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CODE OF PRACTICE FOR HOSPITAL LIGHTING

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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CODE OF PRACTICE FOR HOSPITAL LIGHTING

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Indian Standard
CODE OF PRACTICE FOR HOSPITAL LIGHTING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 November 1967, after the draft finalized by the Illuminating Engineering Sectional Committee had been approved by Electrotechnical Division Council.

0.2 Complex structures of hospitals both by the nature of their construction and the diverse procedures complicate the lighting problem. Many of the areas are highly specialized in purpose, but some (such as kitchens, offices and laboratories) have the same lighting requirements as similar areas in other buildings. This standard is intended to give recommendations for the satisfactory lighting of those interior areas which are peculiar to hospital building. General aspects of interior lighting, including assessment of glare, are dealt with in IS : 3646 (Part I)-1966*.

0.3 Every modern hospital consists of many components serving diverse functions. They may be non-medical areas, such as offices, kitchens, laundries and libraries and may be lighted in the same way as those found in industry or commerce. There are also many specialized interiors, such as operation theatres, clinics, treatment rooms and wards, where special lighting techniques and fittings will be required to achieve the desired standard of lighting, hygiene, electrical safety, reliability and ease of maintenance.

0.4 Provision of a good lighting system calls for co-ordination from the initial stages among the various parties concerned, namely, the architect, the medical 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.

0.5 In preparing this code, assistance has been drawn from ' Draft Technical Report on Hospital Lighting ' prepared by the Illuminating Engineering Society, London.

0.6 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 or analysis, 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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*Code of practice for interior illumination : Part I Principles of good lighting and aspects of design.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the principles and practices governing good lighting of hospitals. It recommends the levels of illumination to be achieved by general principles of lighting.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 3646 (Part I)-1966* shall apply.

3. LIGHTING OF THE PATIENTS' ROOMS OR WARDS

3.1 The patients' rooms in a hospital often account for more than half of the useful floor space. The lighting of patients' rooms is of great importance and has to satisfy the needs of the patients as well as those of the medical and nursing staff. Moreover, the total lighting effect should be such as to contribute to the general decor and should be free of glare to the recumbent patient.

3.2 Lighting for the Medical and Nursing Staff — This lighting is mainly utilitarian for the staff in the sense that it should be adequate to enable them to carry out their routine tasks. They shall be able to take in the room at a glance and also carry out such tasks as reading thermometer or making charts at the bedside or elsewhere. But a level of illumination of 150-300 lux which would be considered normal for similar visual tasks will be too high from the patients' point of view.

3.3 Lighting for the Patients

3.3.1 For the patients in the wards the lighting should create a cosy and pleasant atmosphere. An illumination level of 150-300 lux will be too high for achieving this effect. Moreover, in a ward some of the patients may like to sleep before the scheduled time of 'Lights out' and such a level will be a nuisance to those patients. From experience a level of illumination of 100 lux is found to be acceptable for general lighting of wards which will also meet the needs of the nursing staff.

3.3.2 Apart from general lighting, individual patients should be provided with additional lighting for any occasional reading or other handiwork that they may choose to do. This should be in the form of bed head lights which can be switched 'on' or 'off' by the patients themselves. These lights also contribute to the general appearance of the wards by breaking the monotonous uniformity that will result from the general lighting.

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

3.3.3 It may also become necessary under certain emergencies to examine the patient in the ward itself for which an examination light capable of providing 500 to 1 000 lux will be required (*see also* **3.4.2**).

3.3.4 At night after 'Lights out' the wards cannot be left in complete darkness. The nursing staff should be able to take in the ward at a glance to satisfy themselves that everything is alright. Those patients who can move should also be able to make their way to the lavatory, etc. A night lighting system which gives enough illumination (about 1 lux) for this purpose but which does not disturb the sleeping patients is also therefore necessary in a ward.

3.3.5 The lighting installation in a ward therefore calls for:

a) general lighting,
b) reading lamps,
c) examination lighting, and
d) night lighting.

3.4 Consistent with the above broad requirements, recommendations as to how these could be achieved are given below:

3.4.1 *General and Reading Lighting* — The following two systems are possible:

a) General Lighting is provided by pendent fittings hanging from the middle of the ceiling and having an indirect or semi-indirect light distribution. Reading lighting is provided by small bedside fittings fixed to the wall behind the bed.
b) In the other system both the general lighting and reading lighting elements are incorporated in the same fitting fixed on the wall above the beds.

3.4.1.1 In both the systems the general lighting is controlled from a central point and the reading lights by the individual patients.

3.4.2 *Examination Lighting* — It is never satisfactory to use the reading lamp as examination lamp also. Whether a separate examination lamp is to be provided at each bed will depend on the frequency of its likely use. Where such use is only occasional a good solution will be to have a mobile examination lamp that can be wheeled along and connected to a wall socket by the bedside.

3.4.3 *Night Lighting* — A satisfactory night lighting system can be provided by a number of small fittings (with incandescent lamp of low wattage or miniature fluorescent lamp 4 watt) recessed into the wall at a height of about 30 cm above the floor level. Efforts should be made to screen the light fitting to avoid direct glare.

