International Standard 787/15

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

General methods of test for pigments and extenders — Part 15: Comparison of resistance to light of coloured pigments of similar types

Méthodes générales d'essai des pigments et matières de charge — Partie 15: Comparaison de la résistance à la lumière des pigments colorés de types semblables

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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.

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 787/15 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 787/XV-1973), clauses 0, 2, 3, 4, 6, 7 of which have been technically revised.

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.

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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 modifications 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 sulphates, 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 — 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

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General methods of test for pigments and extenders — Part 15: Comparison of resistance to light of coloured pigments of similar types

0 Introduction

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

The terms "resistance to light" and "light fastness (or colour fastness)" describe the resistance of a material to change in its appearance as a result of exposure to light. The magnitude of the change, if any, is influenced by the quantity and quality of the light to which the material is exposed, and by the nature and composition of the material itself. Two compositions, each consisting of identical components but in different proportions, may not have the same resistance to light. Also, two compositions each consisting of the same proportions of similar, but not identical, components may not have the same resistance to light.

When exposed to natural light, the conditions of the test vary continuously because of the large number of variables (for example intensity and spectral distribution of the light, temperature, relative humidity, and the amount and nature of atmospheric contaminants) and therefore results cannot be related to similar tests carried out on other occasions. Consequently expressing the results as a function of time alone is not recommended.

These considerations form the basis for the comparison of light fastness of two different samples of a coloured pigment. Each sample is incorporated in the same proportion in otherwise identical compositions and these compositions, in a suitable form, are examined for any difference in their change of appearance after exposure to the same quantity and quality of light. In order to comply with these exposure conditions, it is necessary for the compositions to be exposed side by side at the same time to the same light source for the same period of time.

In addition, the light fastness of a pigment may be affected by the presence of other pigments such as titanium dioxide. This important aspect may be accommodated in this part of ISO 787 by allowing the agreed binder (medium) to consist of a dispersion of such a pigment. The test procedure is then followed as described.

The extent to which the change on exposure is allowed to proceed before the comparison is made, may be of importance. It is unrealistic to assess the exposures when the change is only equivalent to the first perceptible change, but it is also inadvisable to wait until the amount of change is large. Thus, it is recommended that comparisons of change of appearance be made when the amount of change of the pigment with known resistance to light (agreed reference pigment) is equal to fastness grade 4 and 3 of the grey scale in accordance with ISO 105, section A02.

For any particular application, the method of test described in this International Standard needs to be completed by the following supplementary information. This information should be derived, in part or totally, from an (inter)national standard or other document related to the product under test or, if appropriate, should be agreed between the interested parties.

a) Type and identification of the agreed reference pigment.

b) The binder (medium) for dispersion of the test sample and the agreed reference pigment and details of the composition of the dispersion.

c) The method of dispersion to be used.

d) Whether the test is to be carried out under natural exposure (method A) or artificial light (method B).

e) If method A is to be used, the exposure angle of the test specimens and glass cover.

f) If method B is to be used, the details of the apparatus and of the light source.

1 Scope and field of application

This part of ISO 787 describes a general method of test for comparing the resistance to light of samples of similar types of coloured pigments (agreed reference pigment and test sample).

Two methods of exposure are described. In method A, the material is exposed under glass to natural light. In method B, the material is exposed to direct artificial light.

NOTE — When either of these general methods (A or B) 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 that may be needed in view of the special properties of the product. Only when the procedures given in this general method are not applicable to a particular product should a different method for comparison of resistance to light be specified.

2 References

ISO 105, *Textiles — Tests for colour fastness —*

Section A02: Grey scale for assessing change in colour.

Section B01: Colour fastness to light: Daylight.

Section B02: Colour fastness to artificial light: Xenon arc fading lamp test.

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

ISO 4892, *Plastics — Methods of exposure to laboratory light sources.*

CIE Publication No. 20 (TC-2.2), *Recommendations for the integrated irradiance and the spectral distribution of simulated solar radiation for testing purposes.*

3 Principle

The test sample and the agreed reference pigment are each dispersed in the same agreed binder (medium). The dispersions are applied to a substrate and dried; they are then exposed to natural daylight with protection from rain (method A) or to artificial light (method B) under specified conditions.

The resistance to light is assessed by comparing the change in colour of the test sample to that of the agreed reference pigment.

4 Apparatus and materials

4.1 Substrate

a) aluminium or rigid cardboard panels of suitable size for the applicator used, and with a white high gloss, light fast, coated and non-absorbent surface for the application of paint or

b) paper used as substrate for mass tone prints.

