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Equipment for general lighting purposes – Objective test method for stroboscopic effects of lighting equipment

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COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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EQUIPMENT FOR GENERAL LIGHTING PURPOSES – OBJECTIVE TEST METHOD FOR STROBOSCOPIC EFFECTS OF LIGHTING EQUIPMENT

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IEC TR 63158, which is a Technical Report, has been prepared by IEC technical committee 34: Lamps and related equipment.

The text of this Technical Report is based on the following documents:

Draft TR	Report on voting
34/436/DTR	34/496/RVDTR

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

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

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

The fast rate at which solid state light (SSL) sources can change their intensity is one of the main drivers behind the revolution in the lighting world and applications of lighting. Linked to the fast rate of the intensity change is a direct transfer of the modulation of the driving current, both intended and unintended, to a modulation of the luminous flux. This light modulation can give rise to changes in the perception of the environment. While in some very specific entertainment, scientific or industrial applications a change of perception due to light modulation is desired, for most everyday applications and activities the change is detrimental and undesired. The general term used for these changes in the perception of the environment is “temporal light artefacts” (TLAs) and these can have a large influence on the judgment of the light quality. Moreover, the visible modulation of light can lead to a decrease in performance, increased fatigue as well as acute health problems like epileptic seizures and migraine episodes [1][3][1].

Different terms exist to describe the different types of TLAs that may be perceived by humans. The term ‘flicker’ refers to light variation that may be directly perceived by an observer. ‘Stroboscopic effect’ is an effect which may become visible for an observer when a moving or rotating object is illuminated (CIE TN 006:2016).

Possible causes for light modulation of lighting equipment that may give rise to flicker or stroboscopic effect are:

– AC supply combined with light source technology and its controlgear topology;
– dimming technology of externally applied dimmers or internal light level regulators;
– mains voltage fluctuations caused by electrical apparatus connected to the mains (conducted electromagnetic disturbances) or intentionally applied for mains-signalling purposes.

Lighting products that show unacceptable stroboscopic effect are considered as poor quality lighting.

Until recently, modulation depth (MD) – also called percent flicker – and flicker index (FI) were often used to quantify flicker or stroboscopic effect. It has been shown that both these metrics are not able to objectively score the level of flicker or stroboscopic effect as actually perceived by humans [1]. Therefore, instead of MD and FI, for ‘flicker’ the IEC-standardized ‘short-term flicker severity’ ($P_{\mathrm{st}}^{\mathrm{LM}}$) is used, which is derived from the widely applied and accepted IEC-standardized P_{st}-metric to assess the impact of voltage fluctuations on flicker [5]. For the objective assessment of stroboscopic effect, the stroboscopic effect visibility measure (SVM) is available [6].

In 2013, a clear need was identified for an objective test method for testing lighting equipment against flicker caused by voltage fluctuations induced by switching loads such as household appliances. Technical committee 34 developed and verified an objective test method for flicker using the flicker metric $P_{\mathrm{st}}^{\mathrm{LM}}$. This objective flicker test method is described in IEC TR 61547-1 [5].

In recent years the interest in objective testing of stroboscopic effect has also increased considerably. In the near future, CIE will start developing a basic standard on TLA metrology including objective test methods for flicker and stroboscopic effect.

This document provides practical considerations and application examples on how to objectively quantify the stroboscopic effect performance of lighting equipment in terms of SVM.

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1 Numbers in square brackets refer to the Bibliography.

EQUIPMENT FOR GENERAL LIGHTING PURPOSES – OBJECTIVE TEST METHOD FOR STROBOSCOPIC EFFECTS OF LIGHTING EQUIPMENT

1 Scope

This document describes an objective stroboscopic effect visibility (SVM) meter, which can be applied for performance testing of lighting equipment under different operational conditions.

The stroboscopic effects considered in this document are limited to the objective assessment by a human observer of visible stroboscopic effects of temporal light modulation of lighting equipment in general indoor applications, with typical indoor light levels (> 100 lx) and with moderate movements of an observer or nearby handled object (< 4 m/s). Details on restriction of the applicability of the stroboscopic effect visibility measure is given in Clause A.1.

For assessing unwanted stroboscopic effects in other applications, such as the misperception of rapidly rotating or moving machinery in an industrial environment for example, other metrics and methods can be required.

The object of this document is to establish a common and objective reference for evaluating the performance of lighting equipment in terms of stroboscopic effect. Temporal changes in the colour of the light (chromatic effects) are not considered in this test. This document describes the methodology for SVM and does not define any limits.

The objective method and procedure described in this document are based on CIE TN 006:2016 on temporal light artefacts (TLAs).

The method described in this document can be applied to objectively assess the stroboscopic effect of lighting equipment that is powered from any type of source, AC mains, DC mains, battery fed or fed through an external dimmer.

2 Normative references

There are no normative references in this document.