



BSI Standards Publication

## **Light and lighting — Maintenance factor determination — Way of working**

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## National foreword

This Published Document is the UK implementation of ISO/CIE TS 22012:2019.

The UK participation in its preparation was entrusted to Technical Committee EL/1, Light and lighting applications.

A list of organizations represented on this committee can be obtained on request to its secretary.

The UK committee draws users' attention to [Table C.5](#), which provides examples of luminaire maintenance factors (LMFs) for general outdoor lighting installations. However, more detailed research has been carried out on road lighting in the UK. LMF values for road lighting can be found in BS 5489-1:2013.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

ISO collaborates closely with the International Commission on Illumination (CIE) on all matters of standardization for light and lighting.

This document was prepared by Technical Committee ISO/TC 274, *Light and lighting*. The document has been jointly prepared with CIE JTC 11, *Light and Lighting — Maintenance factor — Way of working*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Continuous maintenance of lighting installations is essential as it ensures that the performance of a system stays within the design limits and promotes safety and efficient use of energy. In the design phase this is taken into account through the use of the maintenance factor. The maintenance factor combines several different factors such as the assumed product/installation behaviour, the environmental parameters and maintenance and cleaning schedules.

The methodology of determining the maintenance factor has been extensively documented by CIE (see [Clause 2](#) and bibliography). However, as the focus of these technical reports was predominantly on incandescent and gas discharge light sources, more clarity is needed to ensure the proper use/translation of the existing methodology towards technologies such as light emitting diodes (LED).

Technologies such as LED distinguish themselves from other technologies by their long lifetime, low failure rate and their integration of components which were previously seen as separate components. As such the previous methods used to determine the depreciation and survival of luminaires might seem unusable and cause uncertainty. However, based on work by IEC (see [Clause 2](#)) the luminous flux depreciation and light source failure parameters have now been (re)established for LED-based light sources and allow for translation into an updated way of working to determine the maintenance factor using the existing CIE methodology and data for luminaire and surface dirt depreciation.

This document combines insights from IEC standards with regard to product performance of luminaires and light sources currently in the market with the existing determination methodology from CIE Technical Reports. Furthermore, it references the data in the CIE Technical Reports with regard to the impact of the environment on luminaires (accumulation of dirt on surfaces and luminaires).

This document provides the following:

- background information with respect to the principles of the maintenance factor and the relevant parameters for indoor and outdoor applications;
- a detailed way of working on how to apply the maintenance factor determination method (as described in CIE 154:2003 and CIE 097:2005) for outdoor and indoor lighting designs using the technologies available in the market;
- explanation and examples on how to apply the maintenance factor and how to ensure proper operation over time corresponding to the determined values.





# Light and lighting — Maintenance factor determination — Way of working

## 1 Scope

This document specifies a standardized way of working for determining the maintenance factor for both outdoor and indoor lighting installations using the methodology as described in CIE 154:2003 and CIE 097:2005.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of 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 097:2005, *Maintenance of Indoor Electric Lighting Systems*

CIE 154:2003, *Maintenance of Outdoor Lighting Systems*

IEC 62722-2-1, *Luminaire performance — Part 2-1: Particular requirements for LED luminaires*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in CIE S 017 and the following apply.

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

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

### 3.1

#### **abrupt failure value**

#### **AFV**

percentage of LED based products failing to operate at median useful life ( $L_x$ )

[SOURCE: IEC 62717:2014+AMD1:2015, modified — generalized to products]

### 3.2

#### **cleaning interval**

planned time between cleaning of (parts of) the products and/or components

### 3.3

#### **CLO lifetime**

time over which the CLO (3.5) feature ensures a constant luminous flux

### 3.4

#### **component replacement interval**

planned time between replacement of one or more specified luminaire component(s)

### 3.5

#### **CLO**

#### **constant light output**

functionality to constantly adjust the luminous flux of the light source based on the known or predicted depreciation behaviour of the light source to enable a constant luminous flux over time