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IS 7785-6-1 (1981): Elevated type aerodrome lighting fittings, Part 6: Taxiway lights, Section 1: Low intensity omni-directional elevated taxiway lighting fittings [ETD 24: Illumination Engineering and Luminaries]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard
SPECIFICATION FOR
ELEVATED TYPE AERODROME
LIGHTING FITTINGS
PART VI TAXIWAY LIGHTS
Section I Low Intensity Omni-Directional
Elevated Taxiway Lighting Fittings

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

Indian Standard
**SPECIFICATION FOR
 ELEVATED TYPE AERODROME
 LIGHTING FITTINGS**
PART VI TAXIWAY LIGHTS
**Section I Low Intensity Omni-Directional
 Elevated Taxiway Lighting Fittings**

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(Continued on page 2)

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Indian Standard
SPECIFICATION FOR
ELEVATED TYPE AERODROME
LIGHTING FITTINGS

PART VI TAXIWAY LIGHTS

**Section 1 Low Intensity Omni-Directional
Elevated Taxiway Lighting Fittings**

0. FOREWORD

0.1 This Indian Standard (Part VI/Sec 1) was adopted by the Indian Standards Institution on 9 November 1981, after the draft finalized by the Illuminating Engineering Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard is intended to deal with specific requirements of low intensity omni-directional elevated type of taxiway lighting fittings, in order to ensure their safe performance, good construction and high quality of workmanship.

0.3 This standard (Part VI/Sec 1) is one of the series of Indian Standards on elevated type aerodrome lighting fittings. The other parts of the series so far published are as follows:

- Part I General requirements;
- Part II Fixed focus high intensity bi-directional runway edge lighting fittings;
- Part III Low intensity runway edge lighting fittings;
- Part IV Angle of approach lights, Section 1 — Visual approach slope indicators; and
- Part V Approach lighting fittings, Section 1 — High intensity elevated approach lighting fittings.

0.4 This standard shall be read in conjunction with IS : 7785 (Part I)-1975*.

*Specification for elevated type aerodrome lighting fittings: Part I General requirements.

0.5 In the preparation of this standard assistance has been derived from the following:

BS 3224 : Section F1 : 1968 Specification for lighting fittings for civil land aerodromes, Section F1 Low intensity omni-directional elevated taxiway lighting fittings. British Standards Institution.

International Standards and Recommended Practices, Aerodromes, Annexure 14(1976) Ed 7. International Civil Aviation Organization.

Aerodrome Design Manual : Part 4 — Visual Aids (first edition 1976). International Civil Aviation Organization.

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, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the photometric performance and the essential mechanical and electrical features (excluding lamps) of blue, low intensity, omni-directional, elevated fittings for edge lighting of taxiways and other paved areas, on which aircrafts move at civil aerodromes.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS : 1885 (Part XVI/Sec 1)-1968† and IS : 1885 (Part XVI/Sec 2)-1968‡ shall apply.

3. CONDITIONS OF USE

3.1 The indicator shall be suitable for use on ac or dc systems, with a voltage not greater than 50 V dc or ac (rms) to earth.

3.2 Environmental Requirements — The equipment shall be designed for outdoor installation and continuous operation, and shall meet all specified requirements while operating under the following environmental conditions.

3.2.1 Temperature — A temperature range from -20°C to $+55^{\circ}\text{C}$.

*Rules for rounding off numerical values (revised).

†Electrotechnical vocabulary: Part XVI Lighting, Section 1 General aspects.

‡Electrotechnical vocabulary: Part XVI Lighting, Section 2 General illumination lighting fittings and lighting for traffic and signalling.

3.2.2 Altitude — Any altitude from sea level to 3 050 m above sea level.

3.2.3 Humidity — A humidity range from 10 percent to 95 percent at +55°C ambient temperature.

3.2.4 Sand and Dust — Exposure to airborne sand particles encountered in deserts or the result of air blast from jet aircraft.

