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International Standard 4911

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Textiles — Cotton fibres — Equipment and artificial lighting for cotton classing rooms

Textiles — Fibres de coton — Équipement et éclairage artificiel des salles de classement du coton

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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.

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It has been approved by the member bodies of the following countries :

Australia	Ghana	Portugal
Belgium	Hungary	Romania
Bulgaria	India	South Africa, Rep. of
Canada	Indonesia	Spain
China	Israel	Sweden
Cyprus	Japan	Switzerland
Czechoslovakia	Korea, Rep. of	Turkey
Egypt, Arab Rep. of	Libyan Arab Jamahiriya	USA
Finland	New Zealand	USSR
France	Norway	Venezuela
Germany, F. R.	Poland	Yugoslavia

No member body expressed disapproval of the document.

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Textiles — Cotton fibres — Equipment and artificial lighting for cotton classing rooms

0 Introduction

Colour and appearance are criteria of quality establishing the price and use of cotton. Therefore, the colour quality of the light by which cotton is classed is important. Until 1940, practically all cotton classing was carried out in daylight, usually in rooms equipped with special skylights designed to provide sufficient and uniform lighting on the classing tables.

Cotton is classed by an operator[1] on the bases of the colour that the sample and a standard would have in daylight. In classing rapidly, the operator refers to physical standards only occasionally each day. Therefore it is important that artificial lighting in a classing room not only provides a constant colour, but that it makes the cotton appear as nearly as possible as it would in daylight, so that the classer can take full advantage of training and memory.

Daylight with a colour temperature of about 7 500 K has been found, in practise, by many cotton classers [1, 2, 3][2], and colour matchers in other industries [4, 5, 6], to be the minimum colour temperature of preferred daylight. In northern latitudes, this is the colour of a moderately overcast northern sky.

One of the most important reasons for using artificial lighting rather than daylight is that both the colour and amount of artificial light can be maintained more uniform than can daylight, and differences caused by geographical location and sky conditions are overcome. Additionally, standardized lighting conditions eliminate the need for cotton classers to make visual and mental adjustments for wide differences in amount and quality of light when they move from one location to another.

1 Scope and field of application

This International Standard specifies requirements for artificial illumination used for judging accurately and uniformly the colour of cotton. It also describes a method of test for appraising the colour quality of lamps procured for this purpose.

It includes requirements for colours to be used on walls and other surfaces in cotton classing rooms, and for maintaining the required level of performance of the lighting system.

2 Definitions

2.1 spectral quality (of a light source) : The characteristics of a source determined by its spectral composition (radiant energy flux per unit wavelength interval throughout the spectrum).

2.2 colour temperature (of a light source) : The absolute temperature of a black body whose chromaticity is the same (or nearly so) as that of the light source.

2.3 index of colour rendering (of a light source) : The degree to which the perceived colours of objects illuminated by a given source conform to those of the same objects illuminated by a standard source for specified viewing conditions[3].

1) Henceforth referred to as the "classer".

2) These figures refer to the bibliographic references which are to be found after the annexes.

3) Established by the general index for interpretation of colour, recommended in 1965 by the International Commission on Illumination [9, 10].

3 Quality of illumination

3.1 The characteristics of standard lighting shall be the colour and spectral quality of daylight of a moderately overcast northern sky, as represented by the values given in table 1 and the curve shown in the figure of spectral energy data for daylight at 7 500 K [7, 8][1],

3.2 Other levels of colour temperature of between 6 500 to 8 500 K, may be used to meet local and national conditions by agreement between the parties concerned.

3.3 The tolerance for this standard of illumination shall be ± 200 K for the colour temperature and, for spectral quality, the spectral distribution shall be as close as possible to that shown in table 1. In no case shall the colour rendering index be lower than 92.

NOTE — Since classing offices do not have the facilities and spectroradiometric equipment for checking light quality, one must accept the data submitted from reliable tube manufacturers or have the tubes tested by an independent or competing company. National spectroradiometric laboratories may also be used for this purpose, if possible. Light quality is a function of manufacturing design specifications. Combinations of tubes and bulbs should not be used.

