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TECHNICAL REPORT

RAPPORT TECHNIQUE

Method of measurement of centre beam intensity and beam angle(s) of reflector lamps

Méthode de mesure de l'intensité dans l'axe du faisceau et de l'angle (ou des angles) d'ouverture des lampes à réflecteur

IEC/TR 61341:2010

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METHOD OF MEASUREMENT OF CENTRE BEAM INTENSITY AND BEAM ANGLE(S) OF REFLECTOR LAMPS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC 61341, which is a technical report, has been prepared by subcommittee 34A: Lamps, of IEC Technical Committee 34: Lamps and related equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
34A/1340/DTR	34A/1371/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This second edition cancels and replaces the first edition published in 1994 and constitutes a technical revision.

Due to the increasing use of reflector equipped LED lamps, the scope has been broadened and measurement conditions been included in order to take account of these lamps. Further, for easier understanding of the relation between the different axis and different intensities, two figures have been added. The luminous intensity distribution shall be reported instead of the centre beam intensity, if the latter is very low (“butterfly” distributions).

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

While the light output of lamps is normally characterized by the luminous flux, for reflector lamps it is characterized by the centre beam intensity together with the beam angle(s).

This Technical Report gives guidance with regard to the measurement and interpretation of these two basic characteristics of reflector lamps in order to allow the comparability of reported values.

The adopted principles may help to classify lamps into beam angle groups; they are not intended for the assessment of individual lamps.

For additional information, the reader is referred to the CIE Technical Report No 43, describing the photometric characteristics of floodlight luminaires.

METHOD OF MEASUREMENT OF CENTRE BEAM INTENSITY AND BEAM ANGLE(S) OF REFLECTOR LAMPS

1 Scope

This Technical Report describes the method of measuring and specifying the centre beam intensity and the associated beam angle(s) of reflector lamps.

It applies to incandescent, tungsten halogen and gas-discharge and LED based reflector lamps for general lighting purposes. It does not apply to lamps for special purposes such as projection lamps.

These recommendations relate to design testing of lamps only.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
optical beam axis
the axis about which the luminous intensity distribution is substantially symmetrical

NOTE 1 The optical beam axis is not necessarily the same as the lamp axis through the lamp cap or the lamp axis normal to a reference plane on the reflector (e.g. the rim), see Figure 1.

NOTE 2 It is assumed that only small (negligible) errors occur when symmetry is determined visually.

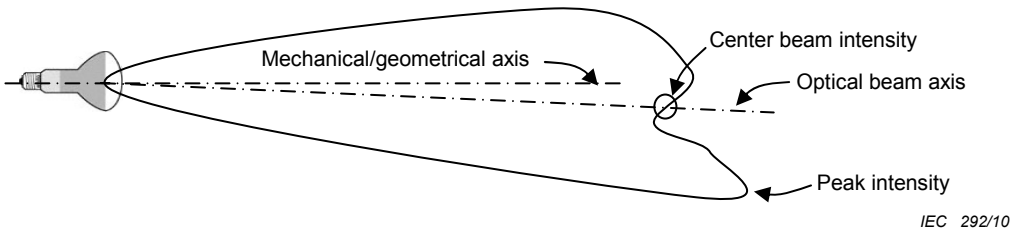

Figure 1 – Relation between optical beam axis, geometrical-mechanical axis, peak intensity and centre beam intensity

2.2
peak intensity
I_p
the highest value of the luminous intensity regardless of whether or not it occurs on the optical beam axis

NOTE The peak intensity is expressed in candela.

2.3
centre beam intensity
I_c
the value of the luminous intensity measured on the optical beam axis

NOTE The centre beam intensity is expressed in candela.

2.4
beam angle
the angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity

3 Basic beam patterns

The following beam patterns, as displayed on a surface normal to the optical beam axis, can be distinguished.

– Symmetrical beam patterns, i.e. circular beams, for which measurements in any two planes at right angles are sufficient.
– Asymmetrical beam patterns, for example oval or elliptical beams, which require measurements in two planes coinciding with the major and minor axes (at right angles) of the projected beam pattern.
– Irregular beam patterns, with more than one point of maximum intensity, which require measurement in a number of planes.

4 General conditions for measurement

For incandescent and tungsten halogen lamps, prior to measurement, the lamp shall be aged for approximately 1 h at its rated voltage. The measurements shall be made with a supply voltage which is equal to the rated lamp voltage and which must be maintained constant within ±0,5 %. If the lamp is marked with a voltage range, the test voltage shall be the mean of the voltage range. The lamp shall not be rotated around the lamp axis during measurement.

For gas-discharge lamps, prior to measurement the lamp shall be aged for 100 h of normal operation. During the measurement the appropriate reference ballast at rated input voltage and frequency shall be used. The position of the gas-discharge lamp shall not be changed during measurement.

For LED based reflector lamps, the measurement shall be made at an ambient temperature of 25 °C and at rated electrical operating conditions (voltage or current). The electrical operating conditions shall be maintained constant within ± 0,5 % at thermal equilibrium. If there is a temperature dependence of the luminous intensity of the LED based reflector lamp, the position shall not be changed during measurement.

5 Test arrangement

The lamp is mounted in a suitable test facility, e.g. a photometer bench or directional photometer.

The lamp is positioned at a suitable distance from the photo detector, i.e. the distance being greater or equal to the shortest test distance which is compatible with the inverse square law such that increasing the distance causes no practical change in the intensity.

