

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

## **Belysningsmateriel – Metallhalogenlampor – Prestandafordringar**

*Metal halide lamps –  
Performance specification*

Som svensk standard gäller europastandarderna EN 61167:2018 och EN 61167:2018/A1:2018.  
Den svenska standarden innehåller de officiella engelska språkversionerna av EN 61167:2018 och EN 61167:2018/A1:2018.

### **Nationellt förord**

Europastandarderna EN 61167:2018 och EN 61167:2018/A1:2018

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61167, Fourth edition, 2018<sup>\*)</sup> - Metal halide lamps - Performance specification**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 61167, utgåva 3, 2016, gäller ej fr o m 2021-11-02.

---

<sup>\*)</sup> Amendment No1:2018 till IEC 61167:2018 är inarbetat i standarden.

### *Standarder underlättar utvecklingen och höjer elsäkerheten*

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

### *SEK är Sveriges röst i standardiseringsarbetet inom elområdet*

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

### *Stora delar av arbetet sker internationellt*

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

### *Var med och påverka!*

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

### **SEK Svensk Elstandard**

Box 1284  
164 29 Kista  
Tel 08-444 14 00  
[www.elstandard.se](http://www.elstandard.se)

English Version

**Metal halide lamps - Performance specification  
(IEC 61167:2018 , modified)**

Lampes aux halogénures métalliques - Spécification de  
performances  
(IEC 61167:2018 , modifiée)

Halogen-Metall dampflampen - Anforderungen an die  
Arbeitsweise  
(IEC 61167:2018 , modifiziert)

This European Standard was approved by CENELEC on 2018-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## **European foreword**

The text of document 34A/2051/FDIS, future edition 4 of IEC 61167, prepared by IEC/SC 34A "Lamps" of IEC/TC 34 "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61167:2018.

A draft amendment, which covers common modifications to IEC 61167 (34A/2051/FDIS), was prepared by CLC/TC 34A "Lamps" and approved by CENELEC.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-05-02
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2021-11-02

EN 61167:2018 supersedes EN 61167:2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 61167:2018 are prefixed "Z".

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

For the relationship with EU Directives see informative Annexes ZZA, ZZB and ZZC, which are integral parts of this document.

This standard provides test methods related to parameters as prescribed by EC Regulation 245/2009, EU Regulation 1194/2012 and EU Regulation 874/2012 while conformity assessment (sampling, conformity procedures as well as limits) for market surveillance are specified in the text of the above Regulations.

## **Endorsement notice**

The text of the International Standard IEC 61167:2018 was approved by CENELEC as a European Standard with agreed common modifications.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
-	-	Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 1: Measurement and file format	EN 13032-1 +A1	2004 2012
-	-	Light and lighting - Measurement and presentation of photometric data of lamps and luminaires - Part 4: LED lamps, modules and luminaires	EN 13032-4	2015
IEC 60050-845	-	International Electrotechnical Vocabulary - Chapter 845: Lighting	-	-
IEC 60061-1	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps	EN 60061-1	1993
IEC 60598-1	-	Luminaires - General requirements and tests	EN 60598-1	2015
IEC 60923	-	Auxiliaries for lamps - Ballasts for discharge lamps (excluding tubular fluorescent lamps) - Performance requirements	EN 60923	2005
IEC 60927	-	Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements	EN 60927	2007
IEC/TR 61341	-	Method of measurement of centre beam intensity and beam angle(s) of reflector lamps	EN 61341	2011
IEC 62035	-	Discharge lamps (excluding fluorescent lamps) - Safety specifications	EN 62035	2014
IEC 62321-4	-	Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS	EN 62321-4	2014
IEC 62471	-	Photobiological safety of lamp and lamp systems	EN 62471	2008

**EN 61167:2018 (E)**

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CIE 84	-	The measurement of luminous flux	-	-
CIE 13.3	-	Method of Measuring and Specifying Colour Rendering Properties of Light Sources	-	-

## CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	10
2 Normative references .....	10
3 Terms and definitions .....	11
4 Lamp requirements.....	13
4.1 General.....	13
4.2 Marking.....	13
4.2.1 Colour appearance .....	13
4.2.2 Lamps for operation on high pressure sodium controlgear .....	13
4.3 Dimensions .....	14
4.4 Caps.....	14
4.5 Starting and warm-up characteristics .....	14
4.5.1 Lamps that may operate on electromagnetic ballasts .....	14
4.5.2 Lamps suitable for low frequency square wave ballasts only.....	14
4.6 Electrical characteristics .....	14
4.7 Photometric characteristics .....	14
4.8 Colour characteristics .....	14
4.8.1 Lamps with non-standardised chromaticity co-ordinates .....	14
4.8.2 Lamps with standardised chromaticity co-ordinates .....	15
4.8.3 Colour rendering index .....	15
4.8.4 Requirements and test conditions .....	15
4.9 Lumen maintenance and life .....	15
5 Information for ballast, ignitor and luminaire design .....	15
6 Data sheets .....	15
6.1 General principles of numbering sheets .....	15
6.2 Lists of data sheets.....	15
6.2.1 List of diagrammatic lamp data sheets .....	15
6.2.2 List of lamp data sheets.....	30
6.3 List of maximum lamp outline sheets (construction according to IEC 61126) .....	361
Annex A (normative) Method of measuring lamp starting and warm-up characteristics .....	364
A.1 General.....	364
A.2 Measurements .....	364
Annex B (normative) Method of measuring electrical and photometrical characteristics (lamps for operation on 50 Hz or 60 Hz supply frequencies) .....	366
B.1 General.....	366
B.2 Particular requirements for double-capped lamps.....	366
B.3 Colour characteristics .....	367
B.4 Supply .....	367
B.5 Instruments .....	367
B.6 Measurement.....	367
Annex C (normative) Method of test for lumen maintenance and life .....	370
C.1 General.....	370
C.2 Lamps for operation on 50 Hz or 60 Hz supply frequencies .....	370
C.3 Lamps for operation on low frequency square wave .....	370

Annex D (informative) Information for luminaire design .....	371
D.1 Maximum lamp outlines.....	371
D.2 Replacement of lamps .....	371
Annex E (normative) Method of measuring electrical and photometrical characteristics on low frequency square wave reference ballast .....	372
E.1 General.....	372
E.2 Characteristics .....	372
E.3 Test procedure.....	372
E.3.1 General .....	372
E.3.2 Start-up .....	373
E.3.3 Steady state .....	373
Annex F (normative) Spectral analysis of power ripple: calculation procedure for amplitude spectrum ratio and guidance .....	374
F.1 General.....	374
F.2 Mathematical background .....	374
F.2.1 General .....	374
F.2.2 Description of the algorithm .....	374
F.3 Measurement procedure .....	375
F.4 Test signal .....	375
F.4.1 General .....	375
F.4.2 Description of the test signal.....	375
F.4.3 Outcome of the test signal .....	376
Annex G (informative) Low frequency square wave operation .....	377
G.1 General.....	377
G.2 Operation phases.....	377
G.3 Information relevant for square wave controlgear design.....	377
G.3.1 Breakdown .....	377
G.3.2 Take-over .....	380
G.3.3 Run-up .....	380
G.3.4 Steady state normal operation .....	381
G.3.5 Steady state extended operation .....	383
Annex H (informative) Information for ballast design .....	385
H.1 General.....	385
H.2 Explanation of the ignition schemes for pulse breakdown.....	385
Annex I (informative) Temperature limits for luminaire design .....	387
Annex J (informative) ILCOS codes .....	389
Annex K (informative) Method of measuring the bulb, pinch, reflector and base temperatures of metal halide lamps for luminaire design .....	392
K.1 General.....	392
K.2 Measurement conditions .....	392
K.3 Choice and attachment of thermocouples for bulb, pinch, reflector and base temperature measurements .....	393
K.3.1 General .....	393
K.3.2 Thermocouple attachment by mechanical clamping .....	393
K.3.3 Thermocouple attachment by adhesive .....	393
K.4 Thermocouple fixing point locations and lamp burning positions by metal halide lamp types .....	394
Bibliography.....	402