3.2.5 Salt Spray — Exposure to a salt-laden atmosphere.

3.3 Care shall be taken in the design of the indicator to avoid the use of surfaces or components on which snow, ice, water, dust or blast effects from the jets can collect, and which might give rise to a false signal from the indicator.

4. DETAILED REQUIREMENTS

4.1 Light Distribution — When equipped with a lamp of light output and dimensions recommended by the manufacturer, the fitting shall give the following light distribution.

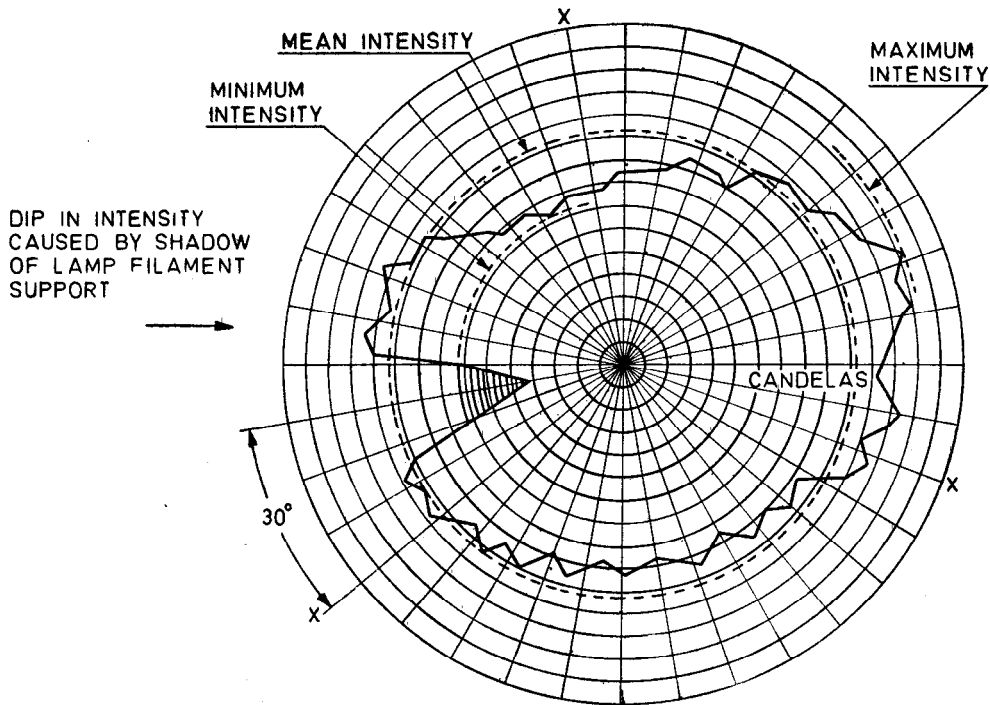
4.1.1 Azimuth — The light distribution throughout 360° in azimuth, measured at any one angle in elevation within the zone 0° to 30° above the horizontal shall be as uniform as possible having a variation in intensity not exceeding 3 : 1, measured in accordance with **6.3.1**, but excluding the effect of any shadow cast by the lamp filament supports. The angular spread and the amplitude of the fall in intensity by a filament support shadow are to be minimized.

NOTE — A typical azimuth distribution is shown in Fig. 1 and illustrates the requirements. The sharp dip in the curve is caused by the lamp filament support shadow and the other variations in intensity are due to the shape of the filament and imperfections in the optical system.

4.1.2 Elevation — For the average vertical polar distribution (see **6.3.2**), the average intensity of blue light in the vertical plane shall be not less than 4 cd from 1° to 6° above the horizontal and not less than 2 cd from 0° to 10° above the horizontal. The minimum intensity between 0° and 30° above the horizontal shall be not less than 0.2 cd.

Although the available flux shall be utilized in the zone 0° to 30° as far as possible, light may be emitted below 0° and above 30°.

4.2 Uniformity — At the angle of elevation of peak intensity, the average azimuth intensity, as measured in **6.3.1** and after correction for variation in light transmittancy of the blue filter, shall not vary by more than 2 : 1 from fitting to fitting using the recommended lamp.



