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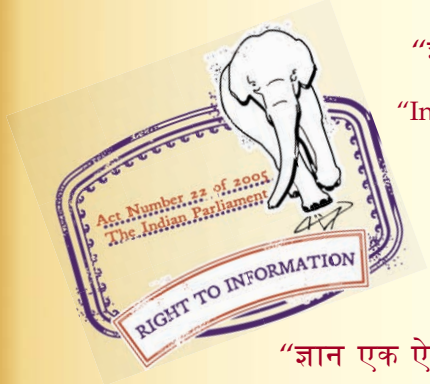

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CODE OF PRACTICE FOR LIGHTING FOR PORTS AND HARBOURS

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CODE OF PRACTICE FOR LIGHTING FOR PORTS AND HARBOURS

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Indian Standard

CODE OF PRACTICE FOR LIGHTING FOR PORTS AND HARBOURS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 March 1984, after the draft finalized by the Illuminating Engineering and Luminaires Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This code is brought out so as to provide guidelines to the ports and harbour authorities for preparation of lighting installation design and maintenance of the various areas covered under ports and harbours.

0.3 Ports and harbour being a vast complex covering multi-functional working areas, the lighting recommendations have been restricted to important parts like loading and unloading areas, container terminal, railway yards, repair docks, passenger berths, jettys, etc. The working conditions in each port and harbour being so different that the recommendations given here should be used as good guide lines to provide suitable lighting.

0.4 Areas like warehouses, sheds, workshops, offices, welfare facilities, service areas, etc, have not been covered in this code. For the lighting design and recommendations of these areas, reference can be made to the similar areas recommended in IS : 3646 (Part 2)-1966* and IS : 6665-1972†.

0.5 Lighting of roads, junctions and round about in ports and harbour is also not covered under this code. For the lighting design and recommendations of these areas a reference can be made to IS : 1944 (Parts 1 and 2)-1970‡.

0.6 In preparing this standard assistance has been derived from the following publications:

IES (UK). Technical Report No. 13 Industrial area flood lighting. 1969. Illuminating Engineering Society of London.

*Code of practice for interior illumination: Part 2 Schedule for values of illumination and glare index.

†Code of practice for industrial lighting.

‡Code of practice on lighting of public thoroughfares (*first revision*).

Guide to safety and health in dock work. 1976. International Labour Office.

Model code of safety regulations for industrial establishments for the guidance of government and industry. 1949. International Labour Office.

1. SCOPE

1.1 This standard covers the guidelines for design and maintenance of lighting installations of the various areas covered under ports and harbours.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS : 1944 (Parts 1 and 2)-1970*, IS : 3646 (Part 1)-1966†, IS : 3646 (Part 2)-1966‡ and IS : 1885 (Part 11)-1968§ shall apply.

3. GENERAL

3.1 The Need for Lighting

3.1.1 Work in unlighted port and harbour is hampered by limited working hours and availability of daylight. The brightness of the sky, and hence the amount of light received from it varies systematically with latitude, season and the time of day. Furthermore cloud movement causes random variations whose extent depends on the size and density of clouds. In winter and monsoon because of bad weather, day light levels for much of the day are too low for many types of task to continue without supplementary lighting.

3.1.2 Electric lighting helps to overcome the restriction of day time working hours and non-availability of day light in bad weather conditions.

3.1.3 Furthermore good lighting also reduces the risk of accidents, contributes to improvement in rate and quality of work as well as assist the security staff to carry out their functions smoothly.

*Code of practice on lighting of public thoroughfares (*first revision*).

†Code of practice for interior illumination: Part 1 Principal of good lighting and aspects of design.

‡Code of practice for interior illumination: Part 2 Schedule for values of illumination and glare index.

§Electrotechnical vocabulary: Part 11 Electrical measurements.

3.2 Classification

3.2.1 For the purpose of lighting design and recommendation, areas of ports and harbours have been broadly classified into three Groups as follows:

Group I — a) Loading and unloading areas along the berth,

b) Passenger berth,

c) Container terminal area and open storage yard,

d) Jettys, and

e) Oil/fuel storage areas.

Group II — Railway yard

Group III — Dry docks for repair of ships

4. LIGHTING OF GROUP I AREA

4.1 Primary Function — Primary functions of Group I lighting are:

a) to assist the captain of the ship to maneuver and berth the ship along the quay;

b) to provide lighting suitable to perform the functions of loading and unloading of cargo and container, safely and efficiently;

c) to provide lighting suitable for embarkation and disembarkation of passengers;

d) to assist the personnel/staff members to carry out routine tasks and perform other service functions in these areas;

e) to maintain security; and

f) to assist the operation of cargo handling equipment, such as cranes, container handling equipment, service vehicles, private cars, for quick gathering of informations to enable to reach in correct manner.

