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Part 2: Objective test method for stroboscopic effects

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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



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COMMITTEE DRAFT (CD)

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TITLE:
Equipment for general lighting purposes – Temporal light artefacts - Part 2: Objective test method for stroboscopic effects

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Temporal light artefacts - Part 2: Objective test method
for stroboscopic effects****FOREWORD**

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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 output. This light modulation can give rise to changes in the perception of the environment and can have a large influence on the judgment of the light quality. Moreover, excessive visible modulation of light can lead to a decrease in performance, increased fatigue as well as health problems like epileptic seizures and migraine episodes [1][3].

The term 'Stroboscopic effect', which has a measure called stroboscopic visibility measure (SVM) with a symbol M_{vs} , is an effect which may become visible for an observer when a moving or rotating object is illuminated (CIE TN 006:2016). Lighting products that show unacceptable stroboscopic effect are considered not good quality lighting.

This document provides a method for measuring objectively the stroboscopic effect performance of lighting equipment based on IEC TR 63158, CIE TN 012 and CIE TR 249 in terms of stroboscopic effect.

EQUIPMENT FOR GENERAL LIGHTING PURPOSES – Temporal light artefacts - Part 2: Objective test method for stroboscopic effects

1 Scope

This document establishes an objective stroboscopic visibility measure meter (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). See also A.1 for details on restriction on the applicability of SVM meter.

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 may 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.

The objective method and procedure described in this document are based on IEC TR 63158, CIE TN 012, and CIE TR 249.

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

The following documents are referred to in the text in such a way that some or all their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CIE TN 006:2016, *Visual Aspects of Time-Modulated Lighting Systems – Definitions and Measurement Models*

CIE TN 012:2021, *Guidance on the Measurement of Temporal Light Modulation of Light Sources and Lighting Systems*

CIE 121:1996, CIE Technical Report – *The Photometry and Goniophotometry of Luminaires*

CIE TR 249:2022, *Technical Report – Visual Aspects of Time-Modulated Lighting Systems*
CIE S025:2015, *Test Method for LED Lamps, LED Luminaires and LED Modules*

ISO/CIE 11664-1:2019, *Colorimetry – Part 1: CIE standard colorimetric observers*
NEMA SSL 7A-2015, *Phase-Cut Dimming for Solid State Lighting: Basic Compatibility*

IEC TR 63037:2016, *Electrical interface specifications for integrated lamps and control gear in phase-cut dimmed lighting systems*

218 IEC TR 63036:2016, *Electrical interface specification for phase-cut dimmer in phase-cut*
219 *dimmed lighting systems*

220 **3 Terms and definitions**

221 **3.1 General**

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

223 ISO and IEC maintain terminological databases for use in standardization at the following
224 addresses:

- 225 • IEC Electropedia: available at <http://www.electropedia.org/>
- 226 • ISO Online browsing platform: available at <http://www.iso.org/obp>

227 **3.2 Terms and definitions**

228 **3.2.1**

229 **auxiliary equipment**

230 **AuxEq**

231 peripheral equipment that is part of the system under test

232 **3.2.2**

233 **equipment under test**

234 **EUT**

235 equipment subjected to stroboscopic visibility tests

236 **3.2.3**

237 **system under test**

238 **SUT**

239 combination of auxiliary equipment and equipment under tests

240 **3.2.4**

241 **temporal light artefact**

242 **TLA**

243 change in visual perception, induced by a light stimulus the luminance or spectral distribution
244 of which fluctuates with time, for a human observer in a specified environment

245 Note 1 to entry: The change of visual perception is a result of comparing the visual perception of the
246 environment lit by the modulated light to the visual perception of the same person in the same
247 environment, when the environment is lit by non-modulated light.

248 [SOURCE: CIE TN 006:2016]

249 **3.2.5**

250 **flicker**

251 perception of visual unsteadiness induced by a light stimulus the luminance or spectral
252 distribution of which fluctuates with time, for a static observer in a static environment

253 Note 1 to entry: The fluctuations of the light stimulus with time include periodic and non-periodic
254 fluctuations and may be induced by the light source itself, the power source or other influencing factors.

255 Note 2 to entry: Flicker is a type of temporal light artefact.

256 Note 3 to entry: A static observer and a static environment are minimal requirements for the detection of flicker, but
257 they are not limiting. This means that flicker can also be detected by a non-static observer or in a non-static
258 environment

259 [SOURCE: CIE TR 249:2022]

3.2.6**stroboscopic effect**

change in motion perception induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a non-static environment

Note 1 to entry: The stroboscopic effect is a type of temporal light artefact.

EXAMPLE 1 For a square periodic luminance fluctuation, moving objects are perceived to move discretely rather than continuously.

EXAMPLE 2 If the frequency of a periodic luminance fluctuation coincides with the frequency of a rotating object, the rotating object is perceived as static.

[SOURCE: CIE TN 006:2016]

3.2.7**static observer**

observer who does not make large voluntary saccades, i.e. observer whose gaze is directed at a target

Note 1 to entry: Only large eye movements (saccades) fall under this definition, with the smallest large voluntary saccades that occur during reading having amplitudes of around 1° to 2° of visual field (Robert and Wilkins, 2013). It is recognized that the eyes of an observer are continually in motion. As such, an observer who makes other types of eye movements, notably involuntary eye movements that occur during fixation (e.g. micro-saccades, drift, tremor), is considered "static".

[SOURCE: CIE TR 249:2022]

3.2.8**static environment**

environment that does not contain perceivable motion under non-modulated lighting conditions

[SOURCE: CIE TN 006:2016]

3.2.9**average observer**

observer representing the mean characteristics of a specified population of sighted individuals

Note 1 to entry: The population in question depends on the application a lighting system is designed for. It can also include specific groups of observers as for example migraine sufferers. A general average observer is based on data aggregated across gender and age but specific observers can be defined for subgroups.

[SOURCE: CIE TN 006:2016]

3.2.10**visibility threshold**

level of light modulation, at which an average observer, when presented with and questioned about the visibility of an artefact, can detect the artefact with a probability of 50 %

[SOURCE: CIE TN 006:2016]

3.2.11**stroboscopic visibility measure (SVM)**

M_{vs}

measure of stroboscopic effect evaluated over a specified time interval of a relatively short duration

Note 1 to entry: The duration is typically 1 sec, in accordance with CIE TN 006.

3.2.12**modulation depth**

MD