X=the positions for the vertical polar curves.

FIG. 1 TYPICAL AZIMUTH DISTRIBUTION AT A SELECTED ANGLE IN ELEVATION

4.3 Colour — The colour of the light shall be aviation blue and its chromaticity shall be as specified in IS : 7785 (Part I)-1975*.

4.4 Mounting — The fittings shall have suitable mounting devices to ensure that the reliability of the lighting system is maintained and that it presents the minimum hazard to aircraft whether in flight or during ground manoeuvring. The fittings shall be either stake mounted or base mounted, having tubular support with breakable coupling or without tubular support but having breakable coupling which shall satisfy the frangibility requirements mentioned in 4.5.

4.4.1 In the case of base mounted fittings, heat resistant rubber/neoprene gasket for base cover plate having a thickness of not less than 3.17 mm may be provided, wherever specified by the purchaser.

4.4.2 All parts of the mounting assembly shall be made of non-ferrous metal. If made of ferrous metal, it should be protected suitably from corrosion.

4.5 Frangibility — The design and construction of the fitting and its mount shall be such that it will collapse or disintegrate when struck by an aircraft and will cause the aircraft the least possible damage. It shall satisfy the frangibility requirements given in 6.8.

4.6 Height — The overall height above ground level, when mounted, shall not exceed 350 mm.

4.7 Adjustment for Levelling — Simple means of lockable adjustment shall be provided for use in conjunction with an indicating device to compensate for installation errors of up to 5°. It shall be possible to make these adjustments to an accuracy of $\pm 0.5^\circ$.

4.8 Day Marker Cone — Provision shall be made for fitting a day marker cone, if required, below the optical portion of the fitting. The cone shall have a base diameter of 356 ± 6 mm and a minimum height of 76 mm and shall be so fitted that the base clears the ground.

4.9 Glasses and Transparent Parts — Outer glasses and colour filters shall be suitable for the temperature gradients to which they will be subjected, under the conditions specified in 3 and 6.4.3. The materials used shall be capable of withstanding, without permanent distortion, the full range of operating temperatures attained within ambient temperatures of -20°C and $+50^\circ\text{C}$.

*Specification for elevated type aerodrome lighting fittings: Part I General requirements.

4.10 Fastening of Covers — Covers which require to be opened or removed for the adjustment of the fitting, lamp changing, etc, shall be secured by strong fastenings which are easily operated without the use of special tools. Fastenings and gaskets shall be captive, either on the body of the fitting or on the removable cover.

4.11 Drainage — The fitting shall be so constructed that any water entering drains away without coming into contact with the lamp, internal optical surfaces or electrical connections.

4.12 Protection Against Corrosion — All parts shall be made of a material having good resistance to corrosion and suitable precautions shall be taken to prevent electrochemical corrosion occurring between parts of different metals. All external parts and surfaces shall have a suitable finish to withstand the effects of corrosion and the conditions referred to in 3.

4.13 Colour of External Finish — The external surfaces shall be finished in yellow colour (No. 355 of IS : 5-1978*).

4.14 Electrical Connections

4.14.1 Cable Entry — Provision shall be made for the entry of a supply cable between 6.35 mm and 12.7 mm in diameter, and for clamping the cable so as to prevent strain and twisting of the ends of the conductors connected to the terminals.

4.14.2 Terminals — Terminals shall be provided in the lampholder for connecting an incoming flexible cable with a conductor of size not less than 3.1 mm².

4.15 Lampholders — Lampholders shall be suitable to hold the prefocus type of lamps covered in IS : 8901-1978† and shall have both poles insulated from earth. The position of a lampholder with respect to the optical system shall be fixed and it shall not be possible to alter it inadvertently during installation, when renewing lamps or performing maintenance operations.

All materials used in the construction of a lampholder shall be capable of withstanding, without deterioration, the temperature reached under the most adverse operating conditions specified in 3 and with the recommended lamp. The maximum temperature of lampholder contacts shall not exceed 200°C.