4.2 Performance Requirements — The foregoing requirements when translated into terms of lighting requirements for these areas can be summarized as follows:

4.2.1 *Illuminance and Uniformity*

4.2.1.1 An average horizontal illuminance of 20 lux is required for recognition of the objects and colour perception.

4.2.1.2 An average vertical illuminance of 10 lux is required for the recognition of objects or details of larger objects in the planes between the vertical and horizontal, as required by operators working from a relatively high positions of wharf cranes and such equipments in container areas, etc.

4.2.1.3 In this group, areas other than those in which cargo is actually slung, lifted, unloaded, etc, in wharf and container terminal areas, can have average horizontal illuminance of 5 lux.

4.2.1.4 To maintain acceptable visibility conditions, the uniformity ratio should be maintained at 0·2 (minimum to average).

4.2.1.5 It is recognized that some visual tasks require supplimentary lighting, for example portable telescopic mast lighting.

4.2.1.6 For security and safety reasons, additional illuminance greater than specified above may be required.

4.2.2 *Glare*

4.2.2.1 There are two types of glare in the shipping areas:

a) Direct glare from the light source, and

b) Indirect glare due to reflections of the light source in the water.

4.2.2.2 To minimize the direct and indirect glare:

a) The mounting height of the floodlights should be at least two times the maximum eye-height (normally at the ship bridge and the cranes).

b) The location and height of the towers should be such that inconvenience to the personnel on the berth due to glare is kept to a minimum.

c) The aiming of the floodlight should be such that the reflection of the same from the water surface does not affect vision from the bridges.

d) In order to meet these requirements floodlight luminaires may have to be provided with screening louvres or to be specially designed with double asymmetrical distribution. This flood light luminaires with special optical design when mounted in its basic mounting position with the glass front cover in an absolute horizontal position then all light distribution shall be below the horizontal plane, providing a cut-off light distribution with glare limitation in accordance with IS : 1944 (Parts 1 and 2)-1970*.

*Code of practice for lighting of public thoroughfares (*first revision*).

4.3 Design Criteria

4.3.1 *Lighting Aspects* — In addition to design criteria derived from the performance requirements, the following aspects should be considered in designing port and harbour lighting system.

4.3.1.1 *Light sources* — While selecting the light sources for any area floodlighting it is very essential to consider salient features like size, colour appearance and colour rendering properties, optical control and luminous efficacy, etc.

The degree of colour rendering which is required depends upon the visual task in ports and harbours (to be able to distinguish between vehicles, wagons, fire engines, fire extinguishers, coloured signals, etc). A sufficient degree of colour rendering will be obtained if the illuminance is about 15 lux and either incandescent, high pressure mercury or high pressure sodium lamps are used. From the point of view of energy conservation high pressure sodium lamp is more preferable.

4.3.1.2 *Luminaires* — The optical system of the luminaires is the most important criteria, whether it is streetlight or floodlight luminaires. The light distribution should meet with cut-off requirements to prevent the glare. Depending upon the location of the luminaire and area to be covered symmetrical, asymmetrical or double asymmetrical distribution of floodlights can be selected which again may be wide beam or narrow beam type.

Special attention should be given to the material used in the construction of luminaires hardwares and accessories as the saline atmosphere due to proximity of sea may cause rapid corrosion.

4.3.1.3 *Mast height and spacing* — The increased mounting height of the luminaires have following proven advantages:

a) Large areas can be illuminated from relatively few positions, thus minimizing the number of towers as well as the amount of obstruction in the working area;

b) Cabling costs are lower as supply is required at fewer points;

c) The glare is reduced;

d) The whole of the light appears to come from the sky or the uniformity at ground level is very good and the lighting is free from harsh shadows; and

e) Maintenance is easy as the floodlights are concentrated in batteries on tower platforms and in turns it results in reliability.

The optimum mounting height — technically and economically varies between 25 and 35 m. For a given mounting height, the spacing between the masts depends upon the light distribution of particular luminaires used and is limited by the requirements for uniformity and average horizontal and vertical illuminance. For all practical purposes the distance between two towers should not be more than seven or eight times mounting height of luminaires.