The photo detector shall have spectral characteristics corrected according to the CIE spectral luminous efficiency curve for photopic vision. The photo detector measures illuminance, which is converted to luminous intensity by multiplying by the square of the distance.

The position of the photo detector relative to the lamp can be varied so that measurements can be made over the field of illumination of the lamp. The distance between the lamp and the photo detector should preferably be kept constant and the line perpendicular to the photo detectors face plane should pass through the centre of the front face of the lamp. This test

arrangement is based on the goniometer method of light intensity distribution measurement. If the distance is not kept constant, suitable corrections shall be made.

NOTE 1 It is not necessary, or in some cases not possible, to achieve accurate alignment of the optical beam axis in the measuring apparatus.

NOTE 2 Although specific details of a measuring system have been given, variations of technique are not excluded. Should any discrepancy of results occur, the test method given in this report should be regarded as the definitive technique.

6 Measuring procedure

6.1 The shape of the beam pattern, as projected on a matt screen, is viewed to determine which basic beam pattern applies.

6.2 For lamps having a symmetrical or asymmetrical beam pattern with

– only one peak in the beam intensity distribution, or
– in case of more than one peak, with an angle between the peaks which is smaller than 10º,

the centre beam intensity is equal to the peak intensity.

The position of peak intensity is determined visually and its value, to be recorded as the centre beam intensity (I_c), is found by moving the lamp or photo detector while observing the photo detector reading.

In each of the two planes (at right angles), the beam angle is determined by pivoting the lamp or rotating the photo detector from one point of reading half centre beam intensity (I_c/2) to the other point on the opposite side of the optical beam axis. For asymmetric beams, there may be a need that before measurement the lamp is rotated around its axis in order to align with the major and minor axes of the beam pattern.

6.3 For lamps having an irregular beam pattern with more than one peak in the luminous intensity distribution, the following procedure shall be used, if both

– the angle between the maxima is 10º or larger, and
– the maxima have a luminous intensity at least 10 % higher than the lowest intensity between them.

Measure the luminous intensity distribution (see Figure 2) and:

a) determine the point of peak intensity I_p;
b) determine the positions on the distribution curve where the intensity is I_p/2;
c) bisect the angle between these two points;
d) determine the intensity value at the mid-point; to be recorded as the centre beam intensity I_c;
e) determine the positions on the distribution curve where the intensity is I_c/2;
f) the beam angle is determined from the curve at the two points where the intensity is I_c/2.

Measurements need to be made in at least 6 planes at regular intervals (or alternatively at least 60 measurements in the field of illumination if plotting iso-candela diagrams).

NOTE Example: The (at least) 60 measurements may be achieved by at least 6 planes at 30 degree intervals and at least 13 points at 15 degree intervals in centre beam side. In this case, the total number of measurement points is 13 points per plane x 6 planes – 5 points = 73 points. The (-5) points are the same measurement points at the mid-point.

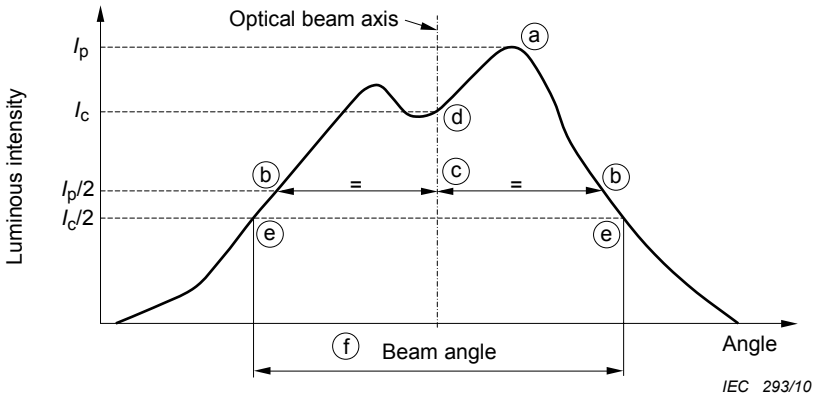

Figure 2 – Measurement of luminous intensity distribution

7 Specification of centre beam intensity and beam angle(s)

The value for the centre beam intensity shall be reported together with its beam angle(s). If the centre beam intensity is smaller than 50 % of the peak intensity, then a luminous intensity distribution shall be reported. See Figure 3.

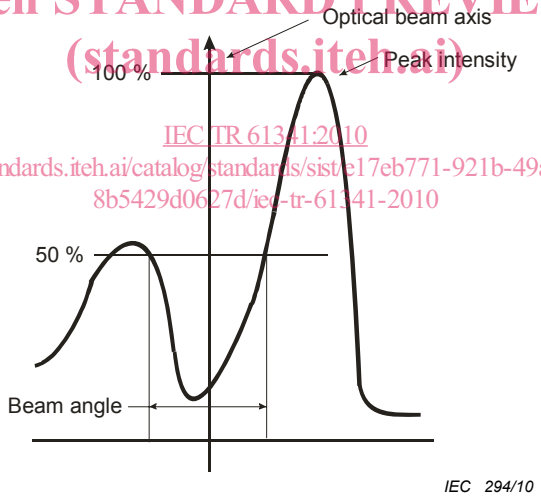

Figure 3 – Case where the centre beam intensity is smaller than 50 % of the peak intensity

The values of the beam angle in the different planes shall be averaged for symmetrical beams or reported for asymmetrical beams.