NOTE — Where lamps of the conventional tungsten filament, airfield lighting type are used, it is essential that the design of the fitting and lamp is such that the temperature at the junction of the lamp cap and its glass does not exceed 210°C.

*Specification for colours for ready mixed paints and enamels (*third revision*).

†Specification for lamps for aerodrome lighting fittings.

4.16 Insulation — The insulation of live parts shall be capable of passing the test specified in 6.5. Insulating materials shall be non-hygroscopic and capable of withstanding indefinitely, without deterioration, the temperatures reached under the operating conditions specified in 3.

5. MARKING

5.1 Information to be Marked — Each light fitting shall be suitably and clearly marked with the following information:

- a) Manufacturer's name, or trade-mark or both;
- b) Model or type designation; and
- c) Country of manufacture.

5.2 Method of Marking — Marking shall be legible and indelible and shall be made either on the fitting itself or on a name plate securely fixed thereto.

NOTE — The performance of marking is checked by inspection or by rubbing lightly with a piece of cloth, or by both methods.

5.3 A complete list of parts, installation and maintenance instructions shall be furnished with each fitting. Sufficient drawings or instructions shall be provided to indicate clearly the method of installation.

5.4 The light fittings may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the rules and regulations made thereunder. The ISI mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. TESTS

6.1 Classification of Tests

6.1.1 Type Tests — The following shall constitute type tests:

- a) Visual examination (see 6.2);
- b) Photometric and colorimetric test (see 6.3);
- c) Thermal test (see 6.4);
- d) Insulation test (see 6.5);

IS : 7785 (Part VI/Sec 1) - 1981

- e) Mechanical test (see 6.6);
- f) High voltage test (see 6.7);
- g) Frangibility test (see 6.8); and
- h) Wind pressure test (see 6.9).

6.1.1.1 For carrying out type tests, the manufacturer shall submit to the testing authority 3 samples, preferably selected at random from regular production lots, together with relevant technical data as required.

6.1.1.2 *Criteria for approval* — The testing authority shall issue a type approval certificate, if the fittings are found to comply with the requirements of the test. In case of failure in any of the tests, testing authority shall call for fresh samples not exceeding twice the number of original samples and subject them to all the tests. If in the repeat tests, no failure occurs, the test may be considered to have been satisfied.

6.1.2 *Acceptance Test* — The following shall constitute acceptance tests:

- a) Visual examination (see 6.2);
- b) Insulation test (see 6.5);
- c) Mechanical test (see 6.6); and
- d) High voltage test (see 6.7).

6.1.2.1 For carrying out acceptance tests, the sampling procedure and criteria of acceptance shall be subject to agreement between the supplier and the purchaser.

6.1.3 *Routine Test* — The following shall constitute routine tests:

- a) Visual examination (see 6.2);
- b) Insulation test (see 6.5); and
- c) High voltage test (see 6.7).

6.2 Visual Examination — Indicators shall not have any visible sign of damage. Compliance is checked by visual examination.

6.3 Photometric and Colorimetric Tests

6.3.0 The fitting shall be tested for compliance with the requirements of 4.1, 4.2 and 4.3 using the recommended lamp at its nominal lumen output. Readings shall be made after the fitting has been operated at the rated wattage of the lamp for 2 hours, in an ambient temperature between 15°C and 40°C.

6.3.1 Azimuth Distribution — The distribution in azimuth shall be determined by measurements taken at 5° interval around 360° in azimuth and at the angle of elevation of the peak intensity indicated by the vertical polar distribution determined below.

6.3.2 Vertical Distribution — The average vertical polar distribution of the fitting shall be the mean of 3 vertical polar curves measured at 120° intervals in azimuth, one of which is displaced 30° from any depression in the light distribution in azimuth caused by a filament support (see Fig. 1). The measurements shall be taken at 1° intervals from the horizontal up to 30°.