To minimize the shadows in loading and unloading areas where heavy movements of material is carried out it is essential that lighting is done from maximum possible sides.

4.3.1.4 *Supplementary lighting*

a) Wherever general illumination is not sufficient but require higher illumination for the particular task or to improve uniformity or to minimize the shadows supplementary lighting can be provided by using portable telescopic mast with halogen lamp luminaires.

b) Cranes cast harsh shadows and to minimize the shadows and to improve illumination in areas below cranes there is a need to provide localised lighting which can be achieved by halogen lamp luminaires. However, heavy vibrations cause problems to life of lamp. For damping the vibrations a suitable mechanical arrangement with springs is recommended.

4.3.2 *Physical Aspects* — During the design stage of lighting installation of ports and harbours considerations should be given to the physical aspects such as:

a) dimensions of ships normally using the berth, particularly height of bridge;

b) width and length of wharf apron;

c) movement of the cranes (jib), slings and cargo to avoid collision with tower or luminaires; and

d) location and height of sheds as well as other structures.

4.3.3 *Electrical Installation*

4.3.3.1 Emergency lighting shall be provided for safe movement of personnel, when considered necessary, to the level of 2 lux, from standby sources — generator or battery banks. This lighting can, with advantage, be provided with halogen lamp luminaires.

4.3.3.2 In areas like oil loading and discharge berths special attention should be given to electrical installation. In the oil handling jetties, the equipment mounted lower than 15 m height should be flameproof in nature.

For general movement and handling illuminance of 10 lux is recommended and can be achieved from luminaires at mounting height of about 15 m approx. The illumination level on the valves and manifolds should be 100 lux for reading gauges and valve labels, handling of pipe couplings, etc. In these circumstances sodium vapour lamps should be avoided as under wet conditions fall out of sodium in the event of lamp breakage can be dangerous.

4.3.4 *Maintenance Aspects*

4.3.4.1 The lighting system should be so designed that maintenance expense can be held to a reasonable value. If access to luminaires is difficult, it is most economical to change lamp on a group replacement basis. The cost of replacing lamps of high mounted luminaires can be significant, thus long life lamps should be used. When possible, the luminaires should be placed in such a way that they will be easily accessible without using special equipment.

5. LIGHTING OF GROUP II AREA — RAILWAY YARD LIGHTING

5.1 To facilitate the intensive scale shunting and speedy assembly of trains, to reduce accidents, to allow safe movement of wagons and railway personnel and to have better security and reduction in theft, there is a great need to illuminate the yard.

5.2 The average horizontal illuminance recommended for railway yards is 10 lux with uniformity ratio of Emin to Eave not less than 0·2.

5.3 Special attention should be given to lighting of switch point, hump area, loading and unloading areas, etc, to provide higher illumination with better uniformity to improve the visible conditions.

5.4 For lighting design criteria like light sources, luminaires, mast height and spacing and supplementary lighting guidance may be taken from **4.3.1.**

6. LIGHTINGS OF GROUP III AREAS — SLIPWAYS AND DRY DOCKS FOR SHIP REPAIR

6.1 Ship repair in slipways and dry docks involves replacement of hull plates, ranging of chains, mending rudder and propeller, repair and replacement of fittings, etc. Colour rendering is not so important in this area. Maintenance activities of ten consist of clearing and painting the hull. For this work, the illumination level produced by the general lighting is sufficient. However, colour rendition is of significance so as to distinguish the difference between painted and unpainted surface and between different paint layers.

General lighting illuminance recommended is 20 lux, although, in some cases, supplementary lighting is necessary.

6.2 Lighting Installation in Upper Part of Dock

6.2.1 To provide more even vertical illuminance on facade of hull, the luminaires are mounted along the upper edge of the dock, remaining above water at all times, and are easily accessible for maintenance. For uniform illuminance wide beam reflector with discharge lamps or tubular fluorescent lamps are recommended. For better uniformity, the mutual distance between the light source must not be greater than half the smallest distance between dockwell and hull.

6.3 Lighting Installation in Lower Part of Dock

6.3.1 For illumination of the keel and lower part of the hull, luminaires should be built into the side walls at, as low a position as possible to obtain the best possible angle of incidence of the light with respect to the keel.

Supplementary portable light shall be used if required. Glass front of the luminaires and watertight seal must be capable of withstanding the pressure of 1 kg per sq cm per 10 metre of water depth.

Gas discharge lamps having longer life are recommended in view of the extent of work involved in maintenance of water-tight luminaires.