l, using ferric ammonium sulfate solution as indicator.

B.2.3 *Ferric ammonium sulfate solution,* Dissolve about 8 g of ferric ammonium sulfate in 400 ml of water containing 3 ml to 5 ml of concentrated sulfuric acid, (rel. den. = 1.84).

B.2.4 *Starch indicator,* Triturate 5 g of starch and 0.01 g of mercuric iodide with 30 ml of cold water and slowly pour it with stirring into 1 litre of boiling water. Boil for 3 minutes. Allow to cool and decant off the supernatant clear liquid.

B.2.5 *Standard copper sulfate solution,* Weigh about 4 g of copper sulfate and dissolve in water. Add 5 ml of glacial acetic acid. Transfer the solution to a 1 000-ml graduated flask and make upto the mark with water. Standardize against sodium thiosulfate solution, $c(Na_2S_2O_3) = 0.01$ mol/l, with potassium iodide using starch as indicator.

B.2.6 *Ammonium hydroxide,* 20 per cent *(V/V)* solution, prepared by using concentrated ammonium hydroxide (rel. den. = 0.88).

B.3 PROCEDURE

Take a sample of known area. Remove any paint or varnish from the mirror back with methylated spirit. Dissolve the copper/silver deposit using the acid over the mirror back with a glass rod. Wash the nitric acid containing the copper/silver deposits into a 200-ml porcelain basin and evaporate carefully the solution to dryness on a sand-bath. Dissolve the residue in 3 to 5 drops of concentrated nitric acid and a little water. Boil the solution, cool and transfer to a 250-ml volumetric flask and make up the volume to the mark with water.

B.3.1 Determination of silver

Take 50 ml of the solution prepared in B.3 and titrate with standard ammonium thiocyanate solution (B.2.2) using 5 ml of ferric ammonium sulfate solution (B.2.3) until the brown colour appears.

B.3.1.1 *Calculation*

$$\text{Silver deposit, in g/m}^2 = \frac{V \times c \times 5 \times 0.108}{A}$$

where,

V = volume, in millilitres, of standard ammonium thiocyanate (B.2.2) required for the titration;

c = concentration, in moles per litre, of the standard ammonium thiocyanate solution; and

A = area, in square metres, of the sample.

B.3.2 Determination of copper

Take a 10-ml portion of the solution prepared in B.3 and transfer to a 100-ml Nessler tube. Add 10 ml of ammonium hydroxide solution (B.2.6) and make to 100 ml mark with water. Transfer to a second 100-ml Nessler tube, 10 ml of ammonium hydroxide solution and make up to 100 ml with water. Add standard copper sulfate solution (B.2.5) to this Nessler tube until the blue colour of the solutions in both Nessler tubes matches.

B.3.2.1 *Calculation*

$$\text{Copper deposit , in g/m}^2 = \frac{m \times 25}{A}$$

where,

m = mass, in grams, of copper present in the volume of standard copper sulfate solution used; and

A = area, in square metres, of the sample.

APPENDIX C

SALT SPRAY TEST

C.1 APPARATUS

Salt spray cabinet as specified in SLS 535:Part 6:Section 6.2, shall be used.

C.2 TEST SAMPLE

Cut test specimens from the corners (in the case of rectangular mirrors) or from the edges of the glass mirrors, as large as possible, but not exceeding 150 mm x 200 mm in size. Seal the cut edge with an inert asphalt paint that will withstand the action of the salt-spray atmosphere. The original edge of the specimen shall not be coated with the asphalt paint but shall be left intact. The overlap of the asphalt paint applied to seal the cut edge of the glass mirror shall not exceed 3.0 mm. If the mirrors are not too large to be placed in the salt-spray cabinet, the entire glass mirrors shall be tested.

C.3 PROCEDURE

Place the prepared specimens of mirrors in the salt spray cabinet (C.1), with the protective coating side up, at an angle of 45° with the horizontal. Subject the specimens to the spray of saturated salt water at 36 ± 2 °C for 12 hours, remove from the cabinet, and allow to stand for 8 hours. Ensure that the surface being tested is thoroughly wetted with the spraying medium and is not allowed to dry during the period of the test.

C.4 The silver shall not show pinholes, spots, fog, cloudiness, haze, separation or any other defects.

C.5 Any defects which develop in the silvered area within 16 mm of the cut and sealed edge shall be discarded in the final inspection of the tested mirrors.

APPENDIX D

DETERMINATION OF THICKNESS

D.1 APPARATUS

Screw calipers, with an accuracy of 0.01 mm.

D.2 GLASS MIRROR SIZES

For the purpose of determining thickness, glass mirrors shall be divided into the following three categories:

a) Perimeter below 1.2 m;

b) Perimeter from 1.2 m to 2.4 m; and

c) Perimeter over 2.4 m.

D.3 PROCEDURE

D.3.1 Marking of points

Draw a rectangle on the surface of the mirror, to cover as wide an area as possible. Draw two diagonals across this rectangle and mark points, A, B, C and D as shown in Figure 2.

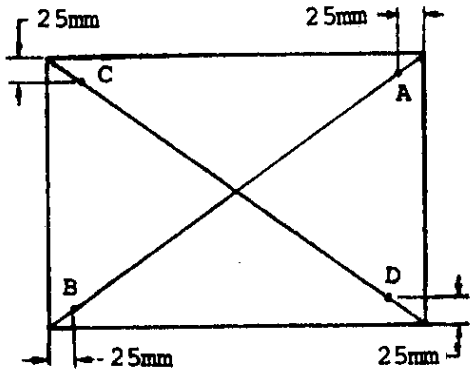


FIGURE 2 - Determination of thickness

D.3.2 Determination of thickness

Measure the thickness of the glass mirror using screw calipers at the four points, A, B, C and D as indicated in Figure 2.

D.3.2.1 *Glass mirrors below 1.2 m perimeter*

Thickness at all the four points A, B, C and D shall individually be within the range specified for a given nominal thickness in Table 1.

D.3.2.2 *Glass mirrors from 1.2 m to 2.4 m perimeter*

The average thickness at points A and B and the average thickness at points C and D shall be within the range specified for a given nominal thickness in Table 1.

D.3.2.3 *Glass mirrors over 2.4 m perimeter*

The average thickness at all the points A, B, C and D shall be within the range specified for a given nominal thickness in Table 1.

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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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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

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