4.2 Film applicator or **other device,** suitable for applying, side by side, two films of wet thickness 50 to 100 µm, or a **suitable apparatus** for preparing mass tone prints with a thickness of about 1,5 µm.

4.3 Cover sheet, of aluminium foil or other suitable opaque material.

4.4 Grey scale for assessing change in colour, complying with ISO 105, section A02.

4.5 Agreed reference pigment, for comparison with the test sample. It shall be agreed between the parties and shall be similar in composition to that of the test sample.

4.6 Binder (medium) to be agreed between the interested parties. Its choice should be made with regard to the field of application of the pigments being tested.

4.7 Cabinet for exposure under glass to natural light (for method A).

The exposure cabinet shall have a glass cover and shall be of a sufficient size to carry out the expected number of tests.

The cabinet shall be constructed of metal, wood or other material capable of protecting the coated test substrates (specimens) from rain and similar climatic effects, and there shall be adequate ventilation to allow free flow of air over the test specimens.

The glass cover shall be a single piece of clear sheet glass, of thickness 2 to 3 mm, and free from bubbles or other imperfections. The transmittance of the glass shall be approximately 90 % at 360 nm and throughout the visible region of the spectrum, falling to a transmittance of less than 1 % at 300 nm and shorter wavelengths. To maintain these characteristics it is usually necessary to clean the glass periodically and to replace the glass at intervals of not more than 2 years.

The cabinet shall be fitted with a means of support that allows the specimens to be placed not less than 50 mm below, and in a plane parallel to, the glass cover. The cabinet shall be placed so as to receive direct sunlight throughout the day without shadows of neighbouring objects falling upon it. If the cabinet is placed over ground, the distance between the bottom of the cabinet and the plane of the cleared area shall be great enough to avoid any undesirable effects of contact with grass or plant growth during the period of exposure. The glass cover and the test specimens shall slope toward the equator at an angle from the horizontal approximately equal to the latitude of the location at which the tests are being made. Other angles of exposure such as 45° may be used, but the angle shall be stated in the test report.

4.8 Apparatus for exposure to artificial light (for method B).

The apparatus may be a conventional artificial weathering machine, containing a suitable light source such as a xenon arc lamp and filter system, or a similar device. (See also clause 5.1.2 of ISO 4892-1981 which gives further details of the characteristics of xenon arc lamps.)

The apparatus shall operate under the following conditions:

— the simulated total irradiance incident on the specimens provided by the light source (lamp and filter system) shall be 550 ± 55 W/m^2 in the range 300 to 800 nm;

— the irradiance shall be 50 ± 15 W/m^2 in the range 300 to 400 nm;

— the irradiance at wavelengths shorter than 320 nm shall not exceed 0,5 W/m^2;

— the spectral distribution of the total radiation at wavelengths above 360 nm corresponding to that given in the table and the figure [taken from CIE Publication No. 20 (TC-2.2)]; an approximation within ±10 % of radiation data is sufficient;

— the air drawn into the test chamber shall be at normal ambient conditions of temperature and humidity;

— the degree of ventilation shall be such that the test specimens are maintained at a black panel temperature of 50 ± 5 °C (see note 1);

— no water spray shall be used.

NOTES

1 ISO 105, Section B02 gives details regarding black panel thermometers.

2 Xenon arc lamps are convenient to use and give a spectrum reasonably close to natural daylight. It is necessary to frequently monitor the output of each lamp because it characteristically decreases (especially within the actinic region) with use. Lamps should be replaced immediately when they fail to comply with the requirements specified in this clause of this International Standard. Typical commercially available lamps have a useful life of about 1 000 h. In some cases, the transmission characteristics of the associated filter system also alter in course of time and a regular replacement of filters is necessary.