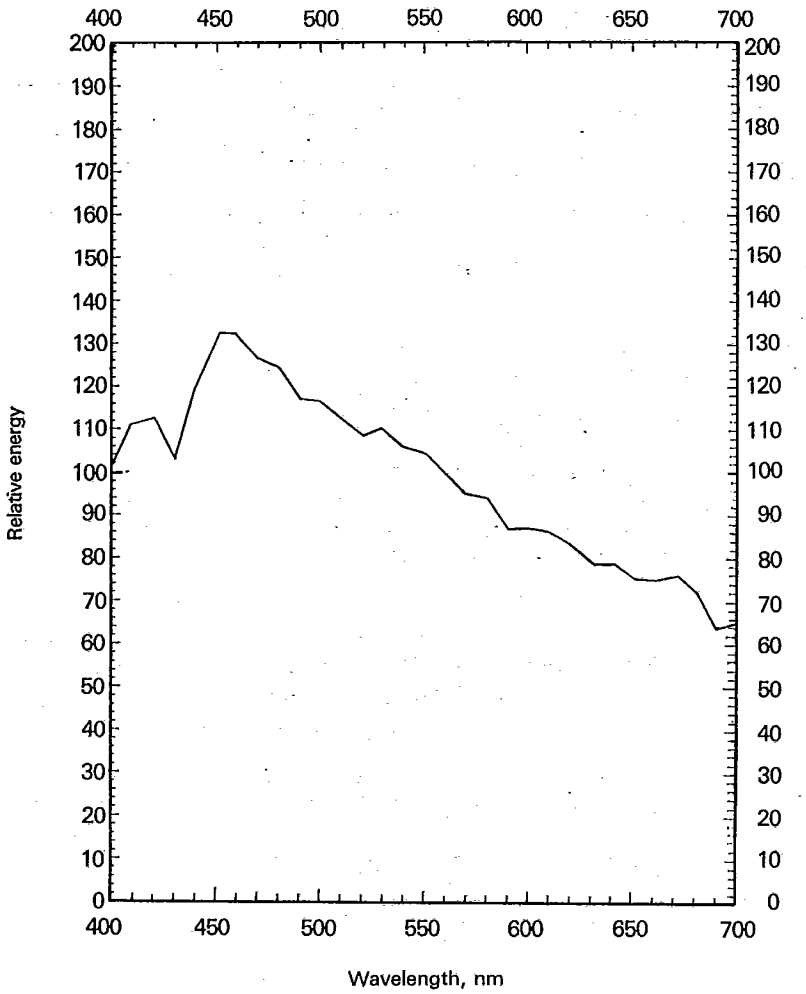

Figure — Standard curve for daylight at 7 500 K

Table 1 — Characteristics of colour quality of illumination for colour grading[1]

Wavelength nm	Relative spectral energy distribution
400	101,9
10	111,9
20	112,8
30	103,1
40	121,2
450	133,0
60	132,4
70	127,3
80	126,8
90	117,8
500	116,6
10	113,7
20	108,7
30	110,4
40	106,3
550	104,9
60	100,0
70	95,6
80	94,2
90	87,0
600	87,2
10	86,1
20	83,6
30	78,7
40	78,4
650	74,8
60	74,3
70	75,4
80	71,6
90	63,9
700	65,1

1) The data is based on table III of the Recommendation, of August 1965, by the Colorimetry Committee (E-1.3.1) of CIE.

1) As defined and recommended by the International Commission on Illumination.

4 Quantity of illumination

4.1 The optimum amount of illumination for cotton classing is not known. For light sources that include use of fluorescent tubes, a minimum of 750 ± 100 lx[1] on the working surface (from the centre to limits of classing areas) is recommended. An illumination above 4 300 lx may be considered "very poor" [4, 5, 11]. Optimum conditions lie somewhere between these values. Most modern installations are well above the minimum requirements, usually in the range of 650 to 1 180 lx on installation.

NOTES

1 Since operating conditions (ambient temperature, hours of operation, etc.) affect the light output of fluorescent tubes, it is neither possible nor practical to set close tolerances for the amount of light to be supplied at all times. A minimum of illumination of 750 ± 100 lx is set for installation to insure that such tubes will operate at a range of at least 430 to 650 lx throughout the latter part of their useful life. Illumination of more than 1 070 lx may be used initially, but the more light that is used, the more carefully must the geometrical aspects of an installation be considered in order to avoid glare and cross lighting.

