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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 787-24

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*

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This document has not been edited by the ISO Central Secretariat.

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 256, *Pigments, dyestuffs and extenders*.

This third edition cancels and replaces the second edition (ISO 787-24:1985), which has been technically revised.

The main changes are as follows:

- the introduction has been deleted;
- the normative references have been updated;
- in [Clause 3](#) the definitions have been update and, where necessary, aligned with ISO 18451-1;
- in [Clause 4.2](#) and [8.1.4](#) the method was opened to other tinting strength criterion, including a reference to ISO 18314-2;
- the notes on the commercial availability of white pigment paste and black pigment paste and the references to that note have been deleted;
- in [Clause 5](#) former notes 2, 3 and 4 have been included in the main text;
- the headers for the first two columns in [Table 1](#), [Table 2](#) and [Table 3](#) in [Clause 5](#) were added, i.e. characteristic and requirement;
- the characteristic “nigrometer index value” and its requirement in [Clause 5](#) have been changed to “blackness value M_Y ” for the characteristic and to “203 to 215” for the requirement, and ISO 18314-3 has been added as test method for carbon black pigment ([Clause 5](#), [Table 2](#));
- the characteristic “volatile matter content” has been changed to “matter volatile at 105 °C” for carbon black pigment ([Clause 5](#), [Table 2](#));
- the requirement for “specific surface area (BET)” has been changed to “25 m²/g to 33 m²/g” for carbon black pigment ([Clause 5](#), [Table 2](#));

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- the requirement for the pH value has been changed to “6 to 9” for carbon black pigment ([Clause 5](#), [Table 2](#));
- ISO 9277 has been added as the test method for the specific surface area (BET) for fumed silica ([Clause 5](#), [Table 3](#));
- in [Clause 6.3](#) a reference was included which described the possibility of measuring paste films on a moving carrier without any contact;
- in [Clause 6.4](#) other light sources for the tristimulus colorimeter were allowed;
- a bibliography has been added.

A list of all parts in the ISO 787 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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

1 Scope

This document specifies photometric methods of test for comparing in the visible spectrum

- a) the tinting strength of two similar 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.

This document is not appropriate for the comparison of coloured pigments that on reduction differ greatly in colour.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 591-1, *Titanium dioxide pigments for paints — Part 1: Specifications and methods of test*

ISO 787-2, *General methods of test for pigments and extenders — Part 2: Determination of matter volatile at 105 °C*

ISO 787-9, *General methods of test for pigments and extenders — Part 9: Determination of pH value of an aqueous suspension*

ISO 787-10, *General methods of test for pigments and extenders — Part 10: Determination of density — Pyknometer method*

ISO 787-16, *General methods of test for pigments and extenders — Part 16: Determination of relative tinting strength (or equivalent colouring value) and colour on reduction of coloured pigments — Visual comparison method*

ISO 787-17, *General methods of test for pigments and extenders — Part 17: Comparison of lightening power of white pigments*

ISO 787-23, *General methods of test for pigments and extenders — Part 23: Determination of density (using a centrifuge to remove entrained air)*

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

ISO 3219 (all parts), *Rheology*

ISO 2114, *Plastics (polyester resins) and paints and varnishes (binders) — Determination of partial acid value and total acid value*

ISO 4629 (all parts), *Binders for paints and varnishes — Determination of hydroxyl value*

ISO 4652, *Rubber compounding ingredients — Carbon black — Determination of specific surface area by nitrogen adsorption methods — Single-point procedures*

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

ISO 9277, *Determination of the specific surface area of solids by gas adsorption — BET method*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

ISO 18314-3, *Analytical colorimetry — Part 3: Special indices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18451-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 For coloured and black pigments

3.1.1

tinging strength **colour strength**

measure of the ability of a colourant (3.19) to colour other materials because of its absorptive power

3.1.2

spectral absorption coefficient

$K(\lambda)$

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 1 to entry: $K(\lambda)$ 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

$K_p(\lambda)$

spectral absorption coefficient of the pigmented binder divided by the pigment concentration C_m :

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

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 **relative colour strength**

percentage ratio of the tinting strength (3.122) of the colourant (3.19) under test related to the tinting strength of a reference colourant

3.2 For white pigments

3.2.1

scattering power

ability of a pigmented medium to partly diffuse the incident light

3.2.2**spectral scattering coefficient** $S(\lambda)$

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 1 to entry: $S(\lambda)$ 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** $S_p(\lambda)$

spectral scattering coefficient of the pigmented binder divided by the pigment concentration C_m (see 3.1.3):

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

3.2.4**relative scattering power**

percentage ratio of the scattering index of the white pigment under test to the scattering index of a reference white pigment

3.3**reflectivity** ρ_∞

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 [Formula \(A.2\)](#), is related to K/S by [Formula \(5\)](#)

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

Values of K/S as a function of $100 \rho_\infty$ or $100 R_\infty$ are given in [Annex B](#).

Note 1 to entry: Kubelka-Munk analysis is strictly applicable only to monochromatic radiation, as indicated in [Formula \(1\)](#) to Formula (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.

Note 2 to entry: 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_∞

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 General**

The methods of test specified in this document provide an instrumental alternative to those specified in ISO 787-16 and ISO 787-17 respectively, avoiding the necessity of visual matching.

4.2 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 [Formula \(6\)](#)

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

where

K_{p1}/S is the K/S value corresponding to ϱ_∞ or R_∞ of the test pigment;
 K_{p2}/S is the K/S value corresponding to ϱ_∞ or R_∞ of the agreed reference pigment.

A different tinting strength criterion, i.e. one that is not dependent on the minimal value of ϱ_∞ or R_∞ , may be used by agreement between the interested parties, but should be stated in the test report (for examples see ISO 18314-2).

4.3 White pigments

Equal masses of a white test pigment p_3 and of an agreed reference pigment p_4 are separately dispersed in the same mass of the same black pigment paste. The reflectivity ϱ_∞ or the reflectance factor R_∞ of each dispersion is measured photometrically at 550 nm or using a Y-filter. From the corresponding values of K/S , the relative scattering power, S_r , of the test pigment, is given by [Formula \(7\)](#)

$$S_r = \frac{(K/S_{p4})}{(K/S_{p3})} \times 100 = \frac{S_{p3}}{S_{p4}} \times 100 \quad (7)$$

where

K/S_{p3} is the K/S value corresponding to ϱ_∞ or R_∞ of the test pigment;
 K/S_{p4} is the K/S value corresponding to ϱ_∞ or R_∞ of the agreed reference pigment.

5 Materials and equipment

5.1 White pigment paste, with the following composition

- 40 parts by mass of titanium dioxide, Grade R2, complying with the requirements of ISO 591-1;
- 56 parts by mass of alkyd resin (see [Table 1](#));

NOTE The alkyd resin is based on a mixture of 63 % (mass fraction) linseed oil and 23 % (mass fraction) phthalic anhydride.

- 4 parts by mass of calcium stearate.

Using a spatula, mix well so as to achieve preliminary wetting of the solids.

Then grind on the triple-roll mill ([6.1](#)) until the particle size is less than 5 μm when tested on a fineness-of-grind gauge (see ISO 1524). Store the paste in an airtight container, preferably a collapsible tube with a screw cap.

Table 1 — Alkyd resin complying with the following requirements

Characteristic	Requirement	Test method
acid value	max. 15 mg KOH/g	ISO 2114
viscosity (solvent free)	7 Pa·s to 10 Pa·s	ISO 3219 (all parts)
hydroxyl content	about 40 mg KOH/g	ISO 4629 (all parts)