4. CORRIDORS

4.1 Corridors in a hospital serve a more important function than in many other buildings because they act as transitional areas between the wards and the service rooms and between the naturally lit and artificially lit rooms. Doctors discuss their work with their colleagues and make notes. Thus the corridors act in a sense as a working area. Moreover, corridors also fall within the visual range of the patients in the wards and therefore require special attention. The artificial lighting to be provided in the corridors will depend on the architectural layout adopted for the building. Generally two types of layouts are followed. In the ' single corridor ' layout the wards and the service rooms are on the two sides of the corridor. The corridor itself will have enough daylighting. But in the evening the service rooms will have an illumination of about 200 lux and the lighting level in the ward will be of the order of 100 lux. The corridors should have an illumination of about 100 lux so that the staff moving between the service rooms and the wards will gradually adapt themselves to the different illumination levels. But after ' Lights out ' there will be only night lighting in the wards and the corridors should also be provided with similar night lighting arrangement. The service room lighting should also be reduced to half its value in the evening.

4.2 In the ' double corridor ' or ' race track ' plan the wards are placed around the outside of the building and are normally daylighted. In the centre of the building are the service rooms which will have no access to daylight and will require artificial lighting at all times. During the day the staff will move between the wards receiving daylight of 500-1 000 lux to the internal rooms artificially lit to a level of 200 lux. The corridor should bridge these two levels and an illumination of 150 lux should be provided in the corridors during the daytime. In the evenings the ward lighting will fall to 100 lux and the corridor lighting may be reduced to the same level. After ' Lights out ' both the ward and the corridor will have night lighting and the service room illumination should therefore be reduced to about 100 lux, which will be just sufficient for the staff to carry on their normal work and will also reduce the excessive contrast between the brightness levels in the service rooms and the wards or corridors.

5. LIGHTING OF SURGICAL AREAS*

5.1 General Lighting of Operating Theatres — The visual requirement in the theatre is the detailed examination of tissue, organs and instruments at the site of the operation. The size of critical detail is very small and the contrast very low indeed. It is recommended that the illumination level for lighting the operating area should be between 2 000 and 10 000 lux. Lower

*These recommendations do not cover lighting of operating theatres fitted with closed circuit TV system.

levels than this may be more comfortable for the surgeon where fine detail does not have to be discriminated, but it is unlikely that higher levels will be required. Considerations of visual acuity and of the glare discomfort which may arise from the presence of a small bright area in an otherwise dark field of view, suggests that when the operation cavity is illuminated to about 10 000 lux, the immediate surrounding to the task should have a luminance of the order of 100 cd/m^2 and the general environment a luminance of the order of 35 cd/m^2. It is known that the attention is held most readily when the visual task is the brightest and most colourful object in the field of view, but it is not recommended that the above figures of brightness contrast should be exceeded, on account of the adverse result upon visual acuity and visual comfort.

5.1.1 If drapes of low reflection factor (say 30%) and neutral colour are used, and the theatre general lighting is arranged to give an illumination at table level of 300 lux the normal fall-off of illumination at the edge of the working beam of the theatre light fitting will ensure that the luminance of the immediate surrounding to the operation area falls off rapidly to about 100 cd/m^2 and eventually to a general level of about 35 cd/m^2 over the rest of the table. This value of 300 lux general illumination will also be adequate for the technical staff to operate the ancillary equipment.

5.1.2 The colour appearance of skin and tissue is also of great importance, and the spectral quality of the light sources used for the general lighting should be the same as that used throughout the rest of the hospital (*see* **13.1**).

5.1.3 Each lighting fitting should be capable of separate switching, to enable the individual requirements for special operations to be met.

5.2 Light Sources — In general, the operating table lighting fittings employ tungsten lamps and produce a very high level of illumination, with very good colour rendering properties, but it is not advisable to use filament lighting for the general lighting of the theatre because of the additional heat output that would be produced by this form of lighting. It is more practical to use fluorescent light sources which inherently have low heat output yet have the added advantage that they can produce good colour rendering for medical purposes (*see* **12.1**).

5.3 Anaesthetic Room — In view of the close association of this room with the theatre proper a general illumination of 300 lux is recommended with provision for a spotlight (which can be either fixed or portable). The general lighting should not be directly over the centre of the room but the lighting fittings should be designed to provide some illumination on the ceiling. Dimming of the installation may be required to enable the anaesthetist to provide suitable environmental conditions.

5.4 Recovery Room and Intensive Care Units — The presence of large quantities of other portable apparatus renders the use of portable lighting

equipment undesirable. General lighting should be installed as in a normal ward with a separate system to raise the illumination level up to 300 lux for each bed independently. This should be provided over an area of 3 m × 2 m centred on the bed and the fitting designs should be such as to limit the spread on adjacent beds. Dimming of the individual bed lights should be provided for.