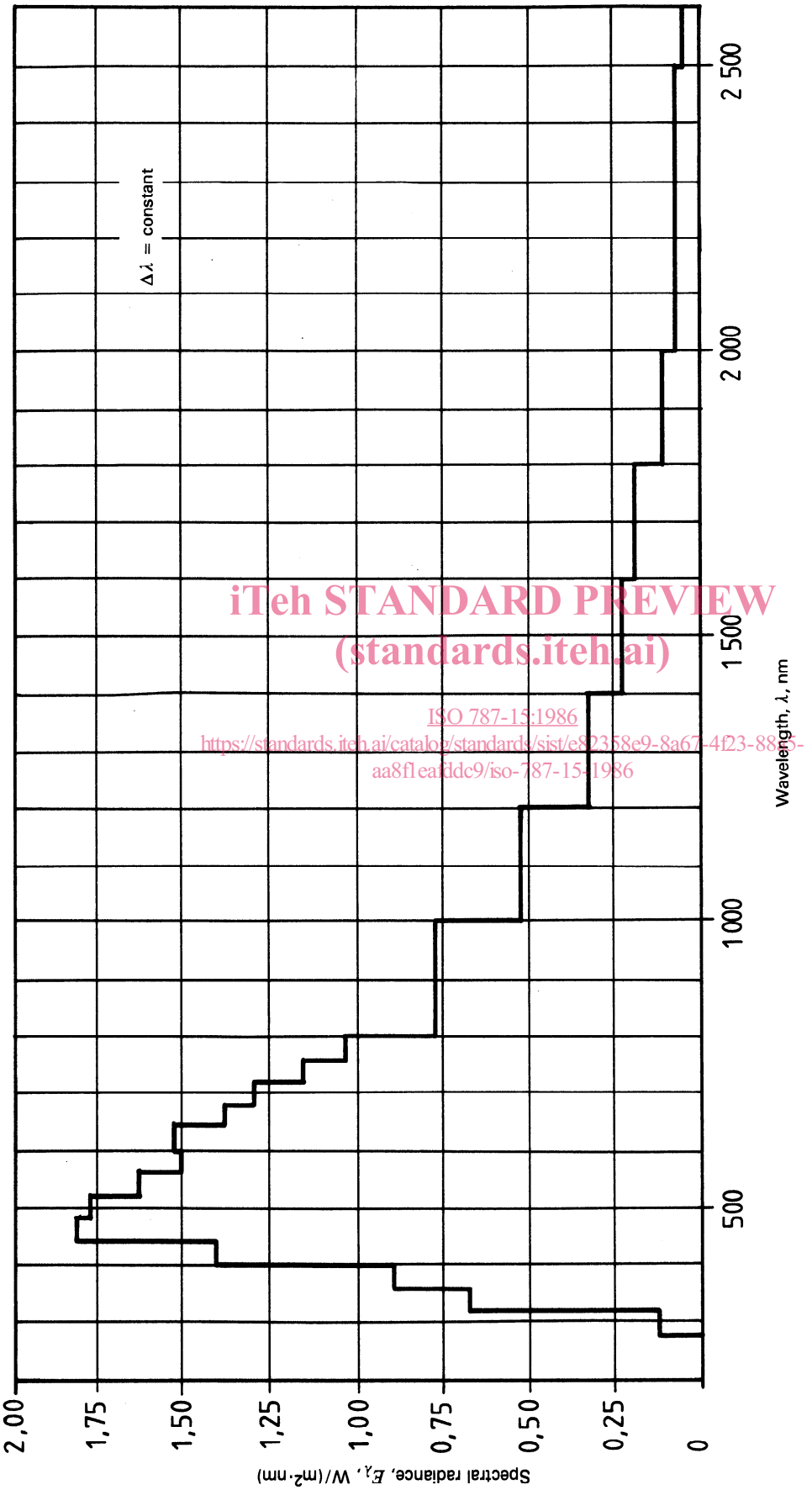
Table — Irradiance of the total radiation in spectral bands, in watts per square metre and in percentage of E_T = 1 120 W/m^2

Range	Wavelength	Irradiance		Percentage of total radiation [1]	
	nm	W/m^2		%	
0	< 280	0		0	
1	280 to 320 [2]	5	68	0,5	6,1
	320 to 360	27		2,4	
	360 to 400	36		3,2	
2	400 to 440	56	580	5,0	51,8
	440 to 480	73		6,5	
	480 to 520	71		6,3	
	520 to 560	65		5,8	
	560 to 600	60		5,4	
	600 to 640	61		5,5	
	640 to 680	55		4,9	
	680 to 720	52		4,6	
	720 to 760	46		4,1	
	760 to 800	41		3,7	
3	800 to 1 000	156	329	13,9	29,4
	1 000 to 1 200	108		9,7	
	1 200 to 1 400	65		5,8	
4	1 400 to 1 600	44	143	3,9	12,7
	1 600 to 1 800	29		2,6	
	1 800 to 2 000	20		1,8	
	2 000 to 2 500	35		3,1	
	2 500 to 3 000	15		1,3	
5	> 3 000 [3]	—		—	
0 to 5	Σ	1 120	1 120	100	100

1) Total radiation, E_T = 1 120 W/m^2

2) Radiation below 300 nm does not reach the surface of the earth.

3) Radiation above 3 000 nm is negligible.



NOTE — The values of the spectral irradiance shall be multiplied by the spectral bandwidth to obtain the table values.

Figure — Spectral irradiance of the total radiation in spectral bands
(altitude of the sun, h = 90°, cloudless days, air mass = 1)