
International Standard



787/24

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

General methods of test for pigments and extenders — Part 24 : Determination of relative tinting strength of coloured pigments and relative scattering power of white pigments — Photometric methods

Méthodes générales d'essai des pigments et matières de charge — Partie 24 : Détermination du pouvoir colorant relatif des pigments colorés et du pouvoir diffusant relatif des pigments blancs — Méthodes photométriques

Second edition — 1985-12-15

UDC 667.622 : 535.24 : 535.362

Ref. No. ISO 787/24-1985 (E)

Descriptors : paints, pigments, tests, determination, colouring power, photometric method.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 787/24 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 787/24-1982), of which it constitutes a minor revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

The purpose of this International Standard is to establish a series of general test methods for pigments and extenders which are suitable for all or many of the individual pigments and extenders for which specifications might be required. In such cases, a cross-reference to the general method should be included in the International Standard relating to that pigment or extender, with a note of any detailed modification which might be needed in view of the special properties of the product in question.

Technical Committee ISO/TC 35, *Paints and varnishes*, decided that all the general methods should be published as they become available, as parts of a single International Standard, in order to emphasize the relationship of each to the whole series.

The Technical Committee also decided that, where two or more procedures were widely used for determining the same or a similar characteristic of a pigment or extender, there would be no objection to including more than one of them in the ISO series. In such cases it will, however, be essential to state clearly in a specification which method is to be used and, in the test report, which method has been used.

Parts of the series already published are as follows :

- Part 1 : Comparison of colour of pigments
- Part 2 : Determination of matter volatile at 105 °C
- Part 3 : Determination of matter soluble in water — Hot extraction method
- Part 4 : Determination of acidity or alkalinity of the aqueous extract
- Part 5 : Determination of oil absorption value
- Part 7 : Determination of residue on sieve — Water method — Manual procedure
- Part 8 : Determination of matter soluble in water — Cold extraction method
- Part 9 : Determination of pH value of an aqueous suspension
- Part 10 : Determination of density — Pyknometer method
- Part 11 : Determination of tamped volume and apparent density after tamping
- Part 13 : Determination of water-soluble sulfates, chlorides and nitrates
- Part 14 : Determination of resistivity of aqueous extract
- Part 15 : Comparison of resistance to light of coloured pigments of similar types
- Part 16 : Determination of relative tinting strength (or equivalent colouring value) and colour on reduction of coloured pigments — Visual comparison method
- Part 17 : Comparison of lightening power of white pigments
- Part 18 : Determination of residue on sieve — Water method — Mechanical flushing procedure
- Part 19 : Determination of water-soluble nitrates — Salicylic acid method
- Part 20 : Comparison of ease of dispersion — Oscillatory shaking method
- Part 21 : Comparison of heat stability of pigments using a stoving medium
- Part 22 : Comparison of resistance to bleeding of pigments
- Part 23 : Determination of density (using a centrifuge to remove entrained air)
- Part 24 : Determination of relative tinting strength of coloured pigments and relative scattering power of white pigments — Photometric methods

General methods of test for pigments and extenders — Part 24 : Determination of relative tinting strength of coloured pigments and relative scattering power of white pigments — Photometric methods

0 Introduction

This document is a part of ISO 787, *General methods of test for pigments and extenders*.

1 Scope and field of application

This part of ISO 787 describes photometric methods of test for comparing in the visible spectrum

- a) the tinting strength of two similar (see note 1) coloured pigments dispersed in an alkyd resin without a drier;
- b) the scattering power of two white pigments of the same type dispersed in an alkyd resin without a drier.

These methods of test provide an instrumental alternative to those described in ISO 787/16 and ISO 787/17 respectively, avoiding the necessity of visual matching.

NOTES

- 1 This International Standard is not appropriate for the comparison of coloured pigments that on reduction differ greatly in colour.
- 2 When one of these general methods is applicable to a given pigment, only a cross-reference to the appropriate method should be included in the International Standard relating to that pigment, indicating any detailed modification which may be needed in view of the special properties of the product in question. Only when the appropriate method in this part of ISO 787 is not applicable to a particular product should different photometric methods for determination of relative tinting strength and determination of relative scattering power be specified.

2 References

ISO 591, *Titanium dioxide pigments for paints*.

ISO 787, *General methods of test for pigments and extenders —*

Part 2 : Determination of matter volatile at 105 °C.

Part 9 : Determination of pH value of an aqueous suspension.

Part 10 : Determination of density — Pyknometer method.

Part 16 : Determination of relative tinting strength (or equivalent colouring value) and colour on reduction of coloured pigments — Visual comparison method.

Part 17 : Comparison of lightening power of white pigments.

Part 23 : Determination of density (using a centrifuge to remove entrained air).