2 The minimum range for lighting cotton classing rooms is based on data given in annex A. The results show that the absolute level of lighting is not critical; the highest light levels for each sky condition do not always rate "very good". Later studies corroborated the opinion that after a minimum level is reached, the quality of the illumination is more important than quantity in choice of illumination for classing cotton.

3 The limits for values of illumination in which the eye perceives differences in colour are wide. Experience indicates that the minimum values which cotton classers use should be higher [12, 13].

5 Geometry of illumination

The light shall be generally diffuse but with enough direction to allow perception of the depth to which the classer works. It shall be as uniform as possible over the working areas and there shall be no glare or crosslighting. The brightness contrast of the light source and its surroundings shall be held at a minimum. Lamp units equipped with a spectrally neutral diffusing glass, designed not only to diffuse the light but to provide a very low brightness contrast, are recommended.

6 Pattern for installation

6.1 Lighting units shall be designed to supply the required amount and colour of illumination over the surface of the classing tables. Installation requirements shall be based on the pattern of illumination provided by the units, calculated so that the illumination will be as uniform as possible throughout the classing room. Where lighting units are intended to illuminate specific areas such as classing tables, the units should be at least 30 cm longer than the table to ensure adequate illumination at both ends

6.2 Since classing rooms are often very dusty, units shall be closed. They shall be as light in mass as is practical, and be easy to install, inspect and maintain in good order.

6.3 Annex B describes a type of installation widely used in cotton rooms and which complies with the requirements of this International Standard.

7 Colour of surroundings

7.1 The colour of walls, ceiling, floor, furniture, lighting unit interiors and even the cotton itself (if it covers a large area when laid out for classing) has a significant effect on the lighting in a room, both on the amount of light reflected, and on brightness contrasts that may be involved.

7.2 Classing rooms shall be painted a neutral colour so that no one chromatic colour will be enhanced or discounted more than another. Neutral colours cover a range from white through a series of greys to black. All greys used in the classing room shall be truly neutral, i.e. they shall show no trace of any hue, and the lightness of the grey shall depend on the amount of light coming into the room and reaching the classing surface.

NOTE — Greys are specified by degrees of visual graduations constituting a "scale of grey", for example, black at N 0, to white at N 10. The neutral N 7,0 is a light grey reflecting about 40 % of the light; N 8,0 (60 % light reflectance) and N 8,5 (68 % reflectance) are lighter greys while N 9,5 (90 % reflectance) is a very good white.[2]

7.3 For rooms with artificial lighting, such as those lighted with wall-to-wall lighting units, the surroundings shall be a very light neutral grey, almost white, in order to conserve the light and reduce brightness contrasts as much as possible.

NOTE — If it is desired to mix paint, it is necessary to start with a good white and add very small amounts of a light neutral grey until the proper grey is obtained. It is better to have a paint too light than too dark.

1) A range in the minimum specification is necessary in order to insure some measure of uniformity of lighting. The range refers to minima allowable for measurements at the time of installation for the entire extent of all the classing surfaces in a room.

2) In the example given, the Munsell neutral value scale is used [14].

7.4 The following colour specifications are recommended for walls and equipment in cotton classing rooms :

a) walls, preferably N 8,5, and not darker than N 8,0 in the scale given;

b) ceilings, white or as nearly white as possible, and in no case darker than N 8,5 in the scale given;

c) floors, preferably about N 7,0 (darker floors may also be satisfactory);

d) mats, on which the operator stands, black (so they may be used as a background for stapling);

e) tables for classing, preferably light grey; they may be black if the operator desires;

f) papers in which samples may be wrapped, should not cover large areas of the field of view. Fold excess paper under the cotton. Cotton is naturally yellowish in hue. It will appear more yellow (creamier) against blue papers, and less yellow (greyer) against brown papers, than when viewed against a neutral grey or black background.

8 Maintenance of lighting equipment

Lamps and equipment shall be properly maintained to assure correct and uniform lighting. The following maintenance routines are recommended :

a) inspect daily to see that all tubes are in good condition;

b) replace immediately deficient tubes by tubes of the appropriate model;

c) use a light intensity meter to measure and record the light intensity throughout the classing areas. Records of this type are helpful in determining the frequency of cleaning and replacement of tubes;

d) regularly clean tube fixtures, and record light levels before and after cleaning;

e) inspect tube ballasts regularly, at least once a year. (Low voltage or lack of ventilation above the lighting units can cause ballasts to overheat and significantly affect tube output.)

