
Paints and Varnishes - Specification for nitrocellulose lacquer

1. Scope

This ECOWAS Standard specifies the requirements, methods of sampling and test for clear nitrocellulose lacquer used as a transparent coating on wood, metal, etc substrates and as finish lacquer enamel on wood, metal, etc. substrates.

2. Normative references

The following standards contain provisions which through reference in this text, constitute provisions of this standard. All standards are subject to revision, and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of these reference standards.

- 2.1 ISO 1513: 1992 - Examination and preparation of samples for testing.
- 2.2 ISO 2814:1973 – Paints and varnishes – Comparison of contrast ratio (hiding power) of paints of the same type and colour.
- 2.3 ISO 2813:1994 – Paints and varnishes – Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees.
- 2.4 ISO 2812-2: 1993 – Paints and varnishes – Determination of resistance to liquids – Part 2:Water immersion methods.
- 2.5 ISO 15528:2000 – Paints, varnishes and raw materials for paints and varnishes – Sampling.
- 2.6 ISO 1514:1993 – Paints and varnishes – Standard panels for testing.
- 2.7 ISO 2431:1993 – Paints and varnishes – Determination of flow time by use of flow cups.
- 2.8 ISO 2808:1997 – Paints and varnishes – Determination of film thickness.
- 2.9 ISO 2812-1:1993 – Paints and varnishes – Determination of resistance to liquids – Part 1: General methods.
- 2.10 ISO 4630: 1997 – Binders for paints and varnishes – Estimation of colour of clear liquids by the Gardner colour scale.
- 2.11 ISO 7724-2: 1984 – Paints and varnishes – Colorimetry – Part 2: Colour measurement
- 2.12 ISO 7724-3: 1984 – Paints and varnishes – Colorimetry – Part 3: Calculation of colour differences

- 2.13 ISO 1524:2000 – Paints, varnishes and printing inks – Determination of fineness of grind.
- 2.14 GS 798:2005 - Paints and Varnishes – Determination of transparency.

3. Definitions

For the purposes of this standard the following definitions apply:

3.1

clear lacquer

a transparent liquid coating manufactured from nitrocellulose, resin, and organic solvent which dries primarily by physical evaporation when applied on substrates

3.2

lacquer enamel

an opaque or a transparent coloured liquid coating manufactured by dispersing pigments in clear lacquer

3.3

defective

a test sample or a container of nitrocellulose lacquer that fails in one or more respects to comply with the requirements of this standard

3.4

lot

the quantity of nitrocellulose lacquer of the same type, in containers, bearing the same batch identification number produced by one manufacturer and submitted at any one time for inspection and testing

3.5

standard conditions

shall be $25 \pm 2^{\circ}\text{C}$ and relative humidity of $60 \pm 5\%$

3.6

graining

the imitation of the appearance of wood by the skilful use of suitable tools and coating materials

4. Classification (Types)

Nitrocellulose lacquer shall be classified as follows:

4.1 Clear lacquer

Clear lacquer shall be of two types according to their end use. They are:

4.1.1 Clear lacquer for wood

4.1.2 Clear lacquer for finishing

4.2 Lacquer enamel

Lacquer enamel shall be of five types depending upon their colours as given below:

4.2.1 White lacquer enamel

4.2.2 Tint lacquer enamel

NOTE: Tint colour is a weak gray or cream colour appearing on a white paint film whose lightness shall be greater or equal to 6 and less than 9.

4.2.3 Silver lacquer enamel

4.2.4 Transparent lacquer enamel.

4.2.5 Lacquer enamel of other colours.

5. Requirements

5.1 The lacquer shall conform to the requirements given in Table 1 when tested in accordance with the test methods given in the table .

Table 1 – Requirements of clear lacquer and lacquer enamel

No.	Characteristic	Requirements			Test Methods
		Clear lacquer		Lacquer enamel	
		Clear lacquer for wood	Clear lacquer for finishing		
1	Condition in container	The lacquer shall be smooth and uniform without any hard lumps when mixed			ISO 1513
2	Colour number (Gardner) max	12	-	-	ISO 4630
3	Degree of dispersion, μm , max, (Except silver colour)	-	-	10	ISO 1524
4	Transparency	It shall be transparent		-	GS 798
5	Application properties	The lacquer shall show no tendency to produce any orange peel effect and the second coat shall join well with the first coat after drying for 30 min. The dry lacquer below shall be free from sag or cissmarks, pinholes or floatation			CI.9.7
6	Full dry time, h, max	1.0			CI.9.8
7	Appearance of paint film	The appearance of lacquer film shall be normal			CI.9.9
8	Contrast ratio (Except silver and transparent colours)	-	-	It shall be 0.9 or more for white and tint colour, and 0.8 or more for other colours. Provided that it should be 0.5 or more for clear,	CI.9.10