ISO 842, *Raw materials for paints and varnishes — Sampling.*

ISO 1524, *Paints and varnishes — Determination of fineness of grind.*

ISO 3219, *Plastics — Polymers in the liquid, emulsified or dispersed state — Determination of viscosity with a rotational viscometer working at defined shear rate.*

ISO 3262, *Extenders for paints.*

ISO 3682, *Binders for paints and varnishes — Determination of acid value — Titrimetric method.*

ISO 4629, *Binders for paints and varnishes — Determination of hydroxyl value — Titrimetric method.*¹⁾

ISO 4652, *Rubber compounding ingredients — Carbon black — Determination of specific surface area — Nitrogen adsorption methods.*

ISO 6209, *Rubber compounding ingredients — Carbon black — Determination of solvent extractable material.*

1) In course of preparation. (Revision of ISO 4629-1978.)

3 Definitions

3.1 For coloured and black pigments

3.1.1 tinting strength : The ability of a pigment (see the note) to absorb incident light, thereby having the power to colour or darken, for example, a white paint in which it is incorporated.

NOTE — Although the properties tested are strictly those of the pigmented binder, absorption and scattering by the binder are relatively small and it is assumed in this International Standard that the material under test is the dispersed pigment.

3.1.2 spectral absorption coefficient $K(\lambda)$: The fraction of the diffusely incident spectral radiant flux of wavelength λ that is absorbed in an elementary layer within a material, divided by the thickness of the layer (Kubelka-Munk analysis).

NOTE — $K(\lambda)$ is a measure of the tinting strength of coloured pigments in a material and is expressed in units of reciprocal film thickness.

3.1.3 absorbance index $K_p(\lambda)$: The spectral absorption coefficient of the pigmented binder divided by the pigment concentration C_m :

$$K_p(\lambda) = \frac{K(\lambda)}{C_m} \quad \dots (1)$$

where C_m is the pigment concentration, for example, expressed as the ratio by mass of pigment to binder.

3.1.4 relative tinting strength $K_r(\lambda)$: The ratio of the absorbance index of the test sample $K_{p1}(\lambda)$ to that of an agreed reference pigment $K_{p2}(\lambda)$, expressed as a percentage :

$$K_r(\lambda) = \frac{K_{p1}(\lambda)}{K_{p2}(\lambda)} \times 100 \quad \dots (2)$$

3.2 For white pigments

3.2.1 scattering power : The ability of a pigment (see the note to 3.1.1) to diffuse incident light, thereby having the power to confer opacity and lightness to, for example, a paint in which it is incorporated.

3.2.2 spectral scattering coefficient $S(\lambda)$: The net transfer of spectral radiant flux of wavelength λ in the outward direction from an elementary layer within a body of material illuminated from outside, divided by the product of the thickness of the layer and the difference between the magnitude of the flux in the two directions through the layer (Kubelka-Munk analysis).

NOTE — $S(\lambda)$ is a measure of the scattering power of white pigments in a material and is expressed in units of reciprocal film thickness.

3.2.3 scattering index $S_p(\lambda)$: The spectral scattering coefficient of the pigmented binder divided by the pigment concentration C_m (see 3.1.3) :

$$S_p(\lambda) = \frac{S(\lambda)}{C_m} \quad \dots (3)$$

3.2.4 relative scattering power $S_r(\lambda)$: The ratio of the scattering index of the test sample $S_{p3}(\lambda)$ to that of an agreed reference pigment $S_{p4}(\lambda)$, expressed as a percentage :

$$S_r(\lambda) = \frac{S_{p3}(\lambda)}{S_{p4}(\lambda)} \times 100 \quad \dots (4)$$

3.3 reflectivity ϱ_∞ : The reflectance of a paste or a paint film of such thickness that further increase in thickness gives no further change in reflectance.

The reflectivity ϱ_∞^* , corrected according to equation (10), is related to K/S by the equation

$$\frac{K}{S} = \frac{(1 - \varrho_\infty^*)^2}{2 \varrho_\infty^*} \quad \dots (5)$$

Values of K/S as a function of 100 ϱ_∞ or 100 R_∞ are given in annex B.

NOTES

1 Kubelka-Munk analysis is strictly applicable only to monochromatic radiation, as indicated in equations (1) to (4). In practice, however, correct results are often also obtained if the mean value for wider wavebands is taken, as is the case when filters are used. Hence, in the subsequent equations the symbol λ is omitted.

2 In a dispersion containing a coloured or black pigment and a white pigment, K is assumed to be characteristic of the coloured or black pigment and S of the white pigment.

3.4 reflectance factor R_∞ : The ratio of the radiant flux reflected in the directions within a given cone by a paste or a paint film to that reflected in the same directions by a perfect reflecting diffuser identically irradiated, when the thickness of the paste or the paint film is such that further increase in thickness gives no further change in the ratio.

4 Principle

4.1 Coloured and black pigments

Equal masses of a coloured pigment p_1 and of an agreed reference pigment p_2 are separately dispersed in the same mass of the same white pigment paste. The reflectivity ϱ_∞ or the reflectance factor R_∞ of each dispersion is measured photometrically at a wavelength giving a minimum value of ϱ_∞ or R_∞ . From the corresponding values of K/S , the relative tinting strength, K_r , of the test pigment is given by the equation

$$K_r = \frac{(K_{p1}/S)}{(K_{p2}/S)} \times 100 = \frac{K_{p1}}{K_{p2}} \times 100 \quad \dots (6)$$