ISBN 3 901 906 44 4

CIE

COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

TECHNICAL REPORT

PRACTICAL DESIGN GUIDELINES FOR THE LIGHTING OF SPORT EVENTS FOR COLOUR TELEVISION AND FILMING

CIE 169:2005

UDC: 621.397.132
628.971.7

Descriptor: Colour television
Lighting of sports grounds

THE INTERNATIONAL COMMISSION ON ILLUMINATION

The International Commission on Illumination (CIE) is an organisation devoted to international co-operation and exchange of information among its member countries on all matters relating to the art and science of lighting. Its membership consists of the National Committees in about 40 countries.

The objectives of the CIE are :

1. To provide an international forum for the discussion of all matters relating to the science, technology and art in the fields of light and lighting and for the interchange of information in these fields between countries.
2. To develop basic standards and procedures of metrology in the fields of light and lighting.
3. To provide guidance in the application of principles and procedures in the development of international and national standards in the fields of light and lighting.
4. To prepare and publish standards, reports and other publications concerned with all matters relating to the science, technology and art in the fields of light and lighting.
5. To maintain liaison and technical interaction with other international organisations concerned with matters related to the science, technology, standardisation and art in the fields of light and lighting.

The work of the CIE is carried on by seven Divisions each with about 20 Technical Committees. This work covers subjects ranging from fundamental matters to all types of lighting applications. The standards and technical reports developed by these international Divisions of the CIE are accepted throughout the world.
A plenary session is held every four years at which the work of the Divisions and Technical Committees is reviewed, reported and plans are made for the future. The CIE is recognised as the authority on all aspects of light and lighting. As such it occupies an important position among international organisations.

LA COMMISSION INTERNATIONALE DE L'ECLAIRAGE

La Commission Internationale de l'Eclairage (CIE) est une organisation qui se donne pour but la coopération internationale et l'échange d'informations entre les Pays membres sur toutes les questions relatives à l'art et à la science de l'éclairage. Elle est composée de Comités Nationaux représentant environ 40 pays.

Les objectifs de la CIE sont :

1. De constituer un centre d'étude international pour toute matière relevant de la science, de la technologie et de l'art de la lumière et de l'éclairage et pour l'échange entre pays d'informations dans ces domaines.
2. D'élaborer des normes et des méthodes de base pour la métrologie dans les domaines de la lumière et de l'éclairage.
3. De donner des directives pour l'application des principes et des méthodes d'élaboration de normes internationales et nationales dans les domaines de la lumière et de l'éclairage.
4. De préparer et publier des normes, rapports et autres textes, concernant toutes matières relatives à la science, la technologie et l'art dans les domaines de la lumière et de l'éclairage.
5. De maintenir une liaison et une collaboration technique avec les autres organisations internationales concernées par des sujets relatifs à la science, la technologie, la normalisation et l'art dans les domaines de la lumière et de l'éclairage.

Les travaux de la CIE sont effectués par 7 Divisions, ayant chacune environ 20 Comités Techniques. Les sujets d'études s'étendent des questions fondamentales, à tous les types d'applications de l'éclairage. Les normes et les rapports techniques élaborés par ces Divisions Internationales de la CIE sont reconnus dans le monde entier.
Tous les quatre ans, une Session plénière passe en revue le travail des Divisions et des Comités Techniques, en fait rapport et établit les projets de travaux pour l'avenir. La CIE est reconnue comme la plus haute autorité en ce qui concerne tous les aspects de la lumière et de l'éclairage. Elle occupe comme telle une position importante parmi les organisations internationales.

DIE INTERNATIONALE BELEUCHTUNGSKOMMISSION

Die Internationale Beleuchtungskommission (CIE) ist eine Organisation, die sich der internationalen Zusammenarbeit und dem Austausch von Informationen zwischen ihren Mitgliedsländern bezüglich der Kunst und Wissenschaft der Lichttechnik widmet. Die Mitgliedschaft besteht aus den Nationalen Komitees in rund 40 Ländern.