				red, blue and yellow	
9	Specular gloss (60°) ⁽¹⁾ min.	-	-	80	Cl.9.11
10	Blocking resistance	There shall be blocking resistance			Cl.9.12
11	Bleeding (Except white and silver colours) ⁽²⁾	-	-	There shall be no bleeding	Cl.9.13
12	Heating stability of paint film (Restricted to white)	-	-	There shall be no change in appearance when heated between 115°C to 12°C for 2 hours	Cl.9.14
13	Water resistance	-	There shall be no abnormalities when the test panel is immersed in 20°C water for 18 h after heating at 80°C for 30 min.		Cl.9.15
14	Boiling-water resistance	There shall be no abnormalities when it is immersed in boiling water for 10 min.	-	-	Cl.9.16
15	Gasoline resistance	There should be no abnormalities when immersed in gasoline No.1 for 2 h.	There should be no abnormalities when immersed in gasoline No.2 for 2 h.		Cl.9.17
16	Heating residue of clear lacquer, %, min	28	22	-	Cl.9.18
17	Heating residue of white and tint coloured lacquer enamel, % min	-	-	35	Cl.9.18
18	Heating residue of silver, transparent and other coloured lacquer enamel, %, min	-	-	30	Cl.9.18

⁽¹⁾ If the specular gloss is less than 80, the limit agreed upon between the parties Concerned can be adopted.

⁽²⁾ When a special pigment is used for the manufacture of red or yellow lacquer enamel at the request of the purchaser, the bleeding requirement can be omitted.

6. Packing and marking

6.1 Packing

The lacquer shall be packed in clean, dry containers. The containers shall be strong enough to withstand normal usage and shall be adequately sealed to prevent leakage and contamination of the contents during normal transporting and handling.

6.2 Marking

The following information shall be legibly and durably marked on each container or on a label securely fixed on it:

- (a) Name of product
- (b) Net mass (kg) or net volume (l)
- (c) Name and address of manufacturer or registered trade mark or both
- (d) Year of manufacture
- (e) Batch number
- (f) Country of manufacture
- (g) Safety symbols (for toxicity and flammability)
- (h) Safety precautions for handling, application, and use, as applicable

7. Sampling and testing

7.1 Sampling

7.1.1 Unless otherwise agreed upon, samples shall be randomly selected in accordance with ISO 15528 to determine whether a sample or lot complies with the requirements of this specification.

7.1.2 Thoroughly mix or stir the contents of the container(s) so drawn (7.1.1) until a completely homogeneous product is obtained and take from the container(s) a test sample of volume of at least 1 litre. If the containers in the lot have a capacity of less than 1 litre, take at random enough containers to provide at least a one-litre test sample.

7.2 Testing

The samples selected in accordance with 7.1 shall be tested for the requirements given in clause 5 using the methods given in Table 1.

8. Compliance criteria

The lot shall be deemed to comply with the requirements of this standard if after inspection of the containers in the lot and on testing of the sample taken in accordance with 7.1 no defect is found.

9. Methods of test

NOTE: At least one litre of sample is required for the tests.

9.1 General conditions

9.1.1 The place for test shall be at a temperature of $25 \pm 2\%$ and relative humidity of $60 \pm 5\%$.

9.1.2 The place for spraying shall be a place, preferably in a spray booth with wind velocity of 0.7 m/s, at a temperature of $25 \pm 2^{\circ}\text{C}$ and $60 \pm 5\%$ R.H.

9.2 Panels

9.2.1 Steel panel, of size 150 mm x 70 mm x 0.8 mm that have been solvent cleaned in accordance with ISO 1514.

9.2.2 Glass panel, of size 150 mm x 70 mm x 2 mm. In the case of the specular gloss test, the thickness of the panel shall be 5 mm. The panel shall be solvent cleaned in accordance with ISO 1514.

9.2.3 Tinplate panel, of dimensions 200 mm x 100 mm x 0.3 mm that have been cleaned in accordance with ISO 1514. In the case of the drying time test the dimensions of the tinplate shall be 150 mm x 70 mm x 0.3 mm.