NOTE — For the uniformity requirements of 4.2, the same lamp may be used in several fittings.

6.3.3 Colour — The colour of the light emitted is to be tested in accordance with 5.1.4 of IS : 7785 (Part I)-1975*.

6.4 Thermal Tests

6.4.1 Resistance to Heat — The fitting shall be operated with the lamp at its rated wattage, in an ambient temperature of $55 \pm 2^\circ\text{C}$ for 24 hours and there shall be no deterioration or permanent deformation of insulating materials or other parts.

6.4.2 Lampholder Contact Temperature — During the test specified in 6.4.1, the maximum temperature of the lampholder contacts shall be measured and shall not exceed 200°C . The fitting shall be switched on for at least 2 hours before the temperature measurement is made.

6.4.3 Resistance of Outer Glass to Thermal Shock — The fitting, without its day marker cone, shall be operated with the lamp at its rated wattage, in an ambient temperature between 15°C and 40°C for 2 hours and the glass shall then be subjected to an artificial rain spray at a temperature of at least 14°C below the ambient temperature and at a rate equivalent to 127 mm per hour for a period not less than 1 minute. No cracking of the glass or other failure shall occur.

6.5 Insulation Test — Immediately following the tests specified in 6.4.1 and 6.6.2, a test shall be made of insulation resistance. With the lamp removed, the insulation resistance between opposite poles of the lamp circuit and between each pole and the body of the fitting shall be not less than $0.1 \text{ M}\Omega$ measured at 100 V dc.

*Specification for elevated type aerodrome lighting fittings: Part I General requirements.

6.6 Mechanical Tests

6.6.1 Strength of Mounting Test — The screwed extremity of the tubular support shall be securely fixed and a gradually increasing load shall be applied to the extremity, at right angles to the support. The test shall be applied to 6 samples and in each case the bending moment to cause failure shall be not less than 67·8 Nm and not more than 271 Nm.

6.6.2 Drainage — The fittings are sprayed with water by means of a spray apparatus mentioned in 11.5.1.2 of IS : 1913 (Part I)-1978*. The fitting, equipped with its lamp which is not switched on, shall be mounted in its normal orientation on an adjustable support, so that it is near the centre of the arc described by the oscillating tube. The mounting plate shall be at least 100 mm greater than the diameter of the day marker cone.

The fitting shall be subjected to a spray of water at a temperature not exceeding 35°C and at a pressure of approximately 0·39 bar, the tube being oscillated so as to describe an angle of $\pm 60^\circ$ from the vertical. This treatment shall be continued for 2 hours, the fitting being rotated 90° in azimuth after 1 hour. The test shall be made first with, and secondly without, the day marker cone fitted.

After each test, the fitting shall be dismantled and inspected to ensure that no water has come into contact with the internal optical surface, lamp or electrical connections, or has accumulated inside the fitting in sufficient quantity to cause damage or interfere with its satisfactory operation.

6.7 High Voltage Test — The provisions of 5.8.8 of IS : 7785 (Part I)-1975† shall apply.

6.8 Frangibility Test — The fitting and its support should fail when an impact load of not more than 5 kgm and a static load of not less than 230 kg is applied horizontally at 30 cm above the break point of the structure. For the purpose of this test impact load test and static load test shall be carried out separately on 2 different fittings.

6.9 Wind Pressure Test — The indicator shall be mounted on a rigid horizontal test spigot tube with its maximum projected area laying in a horizontal plane. A distributed load of 2·4 kN/m² shall be applied, preferably by means of sand bags of suitable weight, for a period of 10 minutes. The test shall be repeated with the fittings turned through 180° about the axis of the spigot.

The fitting shall be deemed acceptable, if there is no failure, no movement at the point of attachment and no deflection exceeding 1°.

*General and safety requirements for luminaires: Part I Tubular fluorescent lamps (second revision).

†Specification for elevated type aerodrome lighting fittings: Part I General requirements.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous Intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg m/s ²
Energy	joule	J	1 J = 1 N m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 s ⁻¹
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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