Die Ziele der CIE sind :

6. Ein internationaler Mittelpunkt für Diskussionen aller Fragen auf dem Gebiet der Wissenschaft, Technik und Kunst der Lichttechnik und für den Informationsaustausch auf diesen Gebieten zwischen den einzelnen Ländern zu sein.
7. Grundnormen und Verfahren der Meßtechnik auf dem Gebiet der Lichttechnik zu entwickeln.
8. Richtlinien für die Anwendung von Prinzipien und Vorgängen in der Entwicklung internationaler und nationaler Normen auf dem Gebiet der Lichttechnik zu erstellen.
9. Normen, Berichte und andere Publikationen zu erstellen und zu veröffentlichen, die alle Fragen auf dem Gebiet der Wissenschaft, Technik und Kunst der Lichttechnik betreffen.
10. Liaison und technische Zusammenarbeit mit anderen internationalen Organisationen zu unterhalten, die mit Fragen der Wissenschaft, Technik, Normung und Kunst auf dem Gebiet der Lichttechnik zu tun haben.

Die Arbeit der CIE wird in 7 Divisionen, jede mit etwa 20 Technischen Komitees, geleistet. Diese Arbeit betrifft Gebiete mit grundlegendem Inhalt bis zu allen Arten der Lichtanwendung. Die Normen und Technischen Berichte, die von diesen international zusammengesetzten Divisionen ausgearbeitet werden, sind von der ganzen Welt anerkannt.
Tagungen werden alle vier Jahre abgehalten, in der die Arbeiten der Divisionen überprüft und berichtet und neue Pläne für die Zukunft ausgearbeitet werden. Die CIE wird als höchste Autorität für alle Aspekte des Lichtes und der Beleuchtung angesehen. Auf diese Weise unterhält sie eine bedeutende Stellung unter den internationalen Organisationen.

Published by the

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ISBN 3 901 906 44 4

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This Technical Report has been prepared by CIE Technical Committee 5-11 of Division 5 "Exterior and other lighting applications" and has been approved by the Board of Administration of the Commission Internationale de l'Eclairage for study and application. The document reports on current knowledge and experience within the specific field of light and lighting described, and is intended to be used by the CIE membership and other interested parties. It should be noted, however, that the status of this document is advisory and not mandatory. The latest CIE proceedings or CIE NEWS should be consulted regarding possible subsequent amendments.

Ce rapport technique a été élaboré par le Comité Technique CIE 5-11 de la Division 5 "Eclairage extérieur et autres applications" et a été approuvé par le Bureau de la Commission Internationale de l'Eclairage, pour étude et emploi. Le document expose les connaissances et l'expérience actuelles dans le domaine particulier de la lumière et de l'éclairage décrit ici. Il est destiné à être utilisé par les membres de la CIE et par tous les intéressés. Il faut cependant noter que ce document est indicatif et non obligatoire. Il faut consulter les plus récents comptes rendus de la CIE, ou le CIE NEWS, en ce qui concerne des amendements nouveaux éventuels.

Dieser Technische Bericht ist vom CIE Technischen Komitee 5-11 der Division 5 "Außenbeleuchtung und andere Lichtanwendungen" ausgearbeitet und vom Vorstand der Commission Internationale de l'Eclairage gebilligt worden. Das Dokument berichtet über den derzeitigen Stand des Wissens und Erfahrung in dem behandelten Gebiet von Licht und Beleuchtung; es ist zur Verwendung durch CIE-Mitglieder und durch andere Interessierte bestimmt. Es sollte jedoch beachtet werden, daß das Dokument eine Empfehlung und keine Vorschrift ist. Die neuesten CIE-Tagungsberichte oder das CIE NEWS sollten im Hinblick auf mögliche spätere Änderungen zu Rate gezogen werden.

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The following members of TC 5-11, "Practical design guidelines for sports lighting installations for television" took part in the preparation of this technical report. The committee comes under Division 5 "Exterior and other lighting applications".

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The production of the figures by Tungsram-Schréder is gratefully acknowledged.

Contents

PRACTICAL DESIGN GUIDELINES FOR THE LIGHTING OF SPORTS EVENTS FOR COLOUR TELEVISION AND FILMING

SUMMARY

This technical report gives practical guidance to those concerned with the designing and planning of sports facilities where lighting is required to meet the needs of colour television and filming.

The report should be read in conjunction with CIE 83-1989, which defines the quantitative lighting requirements. This report is arranged in three main sections:

Firstly, there is general guidance on sports lighting design including luminaires and lamp types, calculation methods, and electrical installation.

The second section lists 51 sports with specific advice on the lighting of each.

The third section gives references to relevant standards and in particular publications in which new sports lighting installations may be described.