9.3 Dilution of samples

Samples shall be diluted using the compounded thinner given in Table 2. The thinner given in Table 2 shall have a flow time (viscosity) in the range 15 s – 19s when determined in accordance with ISO 2431 using a Ford No.4 viscosity cup.

Table 2 – Composition of thinner

Components	Ratio of components (by volume)
Ethyl acetate	15
Butyl acetate	15
n-butanol	5
Toulene/xylene	65

9.4 Coating of sample

Samples shall be diluted in accordance with 9.3, and applied twice on one side of the test plate using a suitable spray gun. The second application shall be carried out 30 minutes after the first application.

9.5 Thickness of dry lacquer film

The thickness of lacquer film shall be between 20 μm and 30 μm in the case of double coatings of clear lacquer and between 30 μm and 40 μm in the case of lacquer enamel when determined in accordance with ISO 2808.

9.6 Evaluation sample

The evaluation sample shall be as given in Table 3

Table 3 – Evaluation sample

Requirement	Observing items	Grouping		
		Type	Method setting up	Quality level
Transparency	Transparency	Coatings of lacquer sample.	Agreed reference sample or Manufacturer's sample	Boundary sample*
Appearance of lacquer film	Colour and gloss	Lacquer film or lacquer sample	Manufacturer's sample	Standard sample**
	Grainning and orange peel	Lacquer film or lacquer sample		Boundary sample
<p>* Boundary sample shall be the evaluation sample giving the permissible limit of the quality of test samples, e.g. the evaluation sample to use for evaluating the degree of unevenness in colour and gloss, brushmarks, sagging or wrinkling of a test film.</p> <p>** Standard sample shall be the sample giving the central (average) quality of test samples e.g. the evaluating sample for evaluating the colour or gloss of a test film.</p>				

9.7 Application properties

9.7.1 Panel

Use the tin plate (200 x 100 x 0.3 mm) specified in 9.2.3 as the test plate.

9.7.2 Dilution of sample

Carry out the dilution of the sample in accordance with 9.3.

9.7.3 Coating

Coat the test piece twice in accordance with 9.4.

9.7.4 Thickness of lacquer film

The thickness of lacquer film shall be as given in 9.5 when determined in accordance with ISO 2808.

9.7.5 Procedure

After applying the second coat as given in 9.4, dry it under standard conditions. During spraying, examine the spray pattern for freedom from spattering. Leave the panel to dry in a vertical position.

Examine the dry film for compliance with the application properties given in Table 1.

9.8 Drying time

9.8.1 Panel

Use the tinplate (150 x 70 x 0.3mm) as specified in 9.2.3 as the test plate.

9.8.2 Dilution of sample

Dilute the sample in accordance with 9.3.

9.8.3 Coating

Coat the test piece once in accordance with 9.4.

9.8.4 Thickness of lacquer film

The thickness of the dry lacquer film shall be as given in 9.5.

9.8.5 Procedure

Leave the panel to dry after coating in a horizontal position with the coated surface upward and dry for one hour under standard conditions.

Place the middle part of the coated surface strongly between the thumb and forefinger.

Rub the middle part of the coated surface repeatedly with the finger, examine for traces of lacquer film.

9.9 Appearance of lacquer film

9.9.1 Evaluation sample

The evaluation sample shall be as given in Table 3.

9.9.2 Test panel

The test panel shall be the test panel used in 9.7. Let it stand for 24h

9.9.4 Procedure

Under diffuse daylight compare the surface of the lacquer film of evaluation sample and that of the test panel for differences in colour (use ISO 3668) and gloss and the degree of graininess and orange peel. Report as conforming to the requirement giving in Table 1 when there is little difference in colour and gloss and the degree of graininess and orange peel are minimal.

9.10 Contrast ratio (Lacquer enamel only)

9.10.1 Preparation of test piece

Fix a hiding-chart horizontally on a flat glass panel under standard conditions. Apply an undiluted sample on it using a double film applicator with 200µm gap.

Leave the glass panel to dry for 24h in a horizontal position with the coated side upwards. Prepare two test pieces.

9.10.2 Method

Measure luminous reflectance of the film which has been applied on the white and black surfaces of the two test panels in accordance with ISO 2814 and calculate the contrast ratio accordingly.

9.11 60° Specular gloss (Lacquer enamel only)

Apply the sample in accordance with 9.3, 9.4 and 9.5 to a glass panel (see 9.2.2). Leave the panel in a horizontal position to dry for 1 hour under standard conditions with the coated side upward.

Heat the test panel in a controlled oven at $80^{\circ} \pm 2^{\circ}\text{C}$ for 30 mins. and condition it for 1 hour under standard conditions.

