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Vitreous and porcelain enamels — Determination of resistance to citric acid at room temperature

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2722 was drawn up by Technical Committee ISO/TC 107, *Metallic and other non-organic coatings*, and circulated to the Member Bodies in June 1972.

It has been approved by the Member Bodies of the following countries :

Australia	Italy	Sweden
Egypt, Arab Rep. of	Japan	Switzerland
France	Netherlands	Thailand
Germany	New Zealand	Turkey
Hungary	Poland	United Kingdom
India	Portugal	U.S.S.R.
Ireland	Romania	
Israel	South Africa, Rep. of	

No Member Body expressed disapproval of the document.

Vitreous and porcelain enamels – Determination of resistance to citric acid at room temperature

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method of test for the determination of acid resistance, at room temperature, of vitreous and porcelain enamelled articles and a method for classifying the results.

It is not suitable for matt enamels, enamels that come in contact with hot and strong acids and enamelled articles that are used in the chemical industry.

2 REFERENCES

ISO 2723, *Vitreous and porcelain enamels for sheet steel – Production of specimens for testing.*

ISO 2724, *Vitreous and porcelain enamels for cast iron – Production of specimens for testing.*

3 PRINCIPLE

A part of the surface of the specimen is exposed to attack by a 100 g/l citric acid solution for 15 min \pm 30 s.

The results are based on the appearance and cleanability of the enamelled surface.

4 REAGENTS

4.1 Citric acid solution, 100 g/l.

Dissolve 10 g of pure crystalline citric acid ($C_6H_8O_7 \cdot H_2O$) in 100 ml of distilled or demineralized water.

A fresh solution, prepared the same day, is required for each test.

4.2 **Grease solvent**, such as trichloroethylene or acetone, suitable for cleaning the specimen.

5 APPARATUS

5.1 **Graduated measuring cylinder**, capacity 100 ml.

5.2 **Pipette**.

5.3 **Towel**, of white cotton or flax.

5.4 **Filter paper**.

5.5 **Pencil**, HB hardness (or equivalent).

5.6 **Caps** (i.e. watch-glasses), made of polyethylene or glass, external diameter approximately 30 mm.

5.7 **Balance**, accurate to $\pm 0,1$ g.

5.8 **Electric lamp**, 40 W, inside white (for example siliconized).

6 TEST SPECIMENS

6.1 The specimens can be commercial items, parts thereof or test pieces specially prepared in accordance with the International Standards for the appropriate basis metal.

NOTE — Production of specimens for testing vitreous and porcelain enamels

- for sheet steel — see ISO 2723;
- for cast iron — see ISO 2724.

6.2 Each specimen shall be cleaned with the grease solvent (4.2), rinsed in hot water until the water spreads evenly on the surface and then dried with the clean towel (5.3); it shall be dabbed, not rubbed.

7 PROCEDURE

7.1 Attack by the test solution

Place a few drops of the test solution (4.1) on each specimen and keep at a temperature of $23 \pm 3^\circ\text{C}$ during the whole period of the test so that there is a continuous etching zone, the diameter of which shall be less than that of the cap (5.6); cover the etching zone immediately with the cap.

After $15 \text{ min} \pm 30 \text{ s}$, remove the cap, wash the specimen with either distilled, demineralized or running water, then dry it with filter paper without wiping.

Take care that, when using running water, no film of water is allowed to form, otherwise the classification might be altered.

7.2 Determination

Examine each specimen within 2 h of the completion of the test attack.

For the evaluation, only that part of the surface of the specimen which has been subjected to attack by acid shall be considered as a treated area.