RECOMMANDATIONS PRATIQUES POUR LES PROJETS D'ECLAIRAGE DES MANIFESTATIONS SPORTIVES POUR LA TELEVISION COULEUR ET LES FILMS

RESUME

Ce rapport technique donne des conseils pratiques aux acteurs concernés par les projets et la mise en oeuvre des installations sportives où l'éclairage est censé respecter les besoins de la télévision couleur et des prises de vue pour les films.

Ce rapport doit être consulté en parallèle avec la publication CIE 83-1989 qui définit quantitativement les exigences d'éclairage. Ce rapport est composé de trois parties principales:

Premièrement, il s'agit d'un guide général sur les projets d'éclairage des installations sportives traitant des types de luminaires et de lampes, des méthodes de calcul et de l'installation électrique.

La deuxième partie comporte une liste de 51 sports avec les conseils d'éclairage spécifiques pour chacun d'eux.

La troisième partie donne les références des normes appropriées et en particulier des publications dans lesquelles de nouvelles installations d'éclairage sportif peuvent être décrites.

RICHTLINIEN ZUR ENTWURFSPRAXIS VON FARBFERNSEH- UND FILMGERECHTER BELEUCHTUNG VON SPORTVERANSTALTUNGEN

ZUSAMMENFASSUNG

Dieser Technische Bericht bietet praktische Hinweise für den Entwurf und die Ausführung von Sportanlagen, deren Beleuchtung den Anforderungen für Farbfernseh- und Filmaufnahmen gerecht werden soll.

Der Bericht ist zusammen mit der Publikation CIE 83-1989 zu lesen, in der die lichttechnischen Anforderungen quantitativ beschrieben sind. Der Bericht ist in drei Hauptabschnitte gegliedert:

Im ersten finden sich generelle Hinweise zur Planung von Sportstätten-beleuchtungen, zur Auswahl von Lampen und Leuchten, sowie zu Berechnungsmethoden und zur elektrischen Installation.

Im zweiten Abschnitt sind 51 Sportarten mit jeweils spezifischen Empfehlungen zur Beleuchtung aufgelistet.

Im dritten Abschnitt werden Verweise auf einschlägige Normen gegeben und im besonderen wird auf Veröffentlichungen hingewiesen, in denen Beschreibungen neuer Sportstätten-Beleuchtungsanlagen gefunden werden können.

PART A: INTRODUCTION AND GENERAL ASPECTS

1. INTRODUCTION

This guide gives practical advice to architects, consultants, and lighting designers on the realisation of good quality installations for sports lighting for colour television and filming. The basic recommendations are laid down in CIE 83-1989. However, broadcasting unions have often extended the standards and, moreover, the television directors have developed over time specific methods of covering games in relation to the particular type of sport. The ongoing development in camera quality has exploited both with respect to use and portability of (auxiliary) cameras.

The practical guidance in this report reflects the state of the art of modern sports lighting design world-wide. The report is divided into a general section with guidelines on design, maintenance and hardware (lamps, luminaires, and systems) valid for many different types of sport and a section that specifically covers all individual sports listed in CIE 83-1989. For each of the sports, a separate paragraph is devoted to giving the typical lay-out of the playing area, the preferred location of the lighting, the most important camera locations, and the points for special attention to avoid pitfalls in the lighting design for that particular sport.

It should be noted that many suppliers of lamps and luminaires regularly publish details of new installations and various sports federations, both national and international, published guidelines, including lighting for their specific field of interest. It is recommended that advice should be sought of specialists in designing sports lighting installations suitable for CTV (colour television) coverage, especially for large international tournaments and games. Also, under each sport, the address of the particular International Sports Federation is given. Many of these federations have extensive information available on details of their specific requirements, many of which are relevant to the lighting design.

2. GENERAL DESIGN CONSIDERATIONS

In CIE 83-1989, the various lighting parameters and, as far as possible, the quantitative values for each of the parameters are given. Sports are divided into three categories, determined mainly on the basis of the speed of action occurring during camera shots and maximum shooting distance. The illuminance values are service values, in that report. Since they were published, the concept of maintained illuminance has been introduced, whereby the quoted values should be the lowest that will occur during the life of the installation. So the minimum requirement is the maintained illuminance averaged over the calculated grid points. Consequently, to adjust the illuminance values in CIE 83-1989 to those for maintained illuminance, the CIE 83-1989 values should be multiplied by 0,8. This is in line with what has been done in the CEN (European) draft standard. The modified table for vertical illuminance in CIE 83-1989 is shown in Section 9, Table 1 of this report. The graph in Fig. 1 illustrates the expected reduction of the initial performance related to lamp lumen depreciation and luminaire cleaning as detailed in CIE 154:2003 "The maintenance of outdoor lighting systems".