Figure A.1 – Circuit diagram for measurement of lamp starting and warm-up characteristics .....	365
Figure B.1 – Circuit diagram for measurement of lamp characteristics .....	368
Figure B.2 – Luminaire simulator for use with double-capped lamps .....	369
Figure E.1 – Circuit for lamp measurement under reference conditions .....	373
Figure G.1 – Typical selection from a high frequency ignition sequence .....	379
Figure G.2 – Measurement of PCR during run-up and steady state .....	383
Figure G.3 – Example of a measurement circuit of lamp potential against earth .....	384
Figure G.4 – Commutation time, deviating waveform .....	384
Figure G.5 – HF ripple and fast Fourier transformation (power curve) .....	384
Figure H.1 – Example 1 for ignition scheme according to option (1) (see Annex G and lamp data sheets) .....	385
Figure H.2 – Example 2 for ignition scheme according to option (1) (see Annex G and lamp data sheets) .....	385
Figure H.3 – Example for ignition scheme according to option (2) (see Annex G and lamp data sheets) .....	386
Figure I.1 – Principal ways of heat transport in a lamp .....	387
Figure K.1 – Schematic view of thermocouple attachment using mechanical clamping .....	394
Figure K.2 – Schematic view of thermocouple attachment using adhesive (cement) .....	395
Figure K.3 – Burning position and thermocouple junction fixing points for temperature readings – G8.5 cap .....	395
Figure K.4 – Burning position and thermocouple junction fixing points for temperature readings – G12 cap .....	396
Figure K.5 – Burning position and thermocouple junction fixing points for temperature readings – E27/E40 cap, tubular bulb .....	397
Figure K.6 – Burning position and thermocouple junction fixing points for temperature readings – E27/E40 cap, elliptical bulb .....	398
Figure K.7 – Burning position and thermocouple junction fixing points for temperature readings – E27 cap, PAR reflector, .....	399
Figure K.8 – Burning position and thermocouple junction fixing points for temperature readings – GX8.5 cap .....	400
Figure K.9 – Burning position and thermocouple junction fixing points for temperature readings – RX7s and RX7s-24 cap .....	401
Figure K.10 – Burning position and thermocouple junction fixing points for temperature readings – Fc2 cap .....	401
Table 1 – List of diagrammatic lamp data sheets .....	16
Table 2 – List of lamp data sheets .....	30
Table 3 – List of maximum lamp outline sheets .....	361
Table B.1 – Correlated colour temperature and chromaticity co-ordinates x and y .....	367
Table E.1 – Characteristics of the reference ballast .....	372
Table F.1 – Settings of the analysing oscilloscope .....	375
Table G.1 – Requirements for pulse breakdown .....	378
Table G.2 – Requirements for high frequency breakdown .....	380
Table G.3 – Requirements for take-over .....	380
Table G.4 – Requirements for run-up .....	381
Table G.5 – Requirements for steady state normal operation .....	382

Table G.6 – Requirements for extended operation .....	383
Table J.1 – Lamp coding .....	389

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## METAL HALIDE LAMPS – PERFORMANCE SPECIFICATION

## 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

**DISCLAIMER**

**This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.**

**This Consolidated version of IEC 61167 bears the edition number 4.1. It consists of the fourth edition (2018-04) [documents 34A/2051/FDIS and 34A/2058/RVD] and its amendment 1 (2018-10) [documents 34A/2066/CDV and 34A/2103/RVC]. The technical content is identical to the base edition and its amendment.**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

International Standard IEC 61167 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This edition includes the following significant technical changes with respect to the previous edition.

- a) A set of new lamp data sheets has been introduced for lamp types designed for replacing high pressure sodium lamps.
- b) A set of new lamp data sheets has been introduced for 4200 K versions of 3000 K lamp types already in the standard.
- c) A set of new lamp data sheets has been introduced for new lamp types where high frequency ignition data is important.
- d) Annex G has been revised to incorporate high frequency ignition. As a consequence of this change, all data sheets in the standard have been revised to a new format.
- e) A new informative Annex K has been introduced, giving recommended methods of making lamp temperature measurements.

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

The committee has decided that the contents of this document and its amendment 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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

A big step forward when standardising metal halide lamps and their operation was made with the second edition which was published in 2011. Meanwhile, agreements were reached for the introduction of new lamp types and in aspects of operation which led to the third edition.