Determine the gloss in accordance with ISO 2813.

9.12 Blocking resistance

9.12.1 Preparation of test piece

Apply the sample on one side of the glass panel (100mm x 100mm x 2 mm) as given in 9.3, 9.4 and 9.5. Let the panel stand in a horizontal position for 1 hour under standard conditions with the coated side upwards. Heat it in a themostically controlled oven at $80^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 30 mins. Let it stand for another 1 hour under standard conditions.

9.12.2 Procedure

Place the coated surface of the test piece (9.12.1) upwards. Pile up 5 sheets of gauze which has been previously conditioned at a temperature of 40°C for 1 hour or more at the centre of the test panel. Put a cylindrical weight measuring 40mm in diameter and 500g. in mass with a flat base, which has previously been conditioned at 40°C for 1 hour or more, at the centre of the gauze. Leave it in a controlled oven kept at $40 \pm 2^{\circ}\text{C}$ for 18 hours. Take it out, peel the gauze from the lacquer film, and check the cloth mark printed on the surface of the lacquer film.

9.12.3 Observation

When the cloth mark printed on the surface of lacquer film is minimal, report as “there is blocking resistance”.

9.13 Bleeding (Lacquer enamel only)

9.13.1 General – When recoating on the film with white lacquer, examine the film for any changes in colour due to bleeding.

9.13.2 Panel – Use a tin plate, 150 mm x 70 mm x 0.3 mm, as given in 9.2.3.

9.13.3 Procedure

Using the tinplate given in 9.2.3 as the test panel, apply the sample on one half of the test panel in accordance with 9.3 to 9.5. Place the panel horizontally with the coated surface upwards, dry it for 24 hours under standard conditions. Overcoat it with white lacquer enamel in accordance with 9.3 to 9.5.

Evaluate the bleeding condition of the film after 1h of standing with respect to the requirement given in Table1.

9.14 Heating stability of lacquer film

9.14.1 Test panel

Use the tin plate, (150 mm x 70 mm x 0.3 mm) specified in 8.2.3.

9.14.2 Preparation of test piece

Apply the sample on one side of the test panel (9.14.1) in accordance with 9.3 to 9.5. Dry it under standard conditions for 24h and use it as the test panel. Prepare one test panel.

9.14.3 Temperature and duration of test

Carry out the test at $118 \pm 2^{\circ}\text{C}$ for a period of 2h.

9.14.4 Procedure

Before heating, measure tristimulus value on CIE 1976 standard colorimetric system in accordance with ISO 7724-2.

Carry out the test in accordance with ISO 3248 cl. 6.

First inspect the appearance of the lacquer film visually for signs of deterioration and after the inspection check its tackiness by touching it slightly with the finger tip. Then, making use of the tristimulus value on CIE 1976 standard colorimetric system, calculate the colour difference before and after heating the test panel in accordance with ISO 7724-3.

9.14.5 Report

In the absence of bubbles, blisters, crackiness, peeling and tackiness on the lacquer film and when the colour difference is less than 2.0, report that "Heating at $116^{\circ}\text{C} - 120^{\circ}\text{C}$ for 2h gives no change in appearance".

9.15 Water resistance (Clear lacquer for finishing and lacquer enamel)

9.15.1 Test panel, shall be the steel panel of dimensions 150 mm x 70 mm x 0.8 mm specified in 9.2.1

9.15.2 Preparation of test piece

Apply the sample on one side of three test panel in accordance with 9.3 to 9.5. Let them stand in a horizontal position with the coated surface upwards under standard conditions for 1 h. Heat them in a controlled oven at $80 \pm 2^{\circ}\text{C}$ for 30 min. Let them stand under standard conditions for 1h, recoat at the back side 5 mm of the periphery of 2 of them. Make one of the samples the original test panel. Let the three test panels stand for additional 2h.

9.15.3 Temperature for immersion: $20 \pm 1^{\circ}\text{C}$

9.15.4 Time for immersion: 18h

9.15.5 Area(s) to observe: Surface of lacquer film including interfacial part of liquid.

9.15.6 Method: Use ISO 2812-2

9.15.7 Final examination

At the end of the immersion period, remove each test panel and blot the test panels with absorbent paper and immediately examine the whole test surface of each test panel visually and again 2h after removal. When examined there shall be no wrinkles, blisters, cracking or peeling of the lacquer film of 2 test panels. After an additional 2h have elapsed the change in gloss, clouding, blushing and degree of colour change shall be minor when compared with the original test panel.