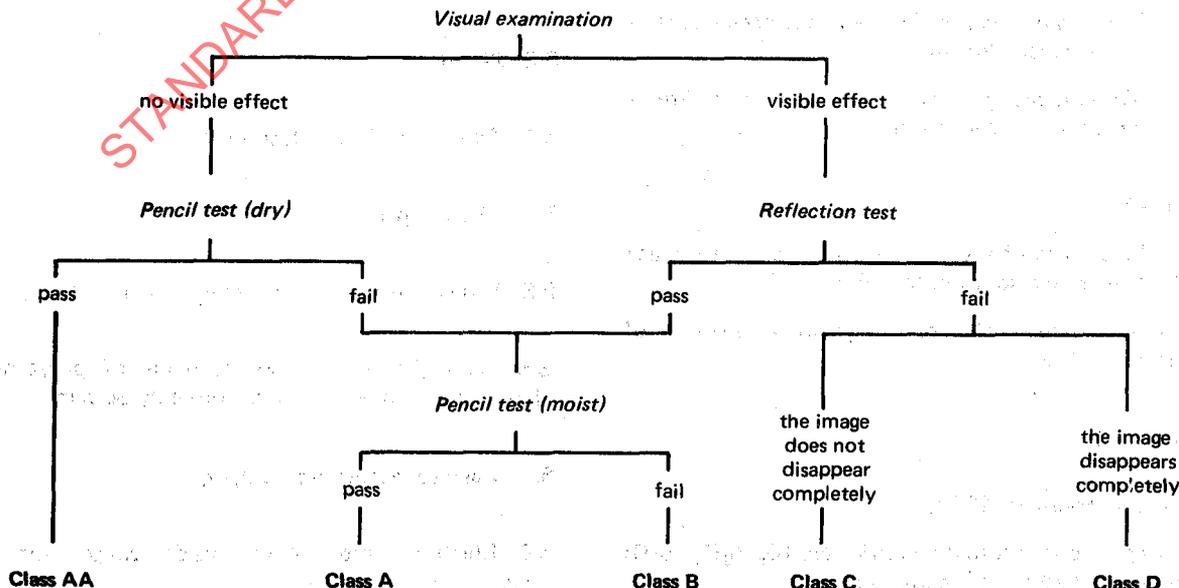
The evaluation is based on the following examinations which shall be in accordance with the scheme and results given below.

7.2.1 Visual examination

View the different areas at varying angles, at a distance of 250 mm from the specimen without a magnifying glass, in order to ascertain whether or not the treated area differs from the non-treated area (for instance, if the brightness or the colour has changed or if some spots have appeared). Carry out the examination in daylight, avoiding direct sunlight. The specimen can also be examined in artificial light provided the latter is uniform and strong enough. If the treated area differs in any respect from the non-treated area, the specimen fails the test.

7.2.2 Pencil test (dry)

Draw some nearly parallel lines on both the treated and non-treated areas. If, on rubbing the specimen with the dry towel (5.3), the lines on the treated area are more difficult to remove than those on the non-treated area, the specimen fails the test with the pencil (5.5).



7.2.3 Reflection test

7.2.3.1 Set the specimen in such a way that the image of the test lamp (5.8), 35 ± 10 cm away from the specimen reflects on the non-treated area with an angle of incidence of 45° . Then watch the image of the lamp on the non-treated area while the specimen is slowly removed, so that the image of the lamp moves into the treated area. If no blurring of the image is observed while it passes from one area to the other, the specimen passes the test.

7.2.3.2 If such is not the case, it is necessary to distinguish, in the passage from one area to the other, if there is a blurring or a complete disappearance of the image.

7.2.4 Pencil test (moist)

Repeat the test specified in 7.2.2 using the towel (5.3) which has been moistened with water and thoroughly wrung out, without using any soap or detergent. If the lines on the treated area are more difficult to remove than those on the non-treated area, the specimen fails the test with the pencil (5.5).

8 CLASSIFICATION OF RESULTS

In consequence of the determinations which have been performed in accordance with 7.2, the enamels are divided into several classes which are conveniently shown from AA to D, as given in the table.

Class	Visual examination	Reflection test	Test with pencil	
			Dry	Moist
AA	pass	—	pass	—
A	pass	—	fail	pass
	fail	pass	—	pass
B	pass	—	fail	fail
	fail	pass	—	fail
C	fail	partly fail	—	—
D	fail	totally fail	—	—

9 TEST REPORT

The test report shall include the following particulars :

- a description of the specimen;
- the results of the tests specified in clause 7;
- the classification of the enamel coating according to clause 8.

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