5.4.1 Some discomfort glare to a conscious patient is unavoidable under these conditions but the recommended general lighting fittings will produce a bright ceiling which will mitigate this effect.

5.5 Emergency Lighting in Theatre Suite—A failure of essential lighting during an operation may have serious consequences. It is, therefore, necessary to provide reliable and safe emergency arrangements.

5.6 Hazardous Areas — The zone of risk in an area where anaesthetic gases are used is defined as being 1·4 m above floor and extending for a radius of 1·2 m beyond any point where an anaesthetising machine may travel.

5.6.1 Lighting fittings installed either in or above the zone of risk should be totally enclosed to provide adequate mechanical protection to the lamp, and to prevent hot particles falling into the zone in the event of lamp breakage (other requirements, for example, limitation of glare, provision for hosing down, demand that the lamps should be fully enclosed) [*see* 'Indian Standard Specification for hospital lighting fittings' (*under preparation*)].

5.6.2 Chokes, condensers, and other control gear associated with lighting fittings should be installed outside the zone of risk. If installed above the zone of risk they should be totally enclosed in incombustible housings.

6. RADIOGRAPH DEPARTMENT

6.1 In the 'screening' room due to the necessity to maintain low brightness level normally incandescent lamps of ruby red glass bulb or a fluorescent lamp with red fluorescent powder is used. Red is chosen because this colour of light has only little effect on the state of adaptation of the eye. In the 'processing' room 15 watts dark room lamps (green or reddish brown depending on the film material used) are used.

6.2 In the 'viewing' room where the radiographs are studied and assessed artificial lighting is used in the viewing boxes.

6.3 For the general lighting required for cleaning of the rooms for setting up the apparatus, etc, an illumination of 100 lux is provided in all these rooms.

7. MATERNITY DEPARTMENT

7.1 Nursery Lighting — Nursery lighting should be subject to the same recommendations as for ward lighting (*see* **3.3**), the rooms of a 'Special baby care suite' may for lighting purposes be regarded as nurseries.

7.2 Fitting Design — The mechanical and electrical design of fittings should take account of the high ambient temperatures and relative humidity experienced in rooms of the ' Special baby care suite '.

8. PHYSIOTHERAPY DEPARTMENT

8.1 Special lighting applicable to this Department should have the following average illumination levels at 0·9 m above the floor:

Gymnasium	100 lux
Hydrotherapy	100 lux

It should be borne in mind that illumination will be required to the bottom of the bath or pool.

9. OTHER TREATMENT AND SERVICE ROOMS

9.1 The lighting of other treatment rooms do not present any special problem. A normal general illumination of 200 lux will serve the purpose. The lighting of service rooms, such as offices, laboratories, kitchens and laundries, can be tackled in the same way as corresponding interiors in other buildings.

10. RECOMMENDED ILLUMINATION VALUES AND GLARE INDEX

10.1 The levels of illumination and glare index recommended for the different areas in a hospital are given in Table 1, according to IS : 3646 (Part I)-1966*.

TABLE 1 ILLUMINATION VALUES AND GLARE INDEX

Sl No.	Classification	Illumination Lux	Limiting Glare Index
(1)	(2)	(3)	(4)
i)	Reception and waiting room	150	16
ii)	Wards:		
	a) General	100	13*
	b) Beds	150	—
iii)	Operating theatres:		
	a) General	300	10
	b) Tables	Special lighting	—
iv)	Laboratories	300	19
v)	Radiology departments	100	—
vi)	Casualty and outpatient departments	150	16
vii)	Stairs, corridors	100	—
viii)	Dispensaries	300	19

*Care should be taken to screen all bright areas from view of patients in bed.

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11. LIGHT SOURCE

11.1 Though the choice of light source is normally a matter of economy, in hospital an additional factor comes into play, especially in clinical areas like the operation theatres and post operative wards. This is the effect of the artificial lighting on the natural skin colour of the patients. In the past most artificial light was produced by tungsten filament lamps and the doctors became familiar with the appearance of patients in varying conditions in this light. But in view of the greater economy and efficiency of the fluorescent lamp it is finding increasing use in hospitals and lamps coated with specially developed fluorescent powders offering better colour rendition are available and they can be used satisfactorily in clinical areas.

12. COLOUR IN HOSPITALS

12.1 Colour can play an important and useful role in creating the desired atmosphere in hospital interiors. It will be necessary not only to consider the colour scheme design in daylight but also to find out the effect on it of the light source to be used. A well chosen colour scheme can also support the effect of the lighting by increasing or decreasing the effect of contrast of suitable places. Depending on the use to which the room is to be put a correct combination of light and colour can result in the desired liveliness or a quiet atmosphere.

13. PERMANENT SUPPLEMENTARY ARTIFICIAL LIGHTING

13.1 Permanent supplementary artificial light of interiors [as described in IS : 3646 (Part I)-1966*] may be useful in hospitals not only to permit deep wards to provide good overall lighting of the appropriate quality but also in laboratories, service and ancillary rooms where a controlled level of working illumination is desirable and in administration offices where the lighting problems are similar to office lighting elsewhere.

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