Typical maintenance factors are (for the same lamp/luminaire combination):

$E_{service} = 0{,}8 \cdot E_{initial}$,

$E_{maintained} = 0{,}8 \cdot E_{service} = 0{,}64 \cdot E_{initial}$

Maintenance is required at the time the illuminance value falls below the specified maintained illuminance as given in Section 9 of Part A, Table 1.

The value of such maintenance programme is indicated as an example in Fig. 1. Clearly the depreciation in the un-maintained scheme will fall by around 65% of the initial value within 3 years, and it will continue to decline. By comprehensive cleaning, the decline is checked at under 40% depreciation.

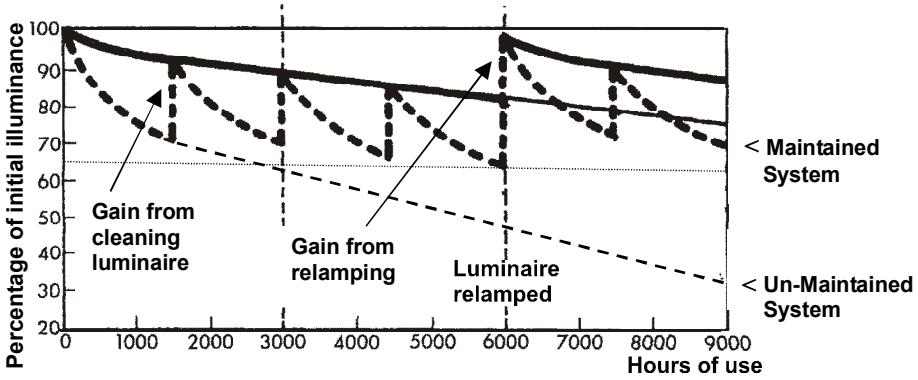

Fig. 1. The effect of maintenance program.

It is evident that the concept of minimum requirement for the maintained illuminance offers options for lower initial illuminance values for high quality lamp/luminaire combinations (see Section 4 of Part A).

A maintenance factor should be included to compensate for ageing and soiling of the lamps, reflectors, and front glasses. This factor is dependent on the type of lamp (see manufacturers' data), the local conditions (to be specified on the basis of local experience) and the luminaire type (e.g. IP classification). In the absence of relevant information, CIE 83-1989 recommends a maintenance factor of 0,8. In designing a CTV lighting installation, the lighting criteria for other users (i.e. players and spectators) besides the CTV viewers should be given full consideration. The players and referee(s) must be able to see clearly all that is going on in the playing area, so that they can achieve their best possible performance. Spectators have to be able to follow the players and developments of the game in an agreeable environment, and in a comfortable way. This means that they must be able to see their surroundings and immediate neighbours as well. The lighting should also support safe entry to and departure from the sports venue. Especially with large crowds, the security aspect is of utmost importance. With respect to comfort and performance for both players and spectators, glare should be kept to a minimum.

The lighting criteria for players and spectators might conflict with the CTV requirements and could limit the number of camera locations or the area covered for a particular camera, for example. This is especially so in those cases where luminaires and floodlights cannot be installed in the preferred positions due to physical limitations of the sports facility. In this respect, it is of primary importance that architects and lighting specialists work closely together straight from the conceptual design phase until final completion of the new sports venue. In many cases, the ultimate lighting quality can benefit greatly from an integrated approach. Such co-operation is even more important in the case of integration of the lighting installation in the building construction, whether it be indoor (e.g. ceiling system) or outdoor (e.g. in the roof of a stadium). Unacceptable glare, direct or indirect (e.g. in swimming pools), can largely be avoided if in the conceptual architectural design phase the lighting requirements are taken into account.

Daylight effects can have a negative influence on the overall lighting quality, both in indoor and outdoor venues.

Indoors, the penetration of daylight, both sunlight and sky brightness, should be avoided as they will give unacceptably high brightness and shadows. This is especially true in the case of glossy floors, and water surfaces in sports halls, and swimming complexes. Properly designed sun blinds, preferably only partly translucent, can avoid these effects.

In outdoor venues, direct sunlight can cause harsh shadows resulting in unacceptable contrasts for the television cameras when shifting from the bright illuminated area to the shadowed area of a playing field. Where certain parts of a grass playing field area are always in shadow, uniformity problems under artificial lighting might occur because of the darker colour of the grass in the shadowed part.