Annex A

Averages of maximum and minimum illumination for certain sky and classing conditions (for horizontal plane on classing tables)

(This annex does not form part of the standard.)

The following tables are based on measurements taken hourly over a 30 day period in June and December.

Table 2 — Average of maximum and minimum illumination (lx) for sky conditions

Classing conditions	Sky conditions					
	Clear		Slightly cloudy		Overcast	
	June	December	June	December	June	December
Very good	1 165 to 1 615	440 to 540	1 350 to 1 670	560 to 670	1 075 to 1 615	1 240 to 1 615
Good	1 270 to 1 560	550 to 645	1 580 to 1 875	690 to 830	2 195 to 2 715	1 140 to 1 315
Fair	1 175 to 1 605	400 to 515	1 485 to 1 700	670 to 805	1 475 to 1 720	860 to 980
Poor	1 280 to 1 605	335 to 385	1 505 to 1 810	670 to 795	1 065 to 1 270	655 to 755

Table 3 — Average of maximum and minimum illumination (lx) for classing conditions designated as "good"[1)]

Classing room (location)	Weather conditions					
	Clear		Slightly cloudy		Overcast	
	June	December	June	December	June	December
Washington (new building)	1 940 to 2 045	365 to 485	2 365 to 2 530	485 to 590	2 365 to 2 690	—
Washington (old building)	1 290 to 1 505	430 to 540	2 155 to 2 475	670 to 805	2 690 to 2 966	590 to 670
Austin	1 290 to 1 615	860 to 970	1 400 to 1 720	1 615 to 1 720	2 905 to 3 335	1 885 to 2 045
Memphis 1	915 to 1 075	590 to 645	1 185 to 1 290	540 to 645	—	—
Memphis 2	1 505 to 2 585	860 to 1 130	2 365 to 3 175	755 to 1 075	2 150 to 2 690	—
Houston	1 400 to 1 505	540 to 645	1 505 to 1 615	805 to 915	1 615 to 1 720	—
Charleston	1 400 to 1 615	485 to 590	1 185 to 1 240	540 to 645	2 690 to 3 765	1 505 to 1 615
Atlanta	645 to 755	805	1 400 to 1 505	645 to 805	—	969
Savannah	1 400 to 1 615	—	1 505 to 1 615	645 to 755	—	—
New Orleans	755 to 970	130 to 140	860 to 1 185	150 to 205	970 to 1 345	—
Dallas	1 940 to 2 365	325 to 430	1 615 to 1 990	590 to 755	—	—
Stoneville	755 to 1 075	580 to 645	1 505 to 2 155	805 to 970	2 155 to 3 230	1 290 to 1 345
Mean values	1 270 to 1 560	550 to 655	1 580 to 1 875	690 to 830	2 195 to 2 710	1 245 to 1 375

1) Users of this International Standard are invited to submit details of illumination conditions which have been found satisfactory in order to extend the geographical coverage of this table.

Annex B

Installation pattern for illumination units[1)]

(This annex does not form part of the standard.)

B.1 Lighting units, of dimensions approximately 60 cm by 120 cm, have given satisfaction for lighting cotton classing rooms and are in wide use. These units are equipped with four special fluorescent tubes and also include a spectrally neutral diffusing glass.

B.2 Based on the pattern of light provided by these units, installations in which they are used are usually arranged as follows :

a) the units are installed with the diffusing glass about 3 m from the floor;

b) they are installed end to end in rows centred about 2 m apart;

c) a minimum of four rows of lights are generally used for an average size classing room. For full use of the room, lighting units should extend to within 1 m of the side walls and be as long as is convenient and possible;

d) for a single classing table, at least three units installed end to end are used; for a small classing room, the minimum is two rows of four units each.

B.3 The units are used in classing rooms having no windows.

1) Suitable lighting installations are available commercially. Details may be obtained from the Secretariat of ISO/TC 38 (BSI) or ISO Central Secretariat.

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