Report that "Immersion in water at 20°C for 18 h after heating at 80°C for 30 min produces no defects if the above conditions are met.

9.16 Boiling – water resistance (Clear lacquer only)

9.16.1 Test Panel

A glass panel of dimensions 150 mm x 70 mm x 2 mm (see 9.2.1).

9.16.2 Preparation of test panel

- (a) Dilute the sample with the thinner given in Table 2 so that its viscosity falls within the range 15s and 25s when determined in accordance with GS ISO 2431 using Ford No. 4 cup.
- (b) Place the sample in a suitable container to a depth of about 120mm.
- (c) Put the glass plate 150 mm x 70 mm x 2 mm, (9.2.2) into the sample in the container; making its long side perpendicular. Immerse it until about 100 mm becomes wet. Draw it up immediately and dry it with the dry end downward.
- (d) Thirty minutes after the first dip coating, carry out a second dip coating in the same way as 9.16.2 (c).
- (e) After drying for 1h, heat it in an oven at a temperature of $80 \pm 2^{\circ}\text{C}$ for 30 min; and let it stand for one more hour under general conditions to prepare the test panel.
- (f) The quantity applied shall be enough to make the thickness of the dried lacquer film to be between (25 – 35) μm per side.
- (g) Prepare 3 test panels, and make one of them as the original test panel.

9.16.3 Procedure

- (i) Use ISO 2812-2
- (ii) The time of immersion shall be 10 mins.
- (iii) Add 2 or 3 pieces of porcelain to boiling water
- (iv) The temperature of the water shall be that of boiling water.

9.16.4 Final examination

At the end of the immersion period, remove the test pieces, blot them with absorbent paper and examine the lacquer film visually and also after 2h for signs of wrinkling, blistering, cracking and peeling of two test panels.

After 2h standing compare the original test panel with the immersed test panels for change in gloss, clouding, blushing and of colour change. When the changes in the immersed

panels are minimal compared to the original test panel and when there are no sign of film defects, report that the film is resistant to boiling water.

9.17 Gasoline resistance

9.17.1 Panel

Steel panel of dimensions 150 mm x 70 mm x 0.8 mm as given in 9.1.1.

9.17.2 Preparation of test panel.
Follow 9.15.2.

9.17.3 Method

- (a) Use Method 1 (Procedure A) of ISO 2812-1
- (b) Test liquid - Use gasoline No.1 for clear lacquer for wood and gasoline No.2 for clear lacquer for finishing and lacquer enamel. Gasoline No.1 and Gasoline No.2 shall be compounded as given in Table 4.

Table 4 – Compounding ratio of gasoline for test (volume)

Reagents	Gasoline No.		
	1	2	3
Benzene*	10	9	8
Toluene	0	1	2

*The commercial name is petroleum benzene

- (c) Period of immersion: Shall be 2 h
- (d) Temperature of test shall be $20 \pm 1^{\circ}\text{C}$

9.17.4 Final examination

- (a) Examine the dry lacquer film of two of the immersed test panels for defects such as blisters, wrinkles, cracking and peeling.
- (b) Compare the original test panel with the immersed test panels for changes in colour and gloss, and softening.
- (c) Examine colour and turbidity of gasoline used.
- (d) Report the film to be resistant to gasoline when:
 - (i) no defects (9.17.4a) are observed
 - (ii) changes in gloss and colour and softening are minimal (9.17.4b)
 - (iii) colour and turbidity of gasoline used are normal (9.17.4c)

9.18 Heating residue

9.18.1 Test Temperature

The test temperature shall be $105 \pm 2^{\circ}\text{C}$

9.18.2 Period of heating

The period of heating shall be 3 hours.

9.18.3 Mass of test portion

The mass of the test sample shall be 2g for the lacquer enamel.

9.18.4 Method

Use the method given in ISO 3251.

ANNEX A

Bibliography

(Informative)

The following standard contain useful information about parts of this standard:

ISO 4628: 1: 1982 - Paints and varnishes - Evaluation of degradation of paint coating - Designation of intensity, quantity and signs of common types of defect - Part 1 - General principles and rating schemes.

ANNEX B

(Informative)

Quality verification of nitrocellulose lacquer.

When the purchaser requires on going quality verification of nitrocellulose lacquer produced to this standard, it is suggested that, instead of concentrating solely on evaluation of the final product, he also directs his attention to the manufacturer's quality system. In this connection it should be noted that ISO 9001: 2000 covers the provisions of an integrated quality system.