Major changes in the second edition were as follows. Since IEC 62035 was published in 1999, the related lamp specific performance standards such as IEC 61167 needed to be reviewed in an editorial action, splitting performance and safety requirements, but also to include all items in abeyance, stored for this occasion. The separation had already been carried out with other HID lamps. So, in some instances, the “pilot” text of IEC 60188 was used. Moreover, the measurement part was introduced with the assistance of IEC 60188 and IEC 60081.

It may also be noted that the colour coordinates for CCT 3 000 K and 4 200 K were adjusted to a point two units below Planck in order to take account of the life time shift to higher y-values.

Apart from these basic changes which had been needed for a long time, the new technique of low frequency square wave (LFSW) operation was implemented. This led to additional pages to the existing lamp data sheets and several annexes describing and specifying the requirements. Further, detailed requirements and measurement methods for the ignition (break down/take-over/run-up) were introduced. Intense discussions took place on measurement and specification of the peak-current ratio during ignition and steady state. Workshops were held in order to come to a broad worldwide acceptance of the concepts. The workshops were open to experts from the lamp and control gear side in order to accommodate the interface between control gear and lamp to these requirements.

Further lamp types which were considered to have market relevance and needing normative support were also added.

Major changes in the third edition were as follows. Compared to the second edition, a set of new lamp data sheets (20 W, 35 W, 50 W, 100 W) was introduced. Reference to ILCOS (International lamp coding system) was removed from the lamp data sheets and located in a new annex. Information on outer bulb temperature (and in some cases also on pin temperature and temperature adjacent to cap) was replaced with an explanation on differences in manufacturers' construction; this explanation was given in detail in a new annex.

Major changes of this fourth edition are as follows. A total of 28 new data sheets have been introduced to specify lamp types designed for replacing high pressure sodium lamps, 4 200 K versions of 3 000 K lamp types already in the standard and lamp types where high frequency ignition is important. Annex G has been revised to incorporate high frequency ignition. As a consequence of this change, all data sheets in the standard have been revised to a new format. A new informative Annex K has been introduced, giving recommended methods of making lamp temperature measurements.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning the lamp given in standard sheets 1035E, 1035F, 1070C and 1070D.

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he/she is willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

Panasonic Corporation

1-1 Saiwai-cho,  
Takatsuki City,  
Osaka 569-1193,  
Japan

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

ISO ([www.iso.org/patents](http://www.iso.org/patents)) and IEC (<http://patents.iec.ch>) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

## METAL HALIDE LAMPS – PERFORMANCE SPECIFICATION

### 1 Scope

This document specifies the performance requirements for metal halide lamps for general lighting purposes.

For some of the requirements given in this document, reference is made to “the relevant lamp data sheet”. For some lamps, these data sheets are contained in this document. For other lamps, falling under the scope of this document, the relevant data are supplied by the lamp manufacturer or responsible vendor.

The requirements of this document relate only to type testing.

The requirements and tolerances specified in this document correspond to testing of a type test sample submitted by the manufacturer for that purpose. In principle this type test sample consists of units having characteristics typical of the manufacturer’s production and being as close to the production centre point values as possible.

It can be expected that with the tolerances given in this document, the product manufactured in accordance with the type test sample will comply with this document for the majority of production. Due to the production spread however, it is inevitable that there will sometimes be products outside the specified tolerances. For guidance on sampling plans and procedures for inspection by attributes, see ISO 2859-10.

### 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.

IEC 60050-845, *International Electrotechnical Vocabulary – Part 845: Lighting* (available at <http://www.electropedia.org>)

IEC 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60923, *Auxiliaries for lamps – Ballasts for discharge lamps (excluding tubular fluorescent lamps) – Performance requirements*

IEC 60927, *Auxiliaries for lamps – Starting devices (other than glow starters) – Performance requirements*

IEC TR 61341, *Method of measurement of centre beam intensity and beam angle(s) of reflector lamps*

IEC 62035, *Discharge lamps (excluding fluorescent lamps) – Safety specifications*

IEC 62471, *Photobiological safety of lamp and lamp systems*

CIE 084, *Measurement of luminous flux*