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***Indian Standard***  
**CODE OF PRACTICE FOR**  
**LIBRARY LIGHTING**

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**NEW DELHI 110002**

# Indian Standard

## CODE OF PRACTICE FOR LIBRARY LIGHTING

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# *Indian Standard*

## CODE OF PRACTICE FOR LIBRARY LIGHTING

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 5 August 1966, after the draft finalized by the Illuminating Engineering and Lifts Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** The technique of interior lighting in building has developed beyond the stage involving mere provision of light. As a result of a good deal of scientific investigation it has been recognized that improvements in environmental conditions are needed to alleviate the strain on eyesight so widely prevalent. This is particularly so in a library building where all sorts of reading materials have to be read for long periods. Modern standards of interior lighting call for the provision of both quantity and quality adequate for a particular visual task so as to ensure a satisfactory degree of ease and comfort to the individual at work. In the designing of a lighting installation, provision of adequate illumination is not a guarantee of comfort. It has been found that such factors as 'glare' and 'brightness pattern' shall receive great consideration if it is to achieve its object. From this point of view, this code of practice has been drawn up.

**0.3** Modern libraries have rooms for lectures, demonstrations and seminars; facilities for projecting still or motion pictures; and acoustically treated rooms where musical records can be played; study rooms, carrels, or individual study rooms as well as special rooms and display cases for showing rare books, manuscripts and archival materials. It is, therefore, necessary that while recommending a lighting practice in a library, the following factors should be taken into account:

- a) The possible wide range in the ages and educational levels of the library visitors,
- b) The varying conditions of eyesight found within these groups, and
- c) The variety of reading materials that are currently used.

**0.4** The following undesirable features should be avoided or eliminated as far as possible while recommending lighting installations for libraries:

- a) The major dependence upon table lamps for reading purposes,
- b) Dark furniture and interior finishes which produce uncomfortable brightness differences with the reading task,
- c) Reading tables with glossy tops which create reflected glare,
- d) Lighting units which produce glare, and
- e) Stack lighting with bare or inadequately shielded lamps or lamps producing a very high glare but inadequate amount of illumination on the bottom shelves.

**0.5** Provision of a good lighting system calls for co-ordination from the initial stages among the various parties concerned, namely, the architect, the consultant and the illumination engineer. Therefore, it is essential that information regarding lighting should be exchanged between the parties from the stage of planning to installation.

**0.6** This code has been drawn up in order to specifically deal with the special aspects of library lighting. General aspects of interior lighting, including assessment of glare, are dealt with in IS : 3646 ( Part I )-1966\*.

**0.7** In preparing this code assistance has been derived from IES/RP4-1950 'Recommended practice of library lighting' prepared by Illuminating Engineering Society of U.S.A.

**0.8** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS:2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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## **1. SCOPE**

**1.1** This standard covers the principles and practices governing good lighting of both public and institutional libraries. It recommends the levels of illumination to be achieved by general principles of lighting.

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions shall apply.

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\*Code of practice for interior illumination : Part I Principles of good lighting and aspects of design.

†Rules for rounding off numerical values ( revised ).



**2.1 Luminous Flux**—The light given by a source, or received by a surface or transmitted by a medium irrespective of the way in which it is distributed spatially as regards direction. The unit of luminous flux is the lumen (lm).

**2.2 Lumen (lm)**—The luminous flux emitted within unit solid angle (one steradian) by a point source having a uniform intensity of one candela.

**2.3 Candela (cd)**—The unit of luminous intensity. Its magnitude is one-sixtieth of the luminous intensity of one square centimetre of a black-body radiator operated at the temperature of solidification of platinum.

**2.4 Illumination**—Illumination is the density of the luminous flux incident upon a surface. The unit of illumination is lumen per square metre ( $\text{lm/m}^2$ ) which is known as lux (lx).

**2.5 Luminance (at a Point of a Surface in a Given Direction) (Brightness)**—The quotient of the luminous intensity in the given direction of an infinitesimal element of the surface containing the point under consideration by the orthogonally projected area of the element on a plane perpendicular to the given direction. The unit is  $\text{cd/cm}^2$ .

**2.6 Reflectance (Reflection Factor)**—The ratio of luminous flux reflected by a body (with or without diffusion) to the flux it receives.

**2.7 Contrast**—The subjective assessment of the difference in appearance of two parts of a field of view seen simultaneously or successively (hence brightness contrast, colour contrast, simultaneous contrast). Objectively the relative difference of luminance between two parts of a field of view.

**2.8 Glare**—A condition of vision in which there is discomfort or a reduction in the ability to see significant objects, or both due to an unsuitable distribution or range of luminance or to extreme contrasts in space and time.

**2.9 Glare Index**—A number representing the amount of discomfort glare in a lighting installation to which upper limits are given for a variety of room sizes and surface reflection factors resulting from ten selected light distributions (BZ classification).

**2.10 BZ (British Zonal) Classification**—A method of classifying the light distribution characteristics of fittings in accordance with the shape of the mean polar curve of luminous intensity in the lower hemisphere.

### 3. ANALYSIS OF VISUAL TASKS

**3.1 Functional Activities** — The various activities which take place in libraries fall into two main categories, namely:

User activities	Catalogue reference, book selection, reference and research reading
Operative activities	Cataloguing, issuing and general control, book stacking, repair, rebinding, etc

### 3.2 Reading

**3.2.1 General** — Reading is the most important visual task performed in a library. In the recommendation of environmental conditions and illumination levels for optimum reading efficiency and comfort, the following three factors, capable of very wide variation, shall be taken into account:

- a) The condition of the reader's eyesight,
- b) The character of the reading material, and
- c) The intensity and purpose of reading.

An additional factor is the angle between the page and the reader's line of vision.

**3.2.2 Condition of Eyesight** — Defective vision may occur in readers of all age groups though, in percentage, it increases with added years. This could be corrected to some extent with glasses but good lighting and proper seeing-conditions will be particularly helpful for people with sub-normal vision.

**3.2.3 Variety of Reading Tasks** — In any library there will be found a great variety of reading tasks. The readability of printed matter depends upon the type size and its contrast with the background; plus factors such as type face, length of lines, and margin widths. It has been found that two to three times the illumination is needed for pencil work as for average printed matter because of the difference in contrast. Lighting levels and environmental conditions should be broad enough to compensate for the range and difficulty of these visual tasks.

**3.2.4 Intensity and Purpose of Reading** — The third variable is the intensity with which reading is done, or the purpose for which the visitor goes to the library. Intensive reading may occur in general reading rooms as well as in carrels or other rooms designed for study purposes. With the exception of children's rooms and other areas set aside for browsing the lighting level and environmental conditions for all reading areas should be selected with the expectation that some intensive study will be carried on there.

**3.3 Book Stacks** — Several factors continue to make the lighting of stacks difficult, especially those to which the people have access. Although people are seldom in the stacks for long periods and their visual tasks are intermittent, they should be able to see all of the titles—top shelf to bottom shelf—easily and quickly. Part of the difficulty in lighting book stacks is caused by the dark book bindings, by the small printing of the titles and the usually worn out condition of the back of the binding partially obliterating the title. Another difficulty is caused by the long, narrow stack aisles, and the limitations as to the location of the light sources in relation to the vertical surfaces to be lighted.

**3.4 Carrels** — Research and study carrels are reading areas often integrated with or located close to the stacks. In these, some additional functional lighting should be arranged besides the general lighting.

**3.5 Administrative Office** — As a part of every library operation, there shall be areas for regular office work and for other visual tasks, such as indexing, cataloguing, recording, issuing and general control, typing and filing. For these, the same kind and amount of illumination employed in commercial offices will be suitable.

## 4. ENVIRONMENTAL FACTORS

**4.1 Planning the Brightness Pattern** — The brightness pattern may be considered as composed of three main parts—the task itself, the immediate background to the task and the general surroundings of walls, ceiling floor, equipment and furnishings. For details see IS : 3646 (Part I)-1966\*.

A general guide for the brightness relationship within the normal field of view could be:

- a) between the visual task and adjacent sources like table tops 3 to 1
- b) between the visual task and remote areas of the room 10 to 1

Since brightness of an object is determined by the reflection characteristics of its surface and the quantity of light falling on it, control of brightness contrasts shall be directed primarily for uniform distribution of light and secondly by the choice of suitable surface colouring whenever possible.

**4.2 Room Finishes** — The ability to keep within the maximum brightness ratios described above will depend to a large extent upon the

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\*Code of Practice for interior illumination : Part I Principles of good lighting and aspects of design.

reflectance values of the room finishes also; in conjunction with the lighting, they set up the brightness pattern of any room and the brightness ratios between the task and other major surfaces within the normal field of views. In order to avoid annoying reflections, smooth non-glossy surfaces are recommended for ceilings, walls and table tops. Besides, these are easy to clean and collect dirt less rapidly than rough matt finishes. In addition to creating comfortable brightness ratios light grey or white coloured surfaces aid materially in the utilization of light. Generally adopted values of reflectance for different surfaces are given in Table 1.

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**TABLE 1 RECOMMENDED REFLECTANCE VALUES**

( Clause 4.2 )

FEATURE	REFLECTANCE VALUE
	percent
Ceiling	70
Walls	50
Desk and table tops, furniture	35
Floors	30

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**4.3 Reading Table and Desk Tops** — In order to keep the brightness ratio between the reading table top and the printed page below, the reflectance of the table top should be higher than the dark-stained tables ( 10 to 12 percent ) commonly used. It is also recommended that reading table and desk tops should have as little specularly or gloss as possible.

**4.4 Glare** — The question of glare is not only connected with that of brightness and contrast but arises when excessively bright sources of light come within the field of view. In effect, a glare source increases the observer's adaptation level\* with a resultant reduction in his contrast-sensitivity and visual efficiency. Discomfort, and in extreme cases disability, follow when the brightness relationship are only mildly annoying; disability when a relatively high brightness lies close to the line of vision. In fact, the degree of discomfort arising from a glare sensation is a function of the brightness of the glare source, its relative size and nearness to the line of sight.

Avoidance of glare in artificial lighting systems can usually be effected with the layout of suitably chosen lighting equipment and by the arrangement of the furniture and fittings to suit. Recourse should first be made to prevent a direct view of the source or fittings by ensuring that the contrasts between them and their surroundings are kept within desirable limits.

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\*When required, the eye has the capacity to adjust automatically the upper and lower limits between which it will respond usefully to stimulation by light. These adjustments are evoked by the prevailing level of ambient brightness, which is usually described as the adaptation level.

**4.4.1 Assessment of Glare** — For assessment of glare from light sources, reference shall be made to IS : 3646 ( Part I )-1966\*.

## 5. RECOMMENDED ILLUMINATION VALUES

**5.1** Any recommended illumination values should be graded according to the difficulty of the visual tasks. These values should be maintained in service through proper cleaning and relamping of lighting equipment, the cleaning of windows, and the maintenance of the reflectance values of room surface. Initial values from the artificial lighting system shall be greater by a percentage sufficient to compensate for the normal depreciation expected in service ( 30 to 35 percent ). As already described, it is apparent that some of the visual tasks encountered in libraries are comparable in character to those in schools and offices and should, therefore, be consistent with them. Consistent with the above explanation but with no reference to the type of illuminant, luminaire, or type of lighting system, the levels of illumination recommended for the various types of visual tasks graded according to the difficulty of the task as a library lighting practice are given in Table 2.

**5.2** It is not a simple matter to specify suitable intensity levels if these are to be based upon sound reasoning. Since there is no distinct threshold level of illumination below which the performance of particular visual task is greatly impeded, some compromise has to be sought between an ideal level and one which is obviously inadequate. Generally, a recommended level is arrived at after being carefully weighed in the relation it bears to the eyesight, the visual task, the environment, and the economics involved. Any specification is, therefore, always open to a great deal of controversy. It may, however, be summarised that any of the above recommended levels of illumination could serve chiefly as a guide to good practices. It is not always sufficient to provide just enough light and leave it at that. Adequate illumination will benefit people with normal sight, but the benefit will be far greater to those with faulty vision. For example, elderly people require higher illumination values for the same facility of seeing as young people.

**5.3** In any lighting arrangement the required level of illumination could be achieved through a combined usage of the natural daylighting and the artificial lighting. Proper use of daylighting will also allow further reduction in the use of artificial lighting consistent with the economics of the lighting arrangement.

## 6. DAYLIGHTING

**6.1** Most people prefer to work in buildings having good daylighting. One of the characteristics of daylight which gives it this appeal is the

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\*Code of practice for interior illumination : Part I Principles of good lighting and aspects of design.

TABLE 2 LEVELS OF ILLUMINATION

( Clause 5.1 )

SL No.	TASK	ILLUMINATION LEVEL	GLARE INDEX
(1)	(2)	(3)	(4)
	lx		
i)	Difficult and Critical Visual Tasks:		
	a) Discrimination of fine detail ( 6-8 point type, footnotes, etc. legal reference books, with small condensed type, illustrations with fine details, etc )	300 to 700	22
	b) Poor contrasts ( newspapers, maps, pencil notes, carbon copies, etc )		
	c) Study and research, reading over long periods of time involving ordinary books		
	d) Book repair and binding		
ii)	Ordinary Visual Tasks:		
	a) Discrimination of moderately fine detail ( leading 8-12 point type, children's books; general and private office work; active file and mail rooms; cataloguing )	150 to 300	19
	b) Better-than average contrast ( reading better magazines and books )		
iii)	Casual Visual Tasks:		
	a) Conference and reception rooms; stacks closed to the public; stairways and hallways used by the public; washrooms; checkrooms; and other service areas; auditoriums; book storage rooms where lables are to be read	70 to 150	16
	b) Intermittent periods of time ( browsing; casual reading; book stacks; card files; check-in and check-out desks )		
iv)	Simple Visual Tasks:		
	Corridors not used by the public; storage rooms involving no reading of lables	30 to 70	—

constant change both in quality and quantity, creating interest and avoiding monotony. This variation has to be taken into account when planning a scheme to ensure that at no time will the illumination over the working area be less than that recommended for the particular visual task. In some buildings it will be possible to achieve this by natural lighting alone, but in other buildings, especially those located in obstructed city areas, it will be necessary to supplement the natural lighting by artificial lighting designed to operate permanently during day time; this should be properly co-ordinated with natural lighting as described in IS : 3646 ( Part I )-1966\*. For detailed aspects of daylighting, reference shall be made to IS : 2440-1963†.

**6.2** In essence, the design of a lighting system should be such as to provide permanent artificial supplementary lighting in addition to possible adequate daylight, in order to create an intimate and inviting atmosphere in libraries.

## **7. MAINTENANCE OF LIGHTING INSTALLATIONS**

**7.1** Unless both the structure ( the room surfaces and windows or roof glazing ) of a building and the lighting equipment are well maintained, the aims of good lighting will soon be nullified; the lighting natural or artificial, will no longer fulfil its purpose adequately, the cost of providing useful light will increase and the appearance of the building will deteriorate. The problems associated with good maintenance are complex and vary from situation to situation, but properly planned maintenance schedules are always desirable for both the structure and the artificial lighting equipment ( the lamps and fittings ) ( *see* IS : 3646 ( Part I ) - 1966\*.

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\*Code of practice for interior illumination : Part I Principles of good lighting and aspects of design.

†Code of practice for daylighting of buildings. ( Since